Unit 2: Energy & Energy Transfer

Content Area: **Science**
Course(s):
Time Period: **December**
Length: **Trimester 2**
Status: **Published**

Unit 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.

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.

Essential Questions

Lesson 1: Speed & Energy

How is your body similar to a car?

Lesson 2: Gravitational Energy, Speed & Collisions

What makes roller coaster go so fast?

Lesson 3: Collisions & Energy Transfer

How can marbles save the world

Lesson 4: Energy Transfer & Engineering 1

Could you knock down a building using only dominoes?

Lesson 5: Energy Transfer & Engineering 2

Can you build a chain reaction machine?

Unit Learning Targets

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.

Materials and Resources for Labs/Activities

Anchor Phenomenon: Energy & Modeling

1. Energy Everything Teach Guide: Mystery Science Document #293
2. Rube Goldberg Machine Model: Mystery Science Document #81

3. See-Think-Wonder Worksheet: Mystery Science Document #2301

Lesson 1: Speed & Energy

1. Twist-O-Matic Printout: Mystery Science Document #89
2. Twist-O-Matic Challenges: Mystery Science Document #93
3. Twist-O-Matic Challenges Answer Key: Mystery Science Document #100
4. Caryons
5. Hardcover Books
6. Rules
7. Scissors
8. Rubber Bands Thin
9. Rubber Bands Thick
10. Small Binder Clips

Lesson 2: Gravitational Energy, Speed & Collisions

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

Lesson 3: Collision & Energy Transfer:

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. 18oz Cup
10. 3ox Dixie Cups
11. Pencils w/ Erasers
12. Sticker Labels
13. Small Marbles

Lesson 4: Energy Transfer & Engineering 1

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. 3oz Dixie Cups
7. File Folder Labels
8. Paper Clips
9. 8oz Paper Cups
10. Rubber Bands
11. Small Marbles

Lesson 5: Energy Transfer & Engineering 2

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. 3oz Dixie Cups
10. File Folder Labels
11. 3x5 Index Cards
12. Jumbo Paper Clips
13. 8oz Paper Cups
14. Rubber Bands
15. Small Marbles

Performance Task: Energy & Engineering

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

Unit Assessments

Lesson 1: Speed & Energy

Exit Ticket: Mystery Science Document #236

Answer Key: Mystery Science Document #237

Lesson 2: Gravitational Energy, Speed & Collisions

Exit Ticket: Mystery Science Document #845

Answer Key: Mystery Science Document #848

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

Lesson 4: Energy Transfer & Engineering 1

Exit Ticket: Mystery Science Document #572

Answer Key: Mystery Science Document #123

Lesson 5: Energy Transfer & Engineering 2

Exit Ticket: Mystery Science Document #572

Answer Key: Mystery Science Document #123

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

Unit 2: Energy & Energy Transfer

Summative Assessment: Mystery Science Document #183

Answer Key: Mystery Science Document #186

Mystery Science Google Forms Assessments:

Google Form Versions of Mystery Science Assessments

Learning Plan (Skills & Activities)

TIME	Lesson	Priority Standard
Week 1	Anchor Phenomenon: Rube Goldberg Machines	• **4-PS3-1**: ***Use evidence to construct an explanation relating the speed 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 curre*** • **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.***

Week 2	Lesson 1: Speed & Energy	• **4-PS3-1:** ***Use evidence to construct an explanation relating the speed an object to the energy of that object.***
Week 3	Lesson 2: Gravitational Energy, Speed & Collisions	• **4-PS3-1:** ***Use evidence to construct an explanation relating the speed 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.***

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.***

		• **4-PS3-4:** ***Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.***
Week 5	Lesson 4: Energy Transfer & Engineering	• **3-5-ETS1-1:** ***Define a simple design problem reflecting a need or a wa that includes specified criteria for success and constraints on materials, time, or cost.***
		• **3-5-ETS1-1:** ***Define a simple design problem reflecting a need or a wa 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.***
Week 6	Lesson 5: Energy Transfer & Engineering 2	
		3-5-ETS1-3: ***Plan and carry out fair tests in which variables are contro 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.***

Week 7	Unit Review & Summative Assessment	• **4-PS3-1:** ***Use evidence to construct an explanation relating the speed 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 curre***
		• **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.***
Week 8	Performance Task: Energy & Engineering	• **3-5-ETS1-1:** ***Define a simple design problem reflecting a need or a wa 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 contro 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.***

Strategies for Multi-Language Learners

- Breaking down the task
- Dictionaries in First Language
- Individual and small group instruction
- Loaded vocabulary and previewing text
- Meaningful real life connections
- Modeling
- Repeated Practice
- Step-by-step prompts
- Think Aloud
- Warm Up Activities
- Clarify directions
- Reading questions/passages aloud

Strategies for Students Needing Intervention

- Additional time on assignments
- Review of directions
- Review sessions
- Provide notes
- Support auditory presentation with visuals
- Work in progress check
- Tiered assessment
- Choice of test format (multiple-choice, essay, true-false)
- Read directions to student
- Highlight directions and key words
- Provide opportunities for cooperative partner work
- Choice boards
- Graphic organizers
- Flexible groupings
- Visuals Aids

- Small group instruction
- Word banks
- Extra time

Strategies For Enrichment

- Higher-level cooperative learning activities
- Provide higher-order questioning and discussion opportunities
- Tiered assessments
- Provide texts at higher reading level
- Extension activities
- Choice boards
- Mystery Science Mini Lessons

Technology Integration

- Higher-level cooperative learning activities
- Provide higher-order questioning and discussion opportunities
- Tiered assessments
- Provide texts at higher reading level
- Extension activities

Interdisciplinary Connections

LA.RL.4.7	Make connections between specific descriptions and directions in a text and a visual or oral representation of the text.
LA.RI.4.1	Refer to details and examples in a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text.
LA.RI.4.3	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.

LA.RI.4.9	Integrate and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) information from two texts on the same topic in order to write or speak about the subject knowledgeably.
MA.4.NF.C	Understand decimal notation for fractions, and compare decimal fractions.
LA.W.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
LA.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
MA.4.MD.A	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.
MA.4.MD.B	Represent and interpret data.

21st century Life and Career Ready Practices

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.