GRADE 4– Unit 2: Energy & Energy Transfer

Mission Statement
The primary goal of the Swedesboro-Woolwich School District is to prepare each student with the real life skills needed to compete in a highly competitive global economy. This will be achieved by providing a comprehensive curriculum, the integration of technology, and the professional services of a competent and dedicated faculty, administration, and support staff. Guiding this mission will be Federal mandates, including No Child Left Behind, the New Jersey Core Curriculum Content Standards, and local initiatives addressing the individual needs of our students as determined by the Board of Education. The diverse resources of the school district, which includes a caring PTO and active adult community, contribute to a quality school system. They serve an integral role in supporting positive learning experiences that motivate, challenge and inspire children to learn.

Unit/Module Overview
In this unit, students explore energy! Students investigate how energy is stored, how it can make objects move, and how collisions transfer energy between objects. Students also construct chain reaction machines to explore the many different ways that energy can be transferred.

Standards Covered in Current Unit/Module
Related Standards & Learning Goals

Priority Standards

SCI.3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
SCI.3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
SCI.3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
SCI.4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
SCI.4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
SCI.4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Learning Goals

Lesson 1: Speed & Energy

I can explain the relationship between the energy of an object and the speed of the object.

Lesson 2: Gravitational Energy, Speed & Collisions

I can explain how energy can be stored as height

Lesson 3: Collisions & Energy Transfer

I can predict outcomes about changes in energy and transfer of energy that occurs when object collide.

Lesson 4: Energy Transfer & Engineering 1

I can design a machine that stores, releases and transfers energy.

Lesson 5: Energy Transfer & Engineering 2

I can design a machine that stores, releases and transfers energy.

Unit/Module Weekly Learning Activities and Pacing Guide			
Topic & # Days	**NJ Standards**	**Critical Knowledge & Skills**	**Possible Resources & Activities**
Week 1: Anchor Phenomenon: Rube Goldberg Machines	● 4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object. ● 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-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide. ● 4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts	**Obj. We are learning to**: ● I can design a rube goldberg machine **Suggested Formative Assessment(s)**:	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Slides -Class Discussion -Complete See-Think-Wonder Worksheet **Day 2:** -Review Slides -Complete Rube Goldberg Machine Model Worksheet -Class Discussion **Materials** ● Energy Everything Teach Guide: Mystery Science Document #293 ● Rube Goldberg Machine Model: Mystery Science Document #81 ● See-Think-Wonder Worksheet: Mystery Science Document #2301

	energy from one form to another.		
Week 2: Lesson 1: Speed & Energy	• 4-PS3-1: *Use evidence to construct an explanation relating the speed of an object to the energy of that object.*	**Obj. We are learning to**: ● I can explain the relationship between the energy of an object and the speed of the object. **Suggested Formative Assessment(s)**: **Lesson 1: Speed & Energy** Exit Ticket: Mystery Science Document #236 Answer Key: Mystery Science Document #237	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Video -Vocabulary Slides -Class Discussion **Days 2 & 3:** -Review Introduction / Vocabulary -Lab / Hands-on Activity **Day 4:** -Finish Video -Wrap up Discussions **Day 5:** -Assessment **Materials** ● Twist-O-Matic Printout: Mystery Science Document #89 ● Twist-O-Matic Challenges: Mystery Science Document #93 ● Twist-O-Matic Challenges Answer Key: Mystery Science Document #100 ● Caryons ● Hardcover Books ● Rules ● Scissors ● Rubber Bands Thin ● Rubber Bands Thick ● Small Binder Clips

Week 3: Lesson 2: Gravitational Energy, Speed & Collisions	• 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.*	**Obj. We are learning to**: ● I can explain how energy can be stored as height **Suggested Formative Assessment(s)**: **Lesson 2: Gravitational Energy, Speed & Collisions** Exit Ticket: Mystery Science Document #845 Answer Key: Mystery Science Document #848	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Video -Vocabulary Slides -Class Discussion **Days 2 & 3:** -Review Introduction / Vocabulary -Lab / Hands-on Activity **Day 4:** -Finish Video -Wrap up Discussions **Day 5:** -Assessment **Materials** 1. Alligator Printout: Mystery Science Document #834 2. Bumper Coaster Part I Answer Key: Mystery Science Document #837 3. Bumper Coaster Part I Tracks Printout: Mystery Science Document #833 4. Collisions Experiments Worksheet: Mystery Science Document #836 5. Distance & Height Experiments: Mystery Science Document #835 6. Box 7. Pencil 8. Rulers 9. Scissors 10. File Folder Label 11. Paper Clips 12. Small Marbles

Week 4: Lesson 3: Collisions & Energy Transfer	• 4-PS3-3: *Ask questions and predict outcomes about the changes in energy that occur when objects collide.*	**Obj. We are learning to**: ● I can predict outcomes about changes in energy and transfer of energy that occurs when objects collide. **Suggested Formative Assessment(s)**: **Lesson 3: Collision & Energy Transfer:** -No Assessment Listed; Just Lab Activity- Bumper Jumper Game: Mystery Science Document #25572 Bumper Jumper Game with Foil: Mystery Science Document #25573 Collision Track Printout: Mystery Science Document #25570 Landing Zone: Mystery Science Document #25571	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Video -Vocabulary Slides -Class Discussion **Days 2 & 3:** -Review Introduction / Vocabulary -Lab / Hands-on Activity **Day 4:** -Finish Video -Wrap up Discussions **Day 5:** -Assessment **Materials** 1. Bumper Jumper Game: Mystery Science Document #25572 2. Bumper Jumper Game with Foil: Mystery Science Document #25573 3. Collision Track Printout: Mystery Science Document #25570 4. Landing Zone: Mystery Science Document #25571 5. Scissors 6. Scotch Tape 7. Scape Paper 8. Aluminum Foil 9. 18 oz Cup 10. 3ox Dixie Cups 11. Pencils w/ Erasers 12. Sticker Labels 13. Small Marbles

Week 5: Lesson 4: Energy Transfer & Engineering	• 4-PS3-4: *Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* • 3-5-ETS1-1: *Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.*	**Obj. We are learning to**: ● I can design a machine that stores, releases and transfers energy. **Suggested Formative Assessment(s)**: **Lesson 4: Energy Transfer & Engineering 1** Exit Ticket: Mystery Science Document #572 Answer Key: Mystery Science Document #123	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Video -Vocabulary Slides -Class Discussion **Days 2 & 3:** -Review Introduction / Vocabulary -Lab / Hands-on Activity **Day 4:** -Finish Video -Wrap up Discussions **Day 5:** -Assessment **Materials** 1. Chain-Reaction Starter Kit Printout: Mystery Science Document #35 2. Marble Corral Printout: Mystery Science Document #548 3. Markers 4. Rulers 5. Scissors 6. 3 oz Dixie Cups 7. File Folder Labels 8. Paper Clips 9. 8 oz Paper Cups 10. Rubber Bands 11. Small Marbles
Week 6: Lesson 5: Energy Transfer & Engineering	• 3-5-ETS1-1: *Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials,*	**Obj. We are learning to**: ● I can design a machine that stores, releases and transfers energy. **Suggested Formative Assessment(s)**: **Lesson 5: Energy Transfer & Engineering 2**	**Curriculum** ○ Mystery Science **Day 1:** -Introduction Video -Vocabulary Slides

2	*time, or cost.* **3-5-ETS1-2:** ***Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.*** **3-5-ETS1-3:** ***Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.*** • 4-PS3-4: *Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*	Exit Ticket: Mystery Science Document #572 Answer Key: Mystery Science Document #123	-Class Discussion **Days 2 & 3:** -Review Introduction / Vocabulary -Lab / Hands-on Activity **Day 4:** -Finish Video -Wrap up Discussions **Day 5:** -Assessment **Materials** 1. Chain-Reaction Starter Kit Printout: Mystery Science Document #35 2. Pop-Up Sign Printout: Mystery Science Document #40 3. Hardcover Books 4. Lever from previous lessons 5. Markers 6. Ramp from previous lessons 7. Rulers 8. Scissors 9. 3 oz Dixie Cups 10. File Folder Labels 11. 3x5 Index Cards 12. Jumbo Paper Clips 13. 8 oz Paper Cups 14. Rubber Bands 15. Small Marbles
Week 7: Unit Review & Summative Assessment	• 4-PS3-1: *Use evidence to construct an explanation relating the speed of an object to the energy of that object.* • 4-PS3-2: *Make observations to provide evidence that*	**Obj. We are learning to**: ● I can design a rube goldberg machine ● I can explain the relationship between the energy of an object and the speed of the object. ● I can explain how energy can be stored as	**Curriculum** ○ Mystery Science **Day 1-2** -Review Units **Days 3-4:** -Summative Assessment

	energy can be transferred from place to place by sound, light, heat, and electric currents. • 4-PS3-3: *Ask questions and predict outcomes about the changes in energy that occur when objects collide.* • 4-PS3-4: *Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*	height ● I can predict outcomes about changes in energy and transfer of energy that occurs when object collide. ● I can design a machine that stores, releases and transfers energy. **Suggested Formative Assessment(s)**: **Unit 2: Energy & Energy Transfer** Summative Assessment: Mystery Science Document #183 Answer Key: Mystery Science Document #186	**Materials**
Week 8: Performance Task: Energy & Engineering	• 3-5-ETS1-1: *Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.* **3-5-ETS1-2:** ***Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.*** **3-5-ETS1-3:** ***Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.*** • 4-PS3-4: *Apply scientific ideas to design, test, and*	**Obj. We are learning to**: ● In the Performance Task, students will design a Rube Goldberg machine that utilizes energy transfers and conversions to complete a goal of the student's choosing. **Suggested Formative Assessment(s)**: **Performance Task: Energy & Engineering** Chain-Reaction Starter Kit: Mystery Science Document #35 Rube Goldberg Conceptual Model: Mystery Science Document #645 Rube Goldberg Final Project: Mystery Science Document #579 Rube Goldberg Final Project Rubric: Mystery Science Document #646	**Curriculum** ○ Mystery Science **Days 1-5:** -Complete Performance Task as needed -Enrichment opportunities through Mystery Science Mini Lessons: Rollercoasters (mysteryscience.com) **Materials** 1. Chain-Reaction Starter Kit: Mystery Science Document #35 2. Rube Goldberg Conceptual Model: Mystery Science Document #645 3. Rube Goldberg Final Project: Mystery Science Document #579 4. Rube Goldberg Final Project Rubric: Mystery Science Document #646

	refine a device that converts energy from one form to another.		

Google Form Versions of Mystery Science Assessments

Link to Additional Components including Cross Curricular Connections, Accommodations, Assessments, Etc
ELA Enduring Understanding Statements