Barrington School District | Haddon Heights School District | Lawnside School District | Merchantville School District

Course Name: Science
Grade: Fourth Grade
Board Approved:

*All curriculum is aligned with the NJSLS in accordance with the Department's curriculum implementation timeline and includes all required components (NJ.A.C.6A:8).
**Resource and activity lists are compiled from all four districts and may not necessarily be reflected in each district or school.

Introduction

New Jersey Student Learning Standards for Science

Michael Heinz, Coordinator

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.

Mission: Scientifically literate individuals possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.

Vision: The science standards are designed to help realize a vision for education in the sciences and engineering in which students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields. The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. Throughout grades K-12, students should have the opportunity to carry out scientific investigations and engineering design projects related to the disciplinary core ideas (pp. 8-9, NRC, 2012).

STANDARD:
4-PS3 - Energy
4-ESS1 - Earth's Place in the Universe

Unit 5: Transfer of Energy

ESTABLISHED GOALS (INDICATOR #)	TRANSFER (How will this apply to their lives?)	
4 - PS3-2 - Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. 4-ESS3-1 - Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	*Students will be able to independently use their knowledge to…* ● Determine different ways energy can be moved from place to place.	
	MEANING	
	UNDERSTANDINGS: ● Energy can be transferred in various ways and between objects. ● Energy can be moved from place to place through sound, light, or electric currents. ● Energy is present whenever there are moving objects, sound, light, or heat. ● Light also transfers energy from place to place. ● Energy can also be transferred from place to place by electric currents; the currents may have been produced to begin with by transforming the energy of motion into electrical energy. ● Cause-and-effect relationships are routinely identified and used to explain change. ● Knowledge of relevant scientific concepts and research findings is important in engineering. ● Over time, people's needs and wants change, as do their demands for new and improved technologies. ● Energy and fuels that humans use are derived from natural sources.	ESSENTIAL QUESTIONS: ● How does energy move? ● From what natural resources are energy and fuels derived? In what ways does the human use of natural resources affect the environment?

	• The use of energy and fuels from natural sources affects the environment in multiple ways. • Some resources are renewable over time, and others are not.	

Unit 5: Grade 4 - Lessons

Students conduct investigations to observe that energy can be transferred from place to place by sound, light, heat, and electrical currents. They describe that energy and fuels are derived from natural resources and their uses affect the environment. Throughout this unit, students obtain, evaluate, and communicate information as they examine cause-and-effect relationships between energy and matter.

To begin the unit of study progression of learning, students need opportunities to observe the transfer of heat energy. They can conduct simple investigations, using thermometers to measure changes in temperature as heat energy is transferred from a warmer object to a colder one. For example, hot water can be poured into a large Styrofoam cup, and then a smaller plastic cup of cold water can be placed inside the larger cup of water. A thermometer can be placed in each cup, and students can observe and record changes in the temperature of the water in each cup every minute over the course of about 10–15 minutes, or until the temperatures are the same. Students can use their data as evidence to explain that some of the heat energy from the hot water transferred to the cold water. This transfer of heat caused the cold water to become gradually warmer and the hot water to cool. This process continued until the cups of water reached the same temperature.

Students can also place a thermometer in the palm of their hands, close their hands around it, and measure the temperature. They can then place a piece or two of ice into their palms and close their fists around the ice until it melts. When they again measure the temperature of their palms, they will observe a change. Students can use these data to describe how some of the heat from their hands transferred to the ice, causing it to melt, while the ice also decreased the temperature of their hand. It is important that students understand that heat is transferred from warmer to colder objects. When an object cools, it loses heat energy. When an object gets warmer, it gains heat energy.

To continue learning about energy transfer, students can build simple electric circuits. As students work in small groups to build circuits, they should add a bulb and/or a buzzer to the circuit in order to observe and describe the ways in which energy is transferred in the circuit. (The word “transfer” can refer to a change in the type of energy or a change in the location of energy.) For example, stored energy in a battery is transferred into electrical energy, which is then transferred into light energy if a bulb is added to the circuit. The energy transfers from the battery to the wire and then to the bulb. The same holds true if a buzzer is added to the circuit. The stored energy in the battery is transferred into electrical energy, which is then transferred into sound energy. (Keep in mind that energy is not actually produced. When we say that energy is “produced,” this typically refers to the conversion of stored energy into a desired form for practical use. Students should be encouraged to use the term “transferred” rather than “produced”).

After conducting these types of investigations, the class can create a list of events in which energy is transferred. For example, when a ball is thrown against a wall, some of the motion energy is transferred to sound energy; when water boils on the stove top, heat energy from the stove is transferred to the pot and to the water in the pot; and when a doorbell is rung, electrical energy is transferred into sound energy.

Next, students learn about fuels and energy, and conduct research using books and other reliable media to determine which natural resources are sources of energy. Light, heat, sound, and electricity are all forms of energy. Energy is not matter. Fuels, however, are matter. For example, fossil fuels, such as coal, oil, and natural gas, are matter. When fossil fuels are burned, energy stored in the fuel can be transferred from stored energy to heat, light, electrical, and/or motion energy. Therefore, fuels are considered to be a source of energy.

Energy can also be obtained from other sources, such as wind, water, and sunlight. Air and water are both matter, but when they are moving, they have motion

energy. Energy from wind (moving air) and from moving water can be transferred into electrical energy. Light energy from the sun can also be transferred to heat energy or electrical energy. In addition, energy can be released through nuclear fission using materials known as fissile materials.

As students learn about fuels and other sources of energy, they should determine which sources are renewable and which are nonrenewable. Generally, a fuel or source of energy is considered nonrenewable if that source is limited in supply and cannot be replenished by natural means within a reasonable amount of time. Renewable sources of energy are those that are replenished constantly by natural means. Using this general description, all fossil fuels are considered nonrenewable, because these resources were naturally created over millions of years. Fissile materials are also nonrenewable. On the other hand, wind, moving water, and sunlight are renewable sources of energy.

As the population continues to grow, so does the demand for energy. Human use of natural resources for energy, however, has multiple effects on the environment. Students should conduct further research to determine how the use of renewable and nonrenewable resources affects the environment. Some examples include:

- ✓ Changes in and loss of natural habitat due to the building of dams and the change in the flow of water;
- ✓ Changes in and loss of natural habitat due to surface mining; and
- ✓ Air pollution caused by the burning of fossil fuels in factories, cars, and homes.

As students conduct research and gather information from a variety of reliable resources, they can take notes and use the information to describe and explain the impact that human use of natural resources has on the environment.

Mystery Science Suggested Lessons: **Also can be used for Unit 6*
Energizing Everything: Energy, Motion and Electricity
Unit Starter: Energy and Modeling: Rube Goldberg Machine
Mystery 1: Speed and Energy: How can a car run without gas?
Mystery 2: Energy Conversion and Engineering: What makes roller coasters go fast?
Mystery 3: Energy and Collisions: Why is the first hill of a roller coaster always the highest?
Mystery 4: Energy and Engineering: Could you knock down a building using only dominoes?
Mystery 5: Energy and Engineering: Can you build a chain reaction machine?
Mystery 6: Electrical Energy: What if there were no electricity?
Mystery 7: Heat, Engines and Energy Transfer: How long did it take to travel across the country before cars and planes?
Mystery 8: Energy Resources and Environmental Impacts: Where does energy come from?

Better Lesson Suggested Units: **Also can be used for Unit 6*

Speed and Energy Unit:
Lesson 1: Drop Pop- Energy and Speed Exploration *SWBAT experiment with gravitational potential energy and elastic potential energy and observe transfer of energy.*
Lesson 2: Balloon Rockets Launch New Learning *SWBAT observe how speed and energy are related.*
Lesson 3: Marvelous Marbles Moving *SWBAT make observations that speed is related to the amount of energy in an object.*
Lesson 4: Crashing Cars *SWBAT predict outcomes about the changes in energy that occur when objects collide.*

Lesson 5: Moving Pennies *SWBAT demonstrate how energy can be transferred from one object to another.*

Energy Unit:
Lesson 1: What is Energy? *SWBAT define kinetic energy and potential energy.*
Lesson 2: Chillin' With Colored Paper *SWBAT demonstrate how energy can be transferred from one object to another, by melting an ice cube.*
Lesson 3: Bright Time with Circuits *SWBAT demonstrate how energy can be transferred from one object to another.*
Lesson 4: Colliding Marbles *SWBAT work with various materials to create and answer questions about what happens with energy when objects collide.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting concepts
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) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)	**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) **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) ● 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)	**Energy and Matter** ● Energy can be transferred in various ways and between objects. (4-PS3-2) **Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) - ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** ● Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1) **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1)

	ESS3.A: Natural Resources ● Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)	

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Students who understand the concepts are able to: ● Make observations to produce data that can serve as the basis for evidence for an explanation of a phenomenon or for a test of a design solution. ● Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. ● Identify cause-and-effect relationships in order to explain change. ● Obtain and combine information from books and other reliable media to explain phenomena. ● Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. ✓ Examples of renewable energy resources could include: o Wind energy, o Water behind dams, and o Sunlight. ✓ Examples of nonrenewable energy resources are: o Fossil fuels, o Fissile materials ✓ Examples of environmental effects could include: o Loss of habitat due to dams o Loss of habitat due to surface mining o Air pollution from burning of fossil fuels.	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* **Mystery Science Assessments:** ***(all resources are accessible on google drive)*** Energizing Everything: Energy, Motion and Electricity

Energizing Everything: Energy, Motion and Electricity:

Mystery 1: Speed and Energy

Mystery 2: Energy Conversion and Engineering

Mystery 3: Energy and Collisions

Mystery 4: Energy and Engineering

Mystery 5: Energy and Engineering

Mystery 6: Electrical Energy

Mystery 7: Heat, Engines and Energy Transfer

Mystery 8: Energy Resources and Environmental Impacts

Alternative Assessments

Evaluative Criteria

Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments:

4 - Innovating:	Advanced understanding and application of the standard
3 - Applying:	Consistently applies skills independently
2 - Developing:	Progressing towards independent application of skills
1 - Beginning:	Early stages of development, need assistance

Assessment Evidence

Suggested Performance Tasks include but are not limited to:

Performance Task: Mystery Science- Energy and Engineering: Can you turn on a flashlight without touching it?

Resources for Performance Task:

Chain Reaction Starter Kit

Rube Goldberg

Final Project Rubric

Conceptual Model Handout

District/School Texts

District/School Supplementary Resources

Haddon Heights - Unit Kits for Science Labs and References Lawnside - Houghton Mifflin Harcourt : Science Fusion Merchantville- Exploring Science (National Geographic Learning)	**-Scholastic News** **-Brain POP** **-NewsELA** **-Read Works**

Interdisciplinary Connections

ELA	**Math**	**21st Century Skills/Career Education**
Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-ESS3-1) **W.4.7** 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-ESS3-1) **W.4.8** Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1) **W.4.9**	Reason abstractly and quantitatively. (4-ESS3-1) **MP.2** Model with mathematics. (4-ESS3-1) **MP.4** Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1) **4.OA.A.1**	CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason CRP11. Use technology to enhance productivity.
Technology 8.2.5.A.1 - Compare and contrast how products made in nature differ from products that are human made in how they are produced and used.		

Modifications and Accommodations

Special Education Students	**English Language Learners**	**Students at Risk of School Failure**
Small group Direct instruction restate/rephrase graphic organizers modified assignments chunking leveled text intentional grouping read text extended time	Labels word banks visuals student friendly definitions extended time chunking intentional grouping	leveled text graphic organizers modified assignments kinesthetic activities restate/rephrase chunking intentional grouping

breaks Teacher records/ student dictates		
Gifted and Talented extension project leveled text leadership roles intentional grouping Targeted learning from assessment	**Students with 504 Plans** breaks chunking preferential seating visual reminders restate/rephrase check-in/check-out system visual time Teacher records/ student dictates	
Unit Duration: 15 days		