Verona Public School District
Curriculum Overview

5th Grade Science

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Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

Fifth grade science curriculum addresses the science standards and presents “opportunities for student to engage directly with natural phenomena, tools of science, real-world problems and technical and design challenges. The course provides an instructional framework to help all students develop age-appropriate scientific habits of mind while building on students’ prior knowledge and experiences and allowing them to apply knowledge and problem solving strategies in new contexts,” (STC, 2012).

Smithsonian Institution, N. S. (2012). *Exploring Properties of Matter.* Burlington: Carolina Biological Supply Company.

The 5th grade curriculum makes use of three Science and Technology Centers kits, Exploring the Properties of Matter, Ecosystems, and Electric Circuits. In the unit Exploring the Properties of Matter, students investigate basic properties of matter and the use of these properties to distinguish 1 substance from another. Students begin by examining physical properties and then turn to the characteristic properties of density; boiling, melting, and freezing points; rates of thermal expansion; and solubility. They determine that these properties are independent of amount and, taken together, can be used to identify an unknown substance. In Ecosystems, students set up terrariums for crickets and isopods. Duckweed, algae, Elodea, guppies, and snails are introduced to an aquarium. Connecting the 2 habitats to create an "ecocolumn," students observe the relationship between the 2 environments and the organisms living within them. Students simulate the effects of pollutants -road salt, fertilizer, and acid rain - on the environment. In Electric Circuits students focus on the properties of electricity. They investigate how various materials are affected by electricity, & they identify conductors and insulators and they go on to explore series and parallel circuits, switches, and diodes.

Prerequisite(s):

4th grade

Standard 8: Technology Standards

8.1: Educational Technology: *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*	**8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming:** *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*
A. Technology Operations and Concepts B. Creativity and Innovation C. Communication and Collaboration D. Digital Citizenship E. Research and Information Fluency **X** F. Critical thinking, problem solving, and decision making	A. The Nature of Technology: Creativity and Innovation B. Technology and Society C. Design D. Abilities for a Technological World E. Computational Thinking: Programming

SEL Competencies and Career Ready Practices

Social and Emotional Learning Core Competencies: *These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities*	**Career Ready Practices:** *These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.*
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.	**X** CRP2. Apply appropriate academic and technical skills. CRP9. Model integrity, ethical leadership, and effective management. CRP10. Plan education and career paths aligned to personal goals.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.	CRP3. Attend to personal health and financial well-being. CRP6. Demonstrate creativity and innovation. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.
Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	**X** CRP1. Act as a responsible and contributing citizen and employee. CRP9. Model integrity, ethical leadership, and effective management.
Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.	**X** CRP4. Communicate clearly and effectively and with reason. CRP9. Model integrity, ethical leadership, and effective management. CRP12. Work productively in teams while using cultural global competence.
Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.	CRP5. Consider the environmental, social, and economic impact of decisions. CRP7. Employ valid and reliable research strategies. **X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership, and effective management.

Standard 9: 21st Century Life and Careers

9.1: Personal Financial Literacy: *This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.*	**9.2: Career Awareness, Exploration & Preparation:** *This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.*	**9.3: Career and Technical Education:** *This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.*
A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing **X** E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting	A. Career Awareness (K-4) **X** B. Career Exploration (5-8) C. Career Preparation (9-12)	A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security M. Manufacturing N. Marketing **X** O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials

Core Instructional Materials: *These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.*	**Differentiated Resources**: *These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.*
● STC curriculum, Exploring Properties of Matter. Text, lab material and all equipment that are encompassed within the curriculum series.	● Various supplemental websites: Ck-12, BrainPop, NASA, etc… ● Chromebooks as assessment and research tools ● School lab equipment to supplement experiments. EX: ball and socket to prove expansion and contraction ● Student Notebook/Journal/Lab book

H.B. Whitehorne — Science Grade 5

Unit Title / Topic: Exploring the Properties of Matter	Unit Duration: 50-55 days

Stage 1: Desired Results

Established Goals NGSS:

Students who demonstrate understanding can:

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

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. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]

5-PS1-3 Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Science and Engineering Practices

Developing and Using Models
- Use models to describe phenomena.

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

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

Disciplinary Core Ideas

- **PS1.A: Structure and Properties of Matter**
  - -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)
  - -The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)
  - - 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)
- PS1.B: Chemical Reactions
  - -When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)
  - - No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2

Crosscutting Concepts

- Cause and Effect
  - - Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4)
- Scale, Proportion, and Quantity
  - -Natural objects exist from the very small to the immensely large. (5-PS1-1)
  - -Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2),(5-PS1-3)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- -Science assumes consistent patterns in natural systems. (5-PS1-2)

Common Core State Standards Connections:

ELA/Literacy -

RI.5.7	*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)*
W.5.7	*Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2),(5-PS1-3),(5-PS1-4)*
W.5.8	*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-PS1-2),(5-PS1-3),(5-PS1-4)*
W.5.9	*Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2),(5-PS1-3),(5-PS1-4)*

Mathematics -

MP.2	*Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)*
MP.4	*Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)*
MP.5	*Use appropriate tools strategically. (5-PS1-2),(5-PS1-3)*
5.NBT.A.1	*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.NF.B.7	*Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)*
5.MD.A.1	*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.C.3	*Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)*
5.MD.C.4	*Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)*

Transfer Goal:

Students will be able to <u>independently</u> use their learning to apply the concepts of mass and volume to calculate density to identify the material from which an object is made.

Students will understand that:

- The scientific method is the basis for using science in argument and explanation, and sharing knowledge is a vital part of the scientific process.
- They must differentiate between science and pseudo-science.
- Science is characterized by identifying and testing natural phenomena to explain patterns in data.
- The contributions of scientists is a contribution in science as a human endeavor.
- Scientific principles lay in the foundation of many jobs and endeavors.
- Science is in every aspect of their lives in and out of the classroom.
- There are risks associated with the role of technology in creating benefits to humans, and those risks must be assessed.
- Substances have different properties that determine their usefulness, function, and danger.
- There are no perfect solutions to technical problems.

Essential Questions:

- Lesson 1: What is Matter? Where did matter come from?
- Lessons 2-5: Why is it important to know about density? How do boats float? Are gases made of matter? (How can we be sure?) Does Air take up space and have mass? What do thermometers actually measure?
- Lesson 6: How does heat affect substances? How do you know a chemical reaction occurred?
- Lesson 7: Can you cook pasta faster?
- Lesson 8: Does the mass of a substance change when it changes phase?
- Lesson 9: What is the best material to make a skateboard?
- Lesson 10: What happens when different substances are mixed with water? What can you do about acid rain?
- Lesson 11: How much salt can you get to dissolve in a cup of water? Can a solvent dissolve an infinite amount of a solute? Does solubility depend on the type of solute?
- Lesson 12: What happens to the mass and volume of two substances when the substances are mixed to form a solution?
- Lesson 13: What is the best way to remove stains? Is there one way or solvent that is better than another?
- Lesson 14: What substance makes up your mystery object?

Students will know:

- All **matter** (solids, liquids and gases) has **mass** and **volume**.
- Matter exists in three phases: **solid, liquid and gas**
- **Characteristic properties** are unique to a substance and can be used to identify a substance.
  - The characteristic properties of a substance can be measured or calculated from other measurements
  - The **density, melting/boiling/freezing points, rate of thermal expansion, and solubility of a substance** are unique and can be used to identify it. They are characteristic properties.
- **Density**, the relationship between **mass** and **volume**, can be calculated from mass and volume measurements.
- **Mass** is the amount of matter in an object and is measured in grams on a balance.
- **Volume** is the space matter occupies and is measured in mL or cm3.
- Water displacement can be used to measure the volume of irregular objects and volume of air in a container.
- Density is independent of amount or shape.
- **Buoyancy** (negative, positive or neutral) is the ability of an object to float in a liquid .
- Shape affects the mass of water displaced by a solid in a liquid and therefore affects its ability to float.
- Density of a substance, in any phase, will determine where it rests in a column of liquid or gas if they are **immiscible** (do not mix).
- Applying heat to a substance affects its properties - it may cause a phase change, a physical or chemical change in a substance.
- Chemical changes form new products.
- In general, matter expands when heated and contracts when cooled. Temperature is based on thermal expansion.
- State of matter depends on its boiling and freezing points and the external temperatures. The **kinetic theory** of matter accounts for the observed phase changes in matter.
- Mass remains constant during **phase changes,** and requires the gain or loss of heat energy.
- The properties of an object determine its uses.
- **Solutions** are **mixtures** of a **solute** and a **solvent**
- Some **solids dissolve** in some liquids.
- Mass remains constant when a solute dissolves in a solvent.
- Differences in **solubility** have practical applications.
- The choice of a material for a product is partly determined by the characteristic properties of the material.
- Manufactured objects are usually made from a variety of material and undergo processing before suitable for manufacturing.

Students will be able to:

- Make accurate observation of scientific phenomena and properties of matter.
- Make accurate measurements of mass and linear quantities.
- Use data collected to make calculations of volume, mass, density, solubility, boiling point, and freezing/melting points.
- Use scientific instruments to gather and record data.
- Work cooperatively with lab partner and class members.
- Make a line graph of data points and use it for interpolations and analysis.
- Follow a sequence of directions over a period of time to answer an inquiry.
- Design and conduct controlled experiments.
- Communicate experimental and research results in writings, graphs, tables, and oral presentations.
- Recognize patterns in single lab-group data and in class results.
- Use results of previous experiments and observations to predictions for new situations.
- Research and manage ideas and information.
- Reflect upon experiences with *Exploring Properties of Matter* in writing and oral discussion.
- Write complete, coherent accounts of inquiries conducted in class with evidence-based conclusions.
- Continue to seek more information on the properties of matter in reading and online research.
- Develop the ability to assess validity of information on properties of matter and other scientific matters.
- Evaluate own learning while studying *Exploring Properties of Matter.*

Stage 2: Acceptable Evidence

Transfer Task

Students will accurately apply the concepts of mass and volume to calculate density to identify the material from which an object is made. Students will utilize measurement skills, knowledge of density and create a data table to determine the substance that makes up an unknown object. Students will be able to independently utilize their knowledge and skills to interpret tables, diagrams, graphs and experiments. Refer to Lesson 14 in the STC manual of Exploring the Properties of Matter for the procedures and materials needed.

H.B. Whitehorne Science Grade 5

Unit Title / Topic: Ecosystems	Unit Duration: 60 days

Stage 1: Desired Results

Established Goals:

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams, and flowcharts.]

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Science and Engineering Practices

Developing and Using Models
- Use models to describe phenomena. (5-PS3-1),(5-LS2-1)

Engaging in Argument from Evidence
- Support an argument with evidence, data, or a model. (5-LS1-1)

Obtaining, Evaluating, and Communicating Information
- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
- Science explanations describe the mechanisms for natural events. (5-LS2-1)

Disciplinary Core Ideas

PS3.D: Energy in Chemical Processes and Everyday Life
- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)

LS1.C: Organization for Matter and Energy Flow in Organisms
- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)

LS1.C: Organization for Matter and Energy Flow in Organisms
- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

LS2.A: Interdependent Relationships in Ecosystems
- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

ESS3.C: Human Impacts on Earth Systems
- Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

Crosscutting Concepts

Energy and Matter
- Energy can be transferred in various ways and between objects. (5-PS3-1)
- Matter is transported into, out of, and within systems. (5-LS1-1)

Systems and System Models
- A system can be described in terms of its components and their interactions. (5-LS2-1),(5-ESS3-1)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World.
- Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)

RI.5.7 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-PS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1)

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (5-LS1-1)

MP.4 Model with mathematics. (5-LS1-1)

MP.5 Use appropriate tools strategically. (5-LS1-1)

5.MD.A.1 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-LS1-1)

Transfer Goal:

Students will be able to <u>independently</u> use their learning to present a design solution for reducing pollution in the Chesapeake Bay.

Students will understand that:

- Interactions within and among living systems cause changes in matter and energy.
- Organisms are linked to each other and to their environments in a web of relationships.
- An ecosystem is a community of organisms that interact with each other and the environment. Humans may affect ecosystems in many ways. Model ecosystems may be used to learn more about the relationships that exist on earth.
- Organisms in ecosystems have dependent and independent relationships.
- Nature and human activity may affect an ecosystem in beneficial or harmful ways.
- People can develop solutions to mitigate the effects of pollutants.
- Environmental problems are complex and must be considered from many viewpoints; most solutions involve trade-offs between those differing views.

Essential Questions:

- What is an environmental trade-off?
- How can studying models inform our understanding of ecosystems?
- How do humans affect ecosystems?
- What is a fair test?

Students will know:

- A terrarum is a model of a terrestrial environment that can be used to make observations applicable to all terrestrial environments.
- An aquarium is a model of an aquatic environment that can be used to make observations applicable to all aquatic environments.
- An environment in which producers and consumers form interdependent relationships is an ecosystem.
- In an ecosystem, organisms function as producers and consumers.
- Natural and human-made events can disturb a stable ecosystem.
- Scientific experiments with variables and a control can be designed to test the impact of pollution upon an ecosystem.
- The data from repeated experiments provide the evidence needed to support or negate a hypothesis.
- A pollutant is anything that can harm an ecosystem.
- Pollution is a condition that results when pollutants interact with the environment.

- aquatic, environment, habitat, observe, terrestrial, aquarium, germination, model, terrarium, frond, model, organism, photosynthesis, producer, respiration, fry, gastropods, gravid spot, larvae, lateral line, live-bearer, mantle, radula, scavengers, abdomen, cerci, consumer, entomologist, exoskeleton, isopod, house cricket, molt, nymph, ovipositor, scavengers, thorax, acid rain, acid, base, neutral, fossil fuels, pH, fertilizers, algae bloom, pollutant, acidity, trade-off, analyze, experimental variable, control, controlled, experiment, data, disrupt, ecosystem, evidence, water pollution, watershed, algae bloom, sediment

Students will be able to:

- Construct model terrariums and aquariums.
- Observe and record data of the relationships in their model habitats.
- Make predictions of cause and effect when the terrarium and aquarium are linked.
- Design and conduct a controlled experiment to study the effects of pollution.
- Analyze and interpret data to make sense of the results of their experimental treatment.
- Use evidence to construct a design solution for pollution reduction.

Stage 2: Acceptable Evidence

Transfer Task

Unit Post Assessment

H.B. Whitehorne — Science Grade 5

Unit Title / Topic: Electric Circuits	Unit Duration: 60 days

Stage 1: Desired Results

Established Goals:

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide. [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)

Planning and Carrying Out Investigations

- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)

Constructing Explanations and Designing Solutions

- Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)
- Apply scientific ideas to solve design problems. (4-PS3-4)

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2),(4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4)

PS3.C: Relationship Between Energy and Forces

- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

PS3.D: Energy in Chemical Processes and Everyday Life

- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

ETS1.A: Defining Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects. (4-PS3-2), (4-PS3-3), (4-PS3-4)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering and Technology on Society and the Natural World

- Engineers improve existing technologies or develop new ones. (4-PS3-4)

Connections to Nature of Science

Science is a Human Endeavor

- Most scientists and engineers work in teams. (4-PS3-4)
- Science affects everyday life. (4-PS3-4)

Common Core State Standards Connections:

ELA/Literacy –

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4)

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. (4-PS3-2),(4-PS3-3),(4-PS3-4)

Mathematics –

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)

Transfer Goal:

Students will be able to <u>independently</u> use their learning to develop a wiring plan and carry out the plan to wire a model house.

Students will understand that:

- Electricity in circuits can produce light, heat, and other forms of energy.
- Electric circuits require a complete loop through which an electrical current passes.
- An electric circuit may be constructed with different devices and in different combinations.
- Different materials can behave as conductors or insulators.
- Electricity in circuits produces a magnetic field and can be used to produce light and heat.
- Conductors are needed to complete an electric circuit.
- Different circuit components can be added and arranged in different ways to produce different results and construct a variety of electrical devices and systems.
- The technological design process consists making a original design, testing it, and making additional modifications for improvement.

Essential Questions:

- How does electricity work?
- Why do the lights go on when I flip a switch?
- How is my house's wiring like the circuits I can make on my desk?
- How can I make technical drawings of electrical circuits?

Students will know:

- Electricity flows along a path called a circuit that can consist simply a battery, a bulb, and connecting wires.
- A complete circuit can be configured in several different ways.
- Troubleshooting is a problem solving strategy that tests malfunctioning circuits
- Conductors are materials that allow electricity to flow through them in detectable amounts, and insulators are materials that do not.
- A circuit tester can be used to find hidden wiring patterns.
- Symbols are used to show how electrical components are connected in circuit diagrams.
- Elements in a circuit can be joined in series or parallel connections that affect the current, voltage, and resistance in the circuit.
- Switches control the flow of electricity.
- A semiconductor diode allows electrical current to flow in only one direction.

- electricity, safety, bulb, wire, battery, short-circuit, circuit, predict, prediction, model, bulb, volts, filament, threaded base, support wire, glass support, ceramic insulator, Fahnestock clip, battery holder, light bulb socket, troubleshoot, analyze, circuit tester, conductor, insulator, conduct, filament, nichrome wire, circuit box, troubleshoot, circuit diagram, symbol, switch, crossing wires, connected wires, parallel circuit, series circuit, brightness, open (off), closed (on), switch, flashlight, switch symbol, series, parallel, circuit, flashlight, open switch, closed switch, switch, semiconductor, diode, current, circuit diagram, symbols, model, wiring plan

Students will be able to:

- Build various working circuits.
- Troubleshoot non-functioning circuits
- Conduct investigations of conductors and insulators.
- Use a circuit tester to investigate hidden wiring patterns.
- Use electrical symbols to make circuit diagrams.
- Assemble series and parallel circuits.
- Conduct an investigation of how diodes function, and the directionality of current flow.
- Use design processes to develop plans for wiring a house.

Stage 2: Acceptable Evidence

Transfer Task

Unit Post Assessment