Unit Title: Measurement/Scientific Practices	**Content Area:** Physical Science	**Grade Level:** 4

Unit Summary: The Measurement Module emphasizes the development of observation and description skills and building explanations based on experience. Students will explore the need for standard measurement units. Students will be able to plan and carry out investigations to emphasize a particular type of measurement: length, mass, volume, and density. Using scientific practices when doing investigations will help students in this unit by incorporating constructing evidence in argument, communication and interpreting scientific information, analyzing and interpreting data, using mathematic tools, asking questions, planning & carrying out investigations to demonstrate engagement and learning in the content.

Unit Essential Questions:

- How do we build and refine models that describe and explain the natural and designed world?
- What constitutes useful scientific evidence?
- How is scientific knowledge constructed?
- How does scientific knowledge benefit, deepen, and broaden from scientists sharing and debating ideas and information with peers?

Unit Enduring Understandings:

- Measurement and observation tools are used to categorize, represent and interpret the natural world.
- Evidence is used for building, refining, and/or critiquing scientific explanations.
- Scientific knowledge builds upon itself over time.
- The growth of scientific knowledge involves critique and communication - social practices that are governed by a core set of values and norms.

Possible Student Misconceptions:

- Objects float in water because they are lighter than water. Objects sink in water because they are heavier than water.
- Mass/volume/weight/heaviness/size/density may be perceived as equivalent.
- Wood floats and metal sinks.
- All objects containing air float.
- Liquids of high viscosity are also liquids with high density.
- Adhesion is the same as cohesion
- Heating air only makes it hotter.
- Liquids rise in a straw because of "suction".
- Gases are not matter because most are invisible.
- Gases do not have mass.
- A "thick" liquid has a higher density than water.
- Mass and volume, which both describe an "amount of matter", are the same property.
- Measurement is only linear. Any quantity can be measured as accurately as you want.
- Children who have used measuring devices at home already know how to measure.
- The metric system is more accurate than the other measurement systems. The English system is easier to use than the metric system.
- You can only measure to the smallest unit shown on the measuring device.
- You should start at the end of the measuring device when measuring distance.
- Some objects cannot be measured because of their size or inaccessibility.
- The five senses are infallible. An object must be "touched" to measure it.
- Mass and weight are the same and they are equal at all times. Mass is a quantity that you get by weighing an object.
- Mass and volume are the same.
- There is only one way to measure perimeter. Only the area of rectangular shapes can be measured in square units.
- Surface area can be found only for two-dimensional objects.
- Surface area is a concept used only in mathematics classes.
- You cannot measure the volume of some objects because they do not have "regular" lengths, widths, or heights.
- An objects' volume is greater in water than in air.
- The density of an object depends only on its volume.
- Density for a given volume is always the same.

- The density of two samples of the same substance with different volumes or shapes cannot be the same.

NJCCCS:

- 5.1.A. Understand Scientific Explanations: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
- 5.1.B. Generate Scientific Evidence Through Active Investigations: Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.
- 5.1.C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over time.
- 5.1.D. Participate Productively in Science: The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.

NGSS Performance Expectations: *Students who demonstrate understanding can…*

- 5-PS1-3: Measurements of a variety of properties can be used to identify materials.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems
- Connections to 3-5-ETS1.B: Designing Solutions to Engineering Problems
- Connections to 3-5-ETS1.C: Optimizing the Design Solution

Primary CCSS ELA/Literacy Connections:

- RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS4-3)
- RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3)
- SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-2)
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

Primary CCSS Mathematics Connections:

- 2MD. Measure and estimate lengths in standard units.
- 3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of rams, kilograms, and liters. Add, subtract, multiply, or divide to solve one---step work problems involving drawings to represent the problem.
- 4.MD.1 Know relative sizes of measurement units within one system of units. Within a single system of measurement, express measurements in a larger unit terms of a smaller unit.
- 5.MD.1 Convert like measurement units within a given measurement system

Lesson Pace & Sequence

Lesson Title/Number: The First Straw	**Learning Objective(s):** Students will be able to communicate measurements using numbers and appropriate units while implementing the scientific process to conduct investigations.	**Lesson Duration:** 150 Minutes

Learning Cycle **What lesson elements will support students' progress towards mastery of the learning objectives(s)?**	**Learning Activities** **What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?**	**Resources/Materials** **What curricular resources/materials are available to facilitate the implementation of the learning activities?**	**Science and Engineering Practices** **What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?**	**Disciplinary Core Ideas** **What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?**	**Crosscutting Concepts** **What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?**

***Elements do not have to be in conducted in sequence.**					
Elicit: How will you access students' prior knowledge?	What do we know about measuring? What tools can be used to measure?	• FOSS Measurement Module Investigation TG • Measurement Unit Masters: • https://drive.google.com/file/d/0B6sWQ-4EPnstU00yUmoxNVZnRHM/edit?usp=sharing	Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.	PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials.	Scale, Proportion, and Quantity: Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Find out what students know about measuring distance. Ask students how they would find out how tall they are, how wide the classroom door is. Ask them what it means to measure something. Listen to the experience they have had with measurement.		Ask questions & Defining Problems: Ask questions that can be investigated and predict reasonable outcomes based on patterns.	PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials.	Scale, Proportion, and Quantity
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Introduce straws as units. Hold up a straw and tells students that today they are going to measure some things, and a straw is the tool they are going to use. Pass out four short straws to half the groups, and four long	• Meter Tape • Straws (2 piles: 1 pile with 3cm cut off) • Tape • Crayons • Scissors • Paper Meter Tape (copy) • Flip chart paper	Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	ETS1.B: Developing Possible Solutions § Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) §	Scale, Proportion, and Quantity Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationship causes underlying them.

	straws to the other groups. Measure desks with straws. Have students measure the length and width of the tops of their desks or tables. Take notes of the methods students use to measure their desks.			At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) § Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	1. Write class results on the board. Have reporters share group results. 2. They should write the measurements for length and width of one desk on the board, making sure they write the number and unit (the straws). 3. Ask the students to look at the data and to comment on what they see. 4. Students may suggest that other students measured wrong, that the desks are different sizes, or that the straws are different lengths. 5. Ask if students have compared their straws and desks with those used by other groups. 6. Have students look at other groups' straws and desks. After the class has acknowledged that the straws are different lengths, ask them some questions: Are straws good units for measuring desks? Why not? What can we use instead of straws to measure our desks?		Constructing Explanations and Designing Solutions: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2) Carrying Out Investigations: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test design solution. Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	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. Scale, Proportion, and Quantity Patterns

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	1. Introduce students to the meter and centimeter, but first: 2. Tell students, "We need what is called a standard. A standard is a measuring unit that everyone agrees to use. 3. Hold up a meter tape and explain, "The standard unit for measuring length is the meter. This is how long a meter is. The meter is used to measure length (how long something is), and distance (how far it is from one place to another)." 4. Explain to students that the doorknob is about a meter high. Ask them to look around the room and see if they notice something else that looks like it might be about a meter in length or height. 5. Write on the board, "things that are a meter long" and list student responses. Next, introduce the centimeter. Tell students, "The meter is large – too large for measuring a pencil or straw. For that reason the meter is subdivided into 100 equal parts called centimeters." 6. Distribute meter tapes to the class. Have students look over the numbers 1 to100. Ask them to locate the longer marks printed next to the numbers. These are 1 cm apart. The shorter lines measure half centimeters. 7. Have each student count 10 cm on the tape and span those 10 cm with their thumb to pinkie.		Constructing Explanations and Designing Solutions: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)	PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials.	Systems and System Models: Scale, Proportion, and Quantity Patterns

	With their hands held in the 10-cm-span position, have students take turns advancing their hands along the tape, counting by tens. 8. Have each group estimate, then measure, the length of their straws, and the length and width of their desks in centimeters. Challenge the students to calculate the length and width of their desks after measuring their straws. They can check their work with their meter tapes. To wrap things up, ask students when they would use meters and when they would use centimeters to measure something.				
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Start a word bank – a list of key vocab words related to measurement. Ask students to suggest words for the word bank. Review the meaning of each word that is suggested. Start a content/inquiry chart, by asking students what they learned from the investigations. Questions that should be answered: Why didn't straws work very well for measuring desks? What is the relationship between a meter and a centimeter? Use Assessment Chart provided by FOSS for final evaluation.	• Assessment Chart	Plan and conduct an investigation: Evaluate appropriate methods and/or tools for collecting data. Analyzing and Interpreting Data: Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	Patterns Scale, Proportion & Quantity
Extend: How will students deepen their conceptual understanding through use in new context?	• DISCUSS METRIC PREFIXES Remind students that large distances are measured in kilometers (1000 m). Introduce millimeters (1/1000 m) as a unit		Asking Questions & Defining Problems Developing & Using Models	PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials.	Scale, Proportion & Quantity

	that is used to measure very small things. Ask what units and tools students would use to measure the distance from their hometown to the next town, or the thickness of a nickel.				
Extend: How will students deepen their conceptual understanding through use in new context?	Students complete an open-ended task where they will individually articulate the investigation results.		Analyzing & Interpreting Data Obtaining, evaluating and communicating information		

Lesson Title/Number: Making Marbles	**Learning Objective(s):** Students study 3 marbles of different sizes. They make observations and measurements, organize their data, and design an experiment to answer questions posed.	**Lesson Duration:** 100 Minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Present the following scenario: Super Toys is a company that manufactures toys. The company has been making only the middle-sized marbles you see on your plate. Marbles are made by pouring melted glass into molds. The company melts enough glass in each container to make 100 middle-sized marbles each time. How many small marbles can be made from one container of glass? How many large marbles can be made from one container of glass?	• Making Marbles: http://pals.sri.com/tasks/k-4/Marbles/admin.html	Mathematical and computational thinking Asking Questions and defining problems		
Explore: What hands-on/minds-on common experience(s) will you provide for students?	There are many different kinds of measuring equipment on your table that your group can use to do experiments to help answer the questions. Use whatever equipment you want. Whenever you make a measurement, each	• Data Sheet • *3 marbles, one small, one middle-sized, one large • *one plate with rim that will keep marbles from rolling off • *several kinds of	Ask questions & Defining Problems: Ask questions that can be investigated and predict reasonable outcomes based on patterns.	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions	Systems and System Models: Scale, Proportion, and Quantity Patterns

	of you should record it on your own Data Sheet. Each of you should plan to organize your data in some way so that it will be easy for other people to understand. NOTE: Always put the marbles back on the plate so they don't roll off the table. Before you begin experimenting, discuss the questions you must answer with your group. Decide what you need to know about the marbles to answer the questions. Then design an experiment to get the necessary information	measuring equipment (e.g. rulers, balance, tape measure, etc.)	Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.		
Explain: How will you help students connect their exploration to the concept/topic under investigation?	As a group, students will work together to gather data and analyze it with their groups		Constructing Explanations and Designing Solutions: Carrying Out Investigations: Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. Using Mathematical Computational Thinking	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	Systems and System Models: Scale, Proportion, and Quantity Patterns
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students complete the Response Form individually, and present their data to the		Analyzing and Interpreting Data: Compare and contrast data collected by different groups in	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to	

	remaining students.		order to discuss similarities and differences in their findings. Obtaining, evaluating and communicating information in 3-5 builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.	determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	
Lesson Title/Number: Measurement: Length, volume, and temperature		**Learning Objective(s):** Evaluate the student's ability to measure temperature, length, and volume accurately utilizing appropriate tools/equipment.			**Lesson Duration:** 50 Minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Review various tools for measurement. Be sure the students use the metric system when conducting any investigations.		Ask questions & Defining Problems	PS1.A: Structure and Properties of Matter	
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Engage the students in discussion to propose how they will approach this investigation. Guide the students to use the scientific processes scientists may use to reach a solution or conclusion.	• **See Advance Preparation • Measurement Activity: http://pals.sri.com/tasks/k-4/Measurement1/admin.html	Plan and Carry out an Investigation	ETS1.A: Defining and Delimiting Engineering Problems	

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students review the questions on the Student response sheet to be aware of what they have to do to complete the investigation. Students work in small group to answer any questions they have on the Student Response Sheet. The assessment in this lesson is the students' abilities to utilize and manipulate measurement tools.	• Piece of cardboard • Ruler • Cup A (with a line marked on it) • Cup B (3/4 full of water) • Graduated cylinder • Thermometer • Student Response Sheet	Constructing Explanations and Designing Solutions: Plan and conduct an investigation: Evaluate appropriate methods and/or tools for collecting data. Analyzing and Interpreting Data: Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.	ETS1.B: Developing Possible Solutions PS1.A: Structure and Properties of Matter	Patterns Scale, Proportion & Quantity Systems and System Models
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students present their findings of the investigation and are assessed on their accuracy of measurement for each item. Temperature in degrees, Length of cardboard, and Volume of the water in the cup.		Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information	PS1.A: Structure and Properties of Matter	Patterns Scale, Proportion & Quantity System and System Models

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students are assessed and evaluated based on the rubric	• Rubric	Analyzing and Interpreting Data: Obtaining, evaluating and communicating information	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	Patterns
Lesson Title/Number: Measurement: Using the Balance		**Learning Objective(s):**			**Lesson Duration:** 50 Minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Explore: What hands-on/minds-on common experience(s) will you provide for students?	1. Students will work in small groups to weigh objects using a balance. 2. Empty objects in the plastic bag onto the table. 3. Weigh each object separately using the gram cubes. 4. Count and write the number of cubes needed to balance each object in the chart. 5. Answer questions: Which object weighs the most? Least?	**See Advance Preparation Notes • Double-pan balance • Plastic bag containing: • Crayon • Clothespin • Washer • Wooden block • 25 colored gram cubes (**Items may be substituted, but be sure to have gram cubes or another method of balancing the mass measurements) • Measurement – Using the Balance: http://pals.sri.com/tasks/k-4/Measurement2/admin.html	Plan and conduct an investigation Constructing Explanations and Designing Solutions: Carrying Out Investigations: Engaging in Argument from Evidence:	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions	Patterns Scale, Proportion, and Quantity Systems and system models Energy & Matter: Flows, Cycles, and Conservation

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students report their answers and provide the remaining students with an explanation of how they reach their answers using evidence.		Constructing Explanations and Designing Solutions: Plan and conduct an investigation: Evaluate appropriate methods and/or tools for collecting data. Analyzing and Interpreting Data: Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students are assessed and evaluated based on the rubric	• Rubric	Analyzing and Interpreting Data: Obtaining, evaluating and communicating information	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	
Lesson Title/Number: States of Matter (Floating & Sinking)		**Learning Objective(s):** comparing the relative density of different liquids by determining the effect of objects placed in a variety of liquids.			**Lesson Duration:** 150 Minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	*Discuss Sinking & Floating as a whole group. * Create a T chart (Sinking & Floating) and have the students list ideas/predictions of objects that may sink or float in water.	Liquids & their Density Lab: https://drive.google.com/file/d/0B6sWQ-4EPnstbW5YUEZlTWFPS0E/edit?usp=sharing	Ask questions & Defining Problems: Ask questions that can be investigated and predict reasonable outcomes based on patterns.	PS1.A: Structure and Properties of Matter	Structure & Function: The way an object is shaped or structured determines many of its properties and functions Cause & 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 Systems & System Models: Scale, Proportion, and Quantity
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Engage the students by asking why an object may sink or float? How does a large cruise ship float and an anchor sink? What is a factor in deciding an object sinks or floats?		Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions	Structure & Function Cause & Effect Scale, Proportion & Quantity

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students will follow the procedure: 1.Pour 150 ml of water into beaker #1, 150 ml of corn syrup into beaker #2, and 150 ml of vegetable oil into beaker #3. (If you are using glass jars, use 2/3 cup of liquid, which is approximately 150 ml.) 2. Gently set a raisin in each beaker. Does it sink or float? Write down what happens to the raisin in each beaker. 3. Take the raisins out of the beakers and try a different object, such as a paperclip or cork. Record what happens in each beaker.	• 3 150 ml beakers (or use glass jars or clear plastic cups) • 600 ml beaker (or use a large jar) • Water • Corn syrup • Vegetable oil • Food coloring • Several small objects - raisins, paperclips, pennies, small corks, etc.	Constructing Explanations and Designing Solutions: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2) Carrying Out Investigations: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test design solution. Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions §	Systems & System Models Structure & Function Cause & Effect Scale, Proportion & Quantity
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Bring the class back as a whole group to discuss their findings. Which object floated? Sank? What can you conclude from this investigation about solids, liquids, and/or gasses? How does an object float? Sink?		Constructing Explanations and Designing Solutions: Plan and conduct an investigation: Evaluate appropriate methods and/or tools for collecting data.	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Answer Questions in Science Notebook or Create an exit slip from the following questions: Were your predictions in conjunction with the observations? Did the raisins and other objects sink and float when you expected them to? Did they float in one liquid and sink in another? Why do you think they acted the way they did?		Analyzing and Interpreting Data: Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	ETS1.C: Optimizing the Design Solution § Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	Patterns Cause & Effect
Lesson Title/Number: (Part 2 from Previous Lesson) Mix it UP!		**Learning Objective(s):** Design and follow simple plans using systematic observations to explore questions and predictions while comparing the relative density of different liquids.			**Lesson Duration:** 100 Minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Which is the most dense: water, corn syrup, or vegetable oil? Which is the least dense? Based on your results from experiment #1, predict which liquid you think is the most dense and which you think is the least dense.	• Liquids and their Density: https://drive.google.com/file/d/0B6sWQ-4EPnstbW5YUEZlTWFPS0E/edit?usp=sharing	Ask questions & Defining Problems: Ask questions that can be investigated and predict reasonable outcomes based on patterns.	PS1.A: Structure and Properties of Matter	Patterns Cause & Effect

Explore: What hands-on/minds-on common experience(s) will you provide for students?	1. Place a few drops of food coloring into the beaker of water so you will be able to tell it apart from the other liquids. (This is not necessary if you are using dark corn syrup.) 2. Carefully pour each of the liquids into a 600 ml beaker or a large jar. Let them settle. 3. What happened? Did the three liquids mix together or separate into layers? Which liquid is at the bottom of the jar? Which is at the top?	• 3 150 ml beakers (or use glass jars or clear plastic cups) • 600 ml beaker (or use a large jar) • Water • Corn syrup • Vegetable oil • Food coloring • Several small objects - raisins, paperclips, pennies, small corks, etc.	Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions	Systems & System Models Structure & Function Cause & Effect Scale, Proportion & Quantity
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Bring the class back as a whole group to discuss their findings. Discuss the term density and devise a definition as a class based on their observations.		Constructing Explanations and Designing Solutions: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2) Carrying Out Investigations: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test design solution. Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions §	Patterns Cause & Effect

			Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Answer Questions in Science Notebook or Create an exit slip from the following questions: How did your observations correlate to your predictions? Students are beginning to discern the definition of density, so the liquid with the most density will be at the bottom of the jar, the next on top of that, and the least dense floats on the very top.		Analyzing and Interpreting Data: Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	PS1.A: Structure and Properties of Matter ETS1.B: Developing Possible Solutions §	Patterns Cause & Effect
Extend: How will students deepen their conceptual understanding through use in new context?	Students may want to recreate this investigation with other liquids to observe the various conclusions that may be derived a change in density		Analyzing and Interpreting Data Planning & Carrying Out an Investigation	ETS1.C: Optimizing the Design Solution	Cause & Effect