Englewood Public School District
Science
Grade 4
Third Marking Period

Unit 5: Transfer of Energy

Overview: In this unit of study, fourth-grade students develop an understanding that sound, light, heat, and electrical currents can transfer energy from place to place. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. The crosscutting *concepts of cause and effect, energy and matter,* and the *interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 4-PS3-2 and 4-ESS3-1.

Time Frame: 15 days

Enduring Understandings:
Energy can be moved from place to place through sound, light, or electric currents.
Energy and fuels that humans use are derived from natural sources.
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.

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?

Standards	Topics and Objectives	Activities	Resources	Assessments
(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)**	**Topics** Transfer of Energy Renewable and Non-Renewable Resources Twenty-First Century Themes and Skills include: Environmental Literacy	**Resources:** Students will create a t-chart to organize renewable and non-renewable resources. Students will then identify items made from these resources and how recycling can help to preserve resources over time.	**Resources:** • Renewable and Nonrenewable Resources • Flier (from Environment & Ecology Series) – 1 per student or pair of students • Whiteboard or chalkboard • Dry erase markers or chalk • Pencils – 1 per student • Appendix 1 – 1 per student or pair of students **Websites:**	**Formative Assessments:** T-chart Student notes Do Now/Ticket to Leave Journal **Benchmark Assessment:** Exact Path **Summative Assessments:** **Colored Paper:**

Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	• The Four C's • Environmental Literacy • Global Awareness **Objectives** **Resources:** Students will be capable of describing a natural resource and differentiating between renewable and non-renewable resources. Student will recognize renewable and nonrenewable resources in a given environment. **Colored Paper:** (Pages 6-8) Students will work with ice cubes and different colored paper to develop observations that prove energy can be transferred from the paper to the ice cube. **Golf Ball/Ping Pong Ball:** (Pages 14 – 17) Students will work with various materials to make observations that energy can be transferred from one object to another. **The Copper Conundrum** Students will be introduced to the	Students will then take a walk in the school and identify items made from different resources in the school. (W.4.7, MP.2, CRP.8,4-ESS3-1) **Colored Paper:** Using different colored paper, students will demonstrate how energy can be transferred from one object to another, by melting an ice cube. **Golf Ball/Ping Pong Ball:** Using golf ball and Ping-Pong balls, the students will work to see how energy can be transferred from one object to another. (MP.4) **The Copper Conundrum:** Students turn and talk with a partner about mining. Then they watch a short video comparing a natural landscape versus a mining pit. Students work in partner pairs to read and note take on an informational piece on copper mining. Students then write a paragraph about copper mining, pollution and	• http://sftrc.cas.psu.edu • http://pbskids.org/eekoworld • www.dnr.state.wi.us/org/caer/ce/eek **Colored Paper:** • Light Absorption Resources • Transfer of Energy Link • Construction Paper: **(**yellow, red, black, white, green and violet) • Ice Cubes **Golf Ball/Ping Pong Ball:** • Golf balls • Ping Pong balls • Tennis balls • Video One • Video Two **The Copper Conundrum:** Reading Piece **Mining For Ore:** • Chocolate chip cookies • Toothpicks • Popsicle sticks • Mining Methods • Investigation Sheet • Student Paragraph Sample **Additional Resources:** https://www.otffeo.on.ca/wp-content/uploads/sites/2/2014/07/Grade-4-Lessons-Rocks.pdf Switch Energy Project Wind Generator: Thermal Energy Transfer http://studyjams.scholastic.com/studyjams/index.htm	Student reflections **Golf Ball/Ping Pong Ball:** Student demonstration Student notes **The Copper Conundrum:** Student paragraph **Mining for Ore:** Student essay Investigation sheet **Alternative Assessments:** Students will reason abstractly and quantitatively as they gather and analyze data during investigations and while conducting research about transfer of energy and energy sources. Think Pair Share Students will model with mathematics as they represent and/or solve word problems. Model, Rubrics, Essays Students will conduct research to build their understanding of energy, transfer of energy, and natural sources of energy. Observations, Informal Presentations Students will recall relevant information from in-class investigations and experiences and gather relevant information from

	complexity of natural resource uses through the example of copper mining and use. **Mining for Ore:** Students will understand that the more natural resources you extract, the greater the impact on the land.	possible solutions. (W.4.8, W.4.9, 8.2.5.D.7, 4-PS3-2) **Mining for Ore:** Students look at different mining options. Students then mine a chocolate chip cookie to remove all chocolate deposits. They are then challenged to reclaim the land. Students record all information in a data sheet. Students looked at their classmates land and made observations. They compile this in a paragraph about how mining could be more environmentally friendly. (4.OA.A.1, CRP4, 9.1.4.B.1, 6.1.4.B.8)	https://www.natgeokids.com/uk/ https://www.readinga-z.com/ http://nrel.com/ https://sn4.scholastic.com/ http://switchenergyproject.com/ http://www.pbs.org/wgbh/nova/labs/	print and digital sources. Visual Thinking Strategies Students will draw evidence from literary and information texts in order to analyze and reflect on their findings. Critiques, Self-Assessments Students will read, take notes, and construct responses using text and digital resources such as Scholastic News, Nat Geo Kids, Study Jams (Scholastic), Reading A–Z.com, NREL.com, switchenergyproject.com, and NOVA Labs by PBS. Capstone Projects

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity In planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Speak and display terminology • Teacher modeling • Peer modeling • Provide ELL students with multiple literacy strategies. • Word walls • Use peer readers • Give page numbers to help the students find answers • Provide a computer for written work • Provide two sets of textbooks, one for home and one for school • Provide visual aides • Provide additional time to complete a task • Use graphic organizers	• Utilize modifications & accommodations delineated in the student's IEP • Work with paraprofessional • Use multi-sensory teaching approaches. • Work with a partner • Provide concrete examples • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	• Using visual demonstrations, illustrations, and models • Give directions/instructions verbally and in simple written format. Oral prompts can be given. • Peer Support • Increase one on one time • Teachers may modify instructions by modeling what the student is expected to do • Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. • Review behavior expectations and make adjustments for personal space or other behaviors as needed. • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide opportunities for students to connect with people of similar backgrounds (e.g.	• Curriculum compacting • Inquiry-based instruction • Independent study • Higher order thinking skills • Adjusting the pace of lessons • Interest based content • Real world scenarios • Student Driven Instruction • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understand -ings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social or community-based issue. • Collaborate with after-school programs or clubs to extend learning opportunities.

		conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	

Interdisciplinary Connections:

ELA-NJSLS/ELA:
W.4.7: Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2), (4-ESS3-1)
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-ESS3-1)
W.4.9: Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1)

Mathematics:
MP.2: Reason abstractly and quantitatively. (4-ESS3-1)
MP.4: Model with mathematics. (4-ESS3-1)
4.OA.A.1: Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ 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)

Career Ready Practices:
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.2.5.D.7: Explain the impact that resources such as energy and materials used in a process to produce products or systems have on the environment.

Integration of 21st Century Skills:
9.1.4.B.1: Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.

Social Studies:
6.1.4.B.8: Compare ways people choose to use and distribute natural resources.

Key Vocabulary:
Natural Resource: materials or things people use from the earth
Renewable Resource: a resource that will never run out, a resource that can regrow or be replaced within a person's lifespan
Non-Renewable Resource: on-living things, they don't regrow, and there are fixed amounts
Energy: something that can do work.
Transfer: move from one place to another

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) **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)	**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)

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Unit 6: Force and Motion

Overview: In this unit of study, students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object, and are expected to develop an understanding that energy can be transferred from object to object through collisions. The crosscutting concept of *energy and matter* is called out as an organizing concept. Students are expected to demonstrate grade-appropriate proficiency in *asking questions, defining problems,* and *constructing explanations, and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.
This unit is based on 4-PS3-1 and 4-PS3-3.

Time Frame: 15 days

Enduring Understandings:
Energy can be transferred in various ways and between objects.
The faster a given object is moving, the more energy it possesses.
Energy is present whenever there are moving objects, sound, light, or heat

Essential Questions: *What is the relationship between the speed of an object and its energy?*
In what ways does energy change when objects collide?

Standards	Topics and Objectives	Activities	Resources	Assessments
(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.**	**Topics** Force and Motion Twenty-First Century Themes and Skills include: Environmental Literacy • The Four C's • Global Awareness **Objectives** **Spool Racers:** Students will build a spool racer to experiment with potential and kinetic energy. **Moving Pennies: (Pages 3-5)** Students will work with pennies to develop questions and predict what happens	**Spool Racers:** Students use a spool, a toothpick, a washer, a rubber band, and a pencil to build a racer. They conduct tests with the racer by varying the number of twists in the rubber band or changing other design features. (4-PS3-3) **Moving Pennies:** Using pennies, in small groups, students will demonstrate how energy can be transferred from one object to another. (RI.4.1) **Energy of the Playground:** Using playground equipment, the students will work to see how speed and energy are related. (RI.4.9, RI.4.3)	**Spool Racers:** • Wooden spool • Flat toothpick • Rubber band • Tape • Large metal washer • Small metal washer • Unsharpened pencil • Student Worksheet **Websites:** http://www.scienceworld.ca/resources/activities/popcan-porsche http://pbskids.org/designsquad/build/rubber-band-car/ **Moving Pennies:** 100 pennies	**Formative Assessments:** **Spool Racers:** Students spool racer and questions **Moving Pennies:** Notes **Benchmark Assessments:** Exact Path **Summative Assessments:** **Moving Pennies:** Student demonstrations **Energy of the Playground:** Student diagram **Colliding Marbles:** Lab Sheet **Marvelous Marbles:**

	when objects collide. **Energy of the Playground: (Pages 22-24)** Students will work with various materials to make observations that speed is related to the amount of energy in an object. **Colliding Marbles:** Students will work with various materials to create and answer questions about what happens with energy when objects collide **Marvelous Marbles:** Students will make observations that speed is related to the amount of energy in an object.	**Colliding Marbles:** Students will work in pairs to investigate how marbles travel after being hit by another marble. Students record their information in a science journal and provide a demonstration for the class. (W.4.9, W.4.7, MP.5, 4-PS3-1, 9.1.4.B.1) **Marvelous Marbles:** Students create a marble rollercoaster using paper plates or tubes. Students demonstrate their roller coaster to the class and explain how the marble moves. (RI.4.3, W.4.2, W.4.8, CRP4, CRP8, 6.1.4.B.9, 8.1.5.F.1)	**Energy of the Playground:** Playground Equipment **Colliding Marbles:** • Marbles • Meter Sticks • Marble Lab **Marvelous Marbles:** • Marbles • Hard Paper plates • Tape **Additional Resources:** Forces and Motion: From Push to Shove. By Christopher Cooper Motion: Push and Pull, Fast and Slow. By Darlene Still Why Doesn't the Earth Fall Up? By Vicki Cobb https://djonesscience4grade.weebly.com/energy-and-motion.html	Roller Coaster Student Presentation **Alternative Assessments:** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. Self-assessments Students will conduct a short research project to build their understanding of the transfer of energy (motion, heat, and sound) in force and motion systems. Essays, Capstone Projects, Rubrics

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning.
The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Provide opportunities for review individually and with small groups • Speak and display terminology • Teacher modeling • Peer modeling • Provide ELL students with multiple literacy strategies. • Word walls • Use peer readers • Give page numbers to help the students find answers • Provide a computer for written work • Provide two sets of textbooks, one for home and one for school • Provide visual aides • Provide additional time to complete a task	• Utilize modifications & accommodations delineated in the student's IEP • Work with paraprofessional • Use multi-sensory teaching approaches. • Work with a partner • Provide concrete examples • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data	• Provide opportunities for review individually and with small groups • Using visual demonstrations, illustrations, and models • Give directions/instructions verbally and in simple written format. Oral prompts can be given. • Peer Support • Increase one on one time • Teachers may modify instructions by modeling what the student is expected to do • Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. • Review behavior expectations and make adjustments for personal space or other behaviors as	• Students can create questions related to experiments to study outside of class • Curriculum compacting • Inquiry-based instruction • Independent study • Higher order thinking skills • Adjusting the pace of lessons • Interest based content • Real world scenarios • Student Driven Instruction • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understand-ings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social or community-based issue. • Collaborate with after-school programs or clubs to extend

• Use graphic organizers	tables, multimedia, modeling).	needed. • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	learning opportunities.

Interdisciplinary Connections:

ELA-NJSLS/ELA:
RI.4.1: 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.4.3: 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. (4-PS3-1)
RI.4.9: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)
W.4.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)
W.4.7: Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-3)
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-PS3-1), (4-PS3-3)
W.4.9: Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1)

Mathematics:
MP.5: Use appropriate tools strategically. (4-ESS1-2)

Career Ready Practices:
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.1.5.F.1: Apply digital tools to collect, organize, and analyze data that supports a scientific finding.

Integration of 21st Century Skills:
9.1.4.B.1: Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking.

Social Studies:
6.1.4.B.9: Relate advances in science and technology to environmental concerns, and to actions taken to address them.

Key Vocabulary:
Force (F): An interaction between masses. A push or pull.
Collide: to come into contact with another object
Energy: the ability to do work
Kinetic energy: energy that matter has because of its motion
Potential energy: energy that matter has because of its position

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) **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)	**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 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)	**Energy and Matter** • Energy can be transferred in various ways and between objects. (4-PS3-1) (4-PS3-3)