Unit Overview	
Content Area: Physical Science	
Unit Title: Properties of Matter and Changes in Matter	**Unit:** 2
Target Course/Grade Level: 5	**Timeline:**

Unit Summary:

When matter changes, does its weight change?
In this unit of study, students describe that matter is made of particles too small to be seen by developing a model. The crosscutting concept of scale, proportion, and quantity is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, and use these practices to demonstrate understanding of the core ideas.
This unit is based on 5-PS1-1 and 5-PS1-3.

If I have a frozen water bottle that weighs 500 mg, how much will it weigh if the water melts?
In this unit of study, students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. The crosscutting concepts of cause and effect and scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and using mathematics and computational thinking. Students are expected to use these practices to demonstrate understanding of the core ideas.
This unit is based on 5-PS1-4 and 5-PS1-2.

Learning Targets	
NJSLS-Science	
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
5-PS1-2	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
5-PS1-3	Make observations and measurements to identify materials based on their properties.
5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)

PS1.A: Structure and Properties of Matter

- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)

PS1.B: Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)

Science and Engineering Practices

Planning and Carrying Out Investigations:

- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)

Developing and Using Models:

- Use models to describe phenomena. (5-PS1-1)

Planning and Carrying Out Investigations:

- 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. (5-PS1-4)

Using Mathematics and Computational Thinking:

- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)

NJSLS Connections

Primary Interdisciplinary Connections:

English Language Arts/Literacy:

- Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1) RI.5.7
- Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-3) W.5.7
- Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-3) W.5.8
- Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-3) W.5.9

Mathematics:

- Reason abstractly and quantitatively. (5-PS1-1) (5-PS1-3) MP.2
- Model with mathematics. (5-PS1-1) MP.4
- Use appropriate tools strategically. (5-PS1-3) MP.5
- Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied

or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1) 5.NBT.A.1
- Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1) 5.NF.B.7
- Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1) 5.MD.C.3
- Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units. (5-PS1-1) 5.MD.C.4
- Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. (5-PS1-2) 5.MD.A.1

Unit Essential Questions

1. How can properties be used to identify materials?
2. What kind of model would best represent/describe matter as made of particles that are too small to be seen?
3. How can we make slime?
4. How can baking soda and vinegar burst a zip-lock bag?

Unit Understandings

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Measurements of a variety of properties can be used to identify materials.
- Natural objects exist from the very small to the immensely large.
- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by means other than seeing.
- A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- When two or more different substances are mixed, a new substance with different properties may be formed.
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- No matter what reaction or change in properties occurs, the total weight of the substances does not change.
- Science assumes consistent patterns in natural systems.

Unit Learning Targets (Outcomes) – Formative Assessment

Students who understand the concepts are able to …

- Measure and describe physical quantities such as weight, time, temperature, and volume.
- Make observations and measurements to produce data that can serve as the basis for evidence for an explanation of a phenomenon.
- Make observations and measurements to identify materials based on their properties. Examples of materials to be identified could include:
  - ✓ Baking soda and other powders
  - ✓ Metals
  - ✓ Minerals
  - ✓ Liquids
- Examples of properties could include:
  - ✓ Color
  - ✓ Hardness

- ✓ Reflectivity
- ✓ Electrical conductivity
- ✓ Thermal conductivity
- ✓ Response to magnetic forces
- ✓ Solubility

- Develop a model to describe phenomena.
- Develop a model to describe that matter is made of particles too small to be seen. Examples of evidence could include:
  - ✓ Adding air to expand a basketball
  - ✓ Compressing air in a syringe
  - ✓ Dissolving sugar in water
  - ✓ Evaporating salt water
- Identify, test, and use cause-and-effect relationships to explain change.
- Conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered.
- Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
- Measure and describe physical quantities such as weight, time, temperature, and volume.
- Measure and graph quantities such as weight to address scientific and engineering questions and problems.
- Measure and graph quantities to provide evidence that regardless of the type of change that occurs when substances are heated, cooled, or mixed, the total weight is conserved.
- Examples of reactions or changes could include:
  - ✓ Phase changes
  - ✓ Dissolving
  - ✓ Mixing

Cross Cutting Concepts:

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-3)
- Natural objects exist from the very small to the immensely large. (5-PS1-1)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4)

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (5-PS1-2)

Integration of Technology: chromebooks, interactive whiteboard, videos

Technology Resources:

- Knowing Science website
  http://knowingscience.com/teacherresources

Opportunities for Differentiation:

Differentiation and support tips, which includes suggestions for ELL, struggling students, and accelerated students are available in the Above and Beyond section of the Knowing Science teacher manual.

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 2, students understand that:

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.
- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

Evidence of Learning

Summative Assessment

Weighty Measures

1. Ask students to respond to the following question in their journals: Why is it important to have a set of standard measures for weight? Illustrate your response with examples from the lesson and/or real life.
2. Rubric
3. Physical Science Unit Test

Matter is Made up of Small Particles

1. Rubric
2. Physical Science Unit Test

States of Matter-Nothing Gets Lost

1. Divide students into 5 groups. Tell students to imagine they are some of the small particles that make up an ice cube. Ask them to develop a short skit which traces the journey of these particles as the ice melts into water and water is boiled into steam.
2. Rubric

3. Physical Science Unit Test

Properties of Matter

1. Design a simple investigation to test the thermal conductivity of several substances, and determine whether each substance is a conductor or an insulator.
2. Rubric
3. Physical Science Unit Test

Can Matter Change?

1. Divide the class into groups of 4-5 students. Ask each group to select an example of a physical or chemical change found in "real life" (as opposed to a science laboratory experiment) and describe that change to the rest of the class.
2. Rubric
3. Physical Science Unit Test

Equipment needed: Whiteboard, laptops, headphones, and hands-on materials for lessons

Teacher Instructional Resources (Hyperlinks):

Material Properties: The dangerous Androvax has crash-landed on Earth! Sabotage his escape plans by tricking him into building a spaceship out of the wrong materials.

Time for Slime: Students combine water and borax to create slime. Be sure to read and follow all of the cautions on the borax box label.

Bubble Burst! How can baking soda and vinegar burst a zip-lock bag?

Flame Out: A candle flame is actually a chemical reaction in action! Candle wax is one of the chemicals in the reaction.

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**
Unit 2: Physical Science	
2.1 Weighty Measures- A Review of Weight and Measurement	
Session 1: (40-50 minutes) What is weight, and how can we compare the weights of different objects?	• Collection of objects to be weighed • Double pan balance
Session 2: (40-45 minutes) What instruments do we use to measure weight?	• Double pan balance • Digital scale • 1 Metric weight set • Collection of objects to be weighed
2.2 Matter is Made Up of Small Particles	
Session 1: (45 minutes) Is matter made up of small particles, even if we cannot see the particles with the naked eye?	• Digital Scale • Air Mass Kit • Matter is Made of Small Particles Kit • Closed System Kit • Baking soda and vinegar • Disposable gloves, one per group • Set of measuring spoons • Set of measuring cups • Safety glasses for each student and teacher
Session 2: (45 minutes) How can we model the basic building blocks of matter?	• Fundamentals Blocks Kit
2.3 States of Matter- Nothing Gets Lost	
Session 1: (45 minutes) What are the properties of each of the three states of matter?	• Hot Plates • Protective gloves • 500ml glass beaker • Digital scale

	• Funnel • Measuring spoons • Exploring States of Matter Kit • Safety glasses, one per student and one for the teacher • Activity Sheet 1: Does the Mass Change? • Solid, Liquid and Gas models from the Fundamental Blocks Kit • 2 cups (500mL) of warm water • Tray of ice cubes • Solid, liquid, and gas examples
2.4 Properties of Matter	
Session 1: (45 minutes) What are the properties of various kinds of matter?	• Activity Sheet 1: Properties of Matter **Station #1** • Light Properties Kit **Station #2** • Heat Conductivity Kit **Station #3** • Conductivity Tester • A collection of metallic objects • A collection of common nonmetallic objects **Station #4** • Magnet Kit ○ U.S. penny, nickel, dime, quarter, paper clips, staples, and other metal object magnets **Station #5** • Electrostatic Kit • Paper torn into small bits
Session 2: (45 minutes) How can we recognize a material by knowing its properties?	• Activity Sheet 2: What's What? • Set of multiple material balls **Station #1**

	• Laser from Light Properties Kit **Station #2** • Small bucket and 1 metal tumbler from Heat Conductivity Kit **Station #3** • Conductivity Tester **Station #4** • 2 Bar magnets from Magnet Kit
2.5 Can Matter Change?	
Session 1: (45 minutes) What are physical changes in matter?	• Hot plate • Protective gloves • 500 ml glass beaker • 1 bar magnet and 1 zipper bag from the Magnet Kit • Physical and Chemical Changes Kit • 1 Tbsp. baking soda • Measuring spoons • Safety glasses • Activity Sheet 1: Mixture, one per student • Digital Scale • Sheet of copy • Ice cubes • 16 fl. oz. of water
Session 2: (45 minutes) What are chemical changes in matter?	• Activity Sheet 2: Matter Changes • Physical and Chemical Changes Kit • 1 tsp. water, ¼ tsp. vegetable oil, and ¼ tsp. Liquid soap, per group • Digital scale • Closed System Kit • Disposable gloves • ¼ cup baking soda • ½ cup vinegar • Fundamental Blocks Kit • 500 mL glass beaker • Set of measuring cups and spoons • Safety glasses • Stirring rod • Water