Unit Overview	
Content Area: Physical Science	
Unit Title: Properties of Matter	**Unit: 1**
Target Course/Grade Level: 2	**Timeline: 40 days**

Unit Summary:

How do the properties of materials determine their use?

How can objects change?

Are all changes reversible?

In this unit of study, students develop and demonstrate an understanding of observable properties of materials through analysis and classification of different materials. The crosscutting concepts of patterns, cause and effect, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

This unit is based on 2-PS1-1, 2PS1-2, 2-PS1-3, 2PS1-4, and K-2-ETS1-3.

Learning Targets

NJSLS-Science

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.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
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.

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)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

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)

Science and Engineering Practices

Planning and Carrying Out Investigations

- 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

- Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2, K-2-ETS1-3)
- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)

Constructing Explanations 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

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

NJSLS Connections

Primary Interdisciplinary Connections:

English Language Arts/Literacy:

Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4) **RI.2.1**

Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4) **RI.2.3**

Describe how reasons support specific points the author makes in a text. (2-PS1-4) **RI.2.8**

Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4) **W.2.1**

Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-3) **W.2.7**

Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-3) **W.2.8**

With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-3) **W.2.6**

Mathematics:

Reason abstractly and quantitatively. (2-PS1-2), (K-2-ETS1-3) **MP.2**

Model with mathematics. (2-PS1-1),(2-PS1-2, (K-2-ETS1-3)) **MP.4**

Use appropriate tools strategically. (2-PS1-2), (K-2-ETS1-3) **MP.5**

Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-PS1-1),(2-PS1-2), (K-2-ETS1-3) **2.MD.D.10**

Unit Essential Questions	**Unit Understandings**
1. In what ways can an object made of a small set of pieces be disassembled and made into a new object? 2. Can all changes caused by heating or cooling be reversed? 3. How can we sort objects into groups that have similar patterns? 4. Can some materials be a solid or a liquid?	• Objects may break into smaller pieces and be put together into larger pieces or change shapes. • Different properties are suited to different purposes. • A great variety of objects can be built up from a small set of pieces. • People search for cause-and-effect relationships to explain natural events. • Events have causes that generate observable patterns. • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. • Patterns in the natural and human-designed world can be observed. • 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.

Unit Learning Targets (Outcomes) – Formative Assessment
Students who understand the concepts are able to …

- Break objects into smaller pieces and put them together into larger pieces or change shapes.
- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- 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.

- Observe patterns in events generated due to cause-and-effect relationships.

- Construct an argument with evidence to support a claim.

- 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
  - ➢ Heating paper

- Design simple tests to gather evidence to support or refute student ideas about causes.

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

- Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (Assessment of quantitative measurements is limited to length.) Examples of properties could include:
  - ✓ Strength
  - ✓ Flexibility
  - ✓ Hardness
  - ✓ Texture
  - ✓ Absorbency

- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of each.

Cross Cutting Concepts:
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)

Patterns

- Patterns in the natural and human designed world can be observed. (2-PS1-1)

Integration of Technology: Interactive whiteboard, videos

Technology Resources: https://jr.brainpop.com/science/
http://www.harcourtschool.com/activity/states_of_matter/

Opportunities for Differentiation: Differentiation and support tips, which includes suggestions for ELL, struggling students, and accelerated students, are available below the instructional practice section of each model lesson.

Teacher Notes:

Career Ready Practices: *In this unit the following career ready practices are addressed*
CRP1: Act as a reasonable and contributing citizen and employee
CRP2: Apply appropriate academic and technical skills
CRP3: Attend to personal health and financial well-being
CRP4: Communicate clearly and effectively and with reason
CRP5: Consider the environmental, social and economic impacts of decisions
CRP6: Demonstrate creativity and innovation
CRP7: Employ valid and reliable research strategies
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them
CRP9: Model integrity, ethical leadership and effective management
CRP10: Plan education and career paths aligned to personal goals
CRP11: Use technology to enhance productivity
CRP12: Work productively in teams while using cultural global competence

Prior Learning- by the end of Grade 1 , students understand that:

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.
- 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.

Evidence of Learning

Summative Assessment

Properties of Matter
1. Students use dichotomous sorting to classify a set of attributes.
2. Student groups design a fair test to determine which sponge is best suited for absorbing a liquid spill.

Solids, Liquids, and Gases
1. Students recognize that all matter takes up space and has mass.
2. Students can differentiate between solids, liquids, and gases, based on observable properties.

Changes in Matter
1. Students can describe how water can change from one state to another by changing the temperature.
2. Students can distinguish between reversible and irreversible changes.
3. Students understand the difference between physical and chemical changes.

Equipment needed: Whiteboard and hands-on materials for lessons

Teacher Instructional Resources (Hyperlinks):

Exploring Reversible Changes of State and Exploring Irreversible Changes of State: These two lessons work together to explore reversible and irreversible changes of state through guided investigations. The PDF is a set of activities focusing on materials followed by some optional post-activity lessons.

Discovering Science: classifying and categorizing (matter, grades 2-3): This resource is a day, or longer, lab activity aimed for second and third grade students. The lesson starts with a guided discussion and an activity identifying and classifying materials, then it guides students through a series of observations of mixing and changing different materials of different states and observing the resulting effects. Overall, the lesson targets the states of matter, and forces and motion. Some of the ideas (i.e., gas and energy) are aimed at the third grader and beyond. Please note that the link above goes to a larger set of activities and you need to click on the link Discovering science: Classifying and categorizing matter grades 2-3.

Materials and Their Properties, lessons Comparing the Properties of Different Materials (pp. 22); and Exploring Thermal Insulators and Conductors (pp. 23): Students participate in an open-ended sort using various materials. Based on their self-selected categories, students explain their reasoning. Next, through a fair test trial, students use new information to decide, using evidence, which material is best suited for maintaining cold the longest.

The Properties of Materials and their Everyday Uses: This wonderful set of lessons engage students in testing materials to understand their properties and discuss appropriate uses for the materials based on those properties. For example, one activity has the students examining the materials that a number of balls are made out of (plastic, rubber, aluminum, etc.) and describing the properties of the materials (light, stretchy, rigid). Next, the students test balls made of those materials for bouncing height and record their data. The students discuss which materials are best for bouncing and why. The teacher could choose to do all of the activities and have a robust alignment with the three dimensions of the NGSS PS1-2, an engineering physical science Performance Expectation.

Matter song a music video by untamed Science: This is an engaging music video that defines and gives examples of matter. The video is fun, colorful and explores many different kinds of matter as part of the music video sequence. Young students will love the song and the interactive dance sequences.

Science Games For Kids: Properties of Materials: This resource is an interactive simulation designed to have students test various materials for different properties including flexibility, strength, waterproof, and transparency. The simulation includes a workshop where students can select different materials to see if the selected property matches the intended use.

STEM in a BOX - Shakin' Up the Classroom: K-3EarthScienceSTEMintheboxprint.docx: In this engaging lesson, the students examine and describe materials and their properties in order to assemble these materials into a strong building that could withstand the earth shaking. The physical science core ideas in the Performance Expectation are met through a larger earth science/earthquake unit that is part of the unit level resource.

Go to the resource listed under K-3: k-3EarthScienceSTEMintheboxprint.docx

Thousands of tiny pieces can create something big: In this resource which is based on enactment in a second grade classroom and includes videos and examples of student work, the teacher introduces students to Watt's tower, a tower made of many pieces of junk in the neighborhood. Students make their own objects out of many pieces or materials that the teacher provides and the students think about and discuss whether they could use the same set of materials to make something different.

Take it apart, put it together: This is a wonderfully supported and creative lesson that involves students taking apart an old appliance and making a new object using the appliance parts. The teacher guides students using a variety of teacher prompts and individual journaling to track their idea development, questions, changing plans, and evidence-based explanations.

Exploring Reversible Changes of State and Exploring Irreversible Changes of State

These two lessons work together to explore reversible and irreversible changes of state through guided investigations. The PDF is a set of activities focusing on materials followed by some optional post-activity lessons. Two of these post activity lessons deal with reversible and irreversible changes to materials. The first lesson involves teachers showing students phenomena and then asking the students to generate questions about their observations of the phenomena. The second lesson involves students engaging in investigating, explaining and asking questions about two irreversible changes and using observations to identify what about the changes make them irreversible.

The Magic School Bus Bakes in a Cake lesson and video, "Ready Set Dough" !: This is a lesson plan that accompanies the reading or watching of The Magic School Bus Bakes a Cake, or Ready Set Dough. The lesson is a short activity with guided questions that accompany making pretzel dough. In the book and video, which are not included in the resource, The Magic School Bus shrinks down to molecule size to observe and discuss chemical and physical changes while baking. The resource contains a link to purchase the book. The video can be found at https://www.youtube.com/watch?v=dTw-ok3KkuU.

The Science of Macaroni Salad (and 2. Dig Deeper): This three minute video is great for teachers who need a short and deeper understanding of what is entailed in the Performance Expectations for Properties of Matter and what is involved when a physical and chemical change occurs. It would be over the heads of younger children, but perfect for elementary teachers who can either view the video themselves and translate the most pertinent ideas in it, or watch the video with the students and narrate in kid language. If the teacher watched the video first, they would be ensured that they had the understanding necessary for tough questions.

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

· Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.

· Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

· Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

· Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

· Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

· Use project-based science learning to connect science with observable phenomena.

· Structure the learning around explaining or solving a social or community-based issue.

· Provide ELL students with multiple literacy strategies.

· Collaborate with after-school programs or clubs to extend learning opportunities.

· Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)

ACTIVITIES	**MATERIALS**
Grade 2 Physical Science **Unit:** Matter **Concept:** Properties of Matter	
2.1 Properties	
Session 1: (Approx. 1 day): Lesson Question: How can we sort solids by observable properties? Teacher models dichotomous sorting by grouping students and having students guess the rule. Students sort playing cards into two groups. Students work in groups to sort solid shapes.	Student Activity Sheet 1 Sorting and Classifying Kit
Session 2: (Approx. 1 day): Lesson Question: How can we sort objects by observable properties? Students choose and describe a mystery object using observable properties. Other students use their senses to guess the object.	Student Activity Sheet 2
Session 3 and 4: (Approx. 2-3 days): Lesson Question: How can we set up and carry out and inquiry to determine which material best cleans up spills? Students define what a fair test is and plan an investigation to determine which sponge is best suited to absorb liquid. Students use their investigation plan to test the absorbency of three different sponges and record the results.	Student Activity Sheet 3 Sponge Sets Metric Beaker Sets Water
Session 5: (Approx. 1 day): Lesson Question: How do we share our results? Students share and compile their data and draw an evidence based conclusion from that data.	Student Activity Sheet 4 Chart Paper or Whiteboard and Group Data Chart PDF
2.2 Properties of Solids, Liquids, and Gases	
Session 1: (Approx. 1 day): Lesson Question: What are states of matter?	Student Activity Sheet 1 Exploring a Beach Kit 1-1000 mL beaker

Students understand that matter has three states by exploring a beach scene that includes solid(sand), liquid(water), and gas(beach ball).	Water
Session 2: (Approx. 1 day): Lesson Question: How can we describe observable properties of liquids? Prior to lesson make class solid-liquid-gas chart to be completed during sessions 2, 3, and 4. Teacher displays liquid in different sized and shaped containers. Children observe and predict which container has the most liquid. Students work in groups to measure capacity and mass of liquid. Complete liquid section of class chart.	Student Activity Sheet 2 Liter Shapes Set 5-1000 mL beakers 2 Metric Weight Sets 5 Double Pan Balances Water
Session 3: (Approx. 1 day): Lesson Question: How can we describe observable properties of solids? Students work in groups to show displacement of liquid using solids(marbles). Student groups measure mass of marbles with double pan balances. Complete solid section of class chart.	Student Activity Sheet 3 Solids Kit 5-250 mL beakers 2 Metric Weight Sets 5 Double Pan Balances
Session 4: (Approx. 1 day): Lesson Question: What are the properties of gas? Activity 1: Teacher led activity "The Mass of Air" using beach ball to demonstrate that air has mass. Activity 2: Teacher led activity "No Room for Gases" to demonstrate that air takes up space. Complete gas section of class chart.	Student Activity Sheet 4 Gases Kit 1-1000 mL beaker 1 Sheet of paper
Session 5: (Approx. 1 day): Lesson Question: How can we compare properties of solids, liquids, and gases? Teach "Comparing Matter" lesson whole group as a shared reading lesson.	Student Activity Sheet 5 Fundamental Blocks Kit
2.3 Changing Matter	
Session 1: (Approx. 1 day): Lesson Question: How does matter change under cooling or heating? Prior to lesson prepare ice cubes. Student groups measure and compare temperature of ice cubes, warm water, and air in the room.	Student Activity Sheet 1 Can Matter Change? Kit 7 Thermometers Warm water Ice cubes

Session 2: (Approx. 1 day): Lesson Question: How does matter change under cooling or heating? Teacher reads "Changing Properties" on student activity sheet 2. Students use copy paper to demonstrate and understand reversible and irreversible changes.	Student Activity Sheet 2 2 Sheets of paper per student
Session 3: (Approx. 1 day): Lesson Question: How does matter change? Student groups work together to complete 4 experiments to determine if there is a physical or chemical change.	Student Activity Sheet 3 Can Matter Change? Kit Fundamentals Blocks Kit Ice cubes Measuring Spoons