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

Unit 6: Forces and Motion

ESTABLISHED GOALS (INDICATOR #)	TRANSFER (How will this apply to their lives?)	
4-PS3-1 - Use evidence to construct an explanation relating the speed of an object to the energy of that object. **4-PS3-3 - Ask questions and predict outcomes about the changes in energy that occur when objects collide.**	*Students will be able to independently use their knowledge to…* ● Explain the transfer of energy. ● Describe how energy changes as objects collide and move.	
	MEANING	
	UNDERSTANDINGS: ● Energy can be transferred in various ways and between objects. ● The faster a given object is moving, the more energy it possesses. ● Energy can be transferred in various ways and between objects. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. ● 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. ● When objects collide, the contact forces transfer energy so as to change the objects' motions.	ESSENTIAL QUESTIONS: ● What is the relationship between the speed of an object and its energy? ● In what ways does energy change when objects collide?

Unit 6: Grade 4 - Lessons

In order to understand and explain the relationship between an object's speed and its energy, students need multiple opportunities to observe objects in motion. Students can roll balls down ramps, build and race rubber band cars, or build roller coasters. As they observe the motion of objects, they should collect data about the relative speed of objects in relation to the strength of the force applied to them. For example, when a ball is placed at the top of a ramp, it has stored energy, due to the force of gravity acting on it. When the ball is released, that stored energy is changed (transferred) into motion energy. Increasing the height of a ramp also increases the amount of stored energy in the ball at the top of the ramp. If the ball is released from a higher starting point, it rolls faster and farther. Likewise, winding the rubber band in a rubber band car stores energy in the rubber band, which is then changed, or transferred, into motion energy (kinetic) as the car moves forward. The more times you wind the rubber band, the greater the amount of stored energy in the rubber band, and the farther and faster the car goes. As students investigate these types of force and motion systems, they should conduct multiple trials, increasing and decreasing the amount of energy, then collect qualitative data as they observe the impact differing amounts of energy have on the relative speed of the object in motion. Students should then use their data as evidence to support their explanation of the relationship between the relative speed of an object and its energy.

Once students understand that the faster an object moves, the more energy it possesses, they can begin to explore ways in which energy can be transferred. As they investigated the relationship between speed and energy, students learned that stored energy was changed, or transferred, into motion energy. To broaden their understanding of energy transfer, students should be provided with opportunities to observe objects colliding and should be encouraged to ask questions that lead to further investigation. For example, if students roll a ball towards a wall, or roll two balls so that they collide, they may observe any or all of the following:

- ✓ Change(s) in the direction of motion
- ✓ Change(s) in speed
- ✓ Change(s) in the type of energy (e.g., motion energy to sound energy, sound energy to heat energy)
- ✓ Change(s) in the type of motion (rolling to bouncing).

As students continue to investigate interactions between moving objects, they should notice that when a moving object collides with a stationary object, some of the motion energy of one is transferred to the other. In addition, some of the motion energy is changed, or transferred to the surrounding air, and as a result, the air gets heated and sound is produced. Likewise, when two moving objects collide, they transfer motion energy to one another and to the surrounding environment as sound and heat. It is important that as students observe these types of interactions, they collect observational data, document the types of changes they observe, look for patterns of change in both the motion of objects and in the types of energy transfers that occur, and make predictions about the future motion of objects. Their investigations will help them understand that:

- ✓ Energy can be transferred in various ways and between objects.
- ✓ Energy is present whenever there are moving objects.
- ✓ Energy can be moved, or transferred, from place to place by moving objects.
- ✓ When objects collide, some energy may be changed or transferred into other types of energy

Mystery Science Suggested Lessons: **Also can be used for Unit 5*
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 5*

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.*

Energy and Motion Unit:
Lesson 1: Deep Impact *SWBAT use evidence to construct an explanation relating the speed of an object with the energy of that object.*
Lesson 2: Collision Course (Part 1) *SWBAT ask questions and predict outcomes about the changes in energy that occur when objects collide.* (Performance Task Assessment)
Lesson 3: Collision Course (Part 2) *SWBAT conduct an experiment, collect data, and draw conclusions about the changes in energy that occur when objects collide.* (Performance Task Assessment)
Lesson 4: Faux News-Energy *SWBAT analyze, critique, and respond to a scientific conclusion in writing.*

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)	**PS3.A: Definitions of Energy** ● The faster a given object is moving, the more energy it possesses. (4-PS3-1) ● Energy can be moved from place to place by moving objects or through	**Energy and Matter** ● Energy can be transferred in various ways and between objects. (4-PS3-1) (4-PS3-3)

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) **Constructing Explanations and Designing Solutions** ● Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)	sound, light, or electric currents. (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-PS3-3) **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)	

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Students who understand the concepts are able to: ● Describe various ways that energy can be transferred between objects. ● Use evidence (e.g., measurements, observations, patterns) to construct an explanation. ● Use evidence to construct an explanation relating the speed of an object to the energy of that object. ● Describe the various ways that energy can be transferred between objects. ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. ● Ask questions and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. **Energizing Everything: Energy, Motion and Electricity:** Mystery 1: Speed and Energy	*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

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	Assessment Evidence
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	Suggested Performance Tasks include but are not limited to: **Performance Task**: **Also used in Unit 5* 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 --- **Optional Performance Task:** Lesson 2: Collision Course (Part 1) *SWBAT ask questions and predict outcomes about the changes in energy that occur when objects collide.* Lesson 3: Collision Course (Part 2) *SWBAT conduct an experiment, collect data, and draw conclusions about the changes in energy that occur when objects collide.*

District/School Texts	District/School Supplementary Resources
Haddon Heights - Unit Kits for Science Labs and References	**-Scholastic News** **-Brain POP**

Lawnside - Houghton Mifflin Harcourt : Science Fusion Merchantville- Exploring Science (National Geographic Learning)	**-NewsELA** **-Read Works**

Interdisciplinary Connections

ELA	**Technology**	**21st Century Skills/Career Education**
Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1) **RI.4.1** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1) **RI.4.3** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1) **RI.4.9** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1) **W.4.2** Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-3) **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-PS3-1),(4-PS3-3) **W.4.8** Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1) **W.4.9**	8.2.5.D.3 - Follow step by step directions to assemble a product or solve a problem.	CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason CRP11. Use technology to enhance productivity.

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 breaks Teacher records/ student dictates	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
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		