Unit 3 Energy

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Belleville Public Schools

Curriculum Guide

PHYSICAL SCIENCE, 6th GRADE

ENERGY

Belleville Board of Education

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Unit Overview

In Unit 3 Energy, students will:

- conclude, through observation, that when two objects interact, it can result in an energy transfer and explore both natural and designed systems that can serve as models of energy transfer and transformation.
- develop models to demonstrate that potential energy is stored energy due to an object's position or condition, kinetic energy is proportional to mass and the square of velocity, gravitational potential is proportionate to mass and height.
- design a device to demonstrate potential energy.
- explore the many forms that energy can take and how it can be transfered from one object to another.
- observe that thermal energy flows warmer objects to cooler objects
- plan and conduct an investigation into how the thermal energy of an object is affected by it's size and shape.

Enduring Understanding

- Motion energy is properly called kinetic energy and is proportionate to its mass and velocity, growing with the square of its speed.
- A system of objects may contain potential energy depending on its condition or position.
- Temperature is the measure of the average kinetic energy of particles of matter.
- The amount of energy transfer needed to change the temperature of a matter depends on the nature of the matter, the size of the sample, and the environment.
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
- Energy can only be transfered or transformed. It can not be created or destroyed.

Essential Questions

- What do we mean by work?
- How can the potential energy of an object change?
- What is the relationship between kinetic and potential energy?

- Can energy be created or destroyed?
- How can we minimize the change in temperature of an object?
- How does heat travel from one object to another?
- What does it mean to say that a system is "energy efficient"?

Exit Skills

By the end of Unit 3, the student should be able to:

- Construct and interpret graphical displays to describe the relationship of kinetic energy to the mass and speed of an object.
- Develop a model to decribe that when the arrangement of objects interact at different distances, different amounts of potential energy are stored in the system.
- Evaluate competing design solutions using systematic process to determine how well they meet the criteria and constraints of the problem.
- Apply scientific principles to design and test a device that either minimizes or maximizes thermal energy transfer.
- Plan an investigation to determine the relatioships between the energy transferred, the type of matter, the mass, and change in average kinetic energy of the particles as measured by the temperature of the sample.
- Construct, use and present arguements to support their understanding of how kinetic energy is transfered to or from and object.

New Jersey Student Learning Standards (NJSLS-S)

SCI.MS	Energy
SCI.5-6.5.2.6.C.c	The transfer of thermal energy by conduction, convection, and radiation can produce large-scale events such as those seen in weather.
SCI.5-6.5.2.6.D.1	Use simple circuits involving batteries and motors to compare and predict the current flow with different circuit arrangements.
SCI.5-6.5.2.6.D.a	The flow of current in an electric circuit depends upon the components of the circuit and their arrangement, such as in series or parallel. Electricity flowing through an electrical circuit produces magnetic effects in the wires.
SCI.5-6.5.2.6.E.1	Model and explain how the description of an object’s motion from one observer’s view may be different from a different observer’s view.
SCI.5-6.5.2.6.E.2	Describe the force between two magnets as the distance between them is changed.
SCI.5-6.5.2.6.E.3	Demonstrate and explain the frictional force acting on an object with the use of a physical model.
SCI.5-6.5.2.6.E.4	Predict if an object will sink or float using evidence and reasoning.
SCI.5-6.5.2.6.E.a	An object’s position can be described by locating the object relative to other objects or a background. The description of an object’s motion from one observer’s view may be different from that reported from a different observer’s view.
SCI.5-6.5.2.6.E.b	Magnetic, electrical, and gravitational forces can act at a distance.
SCI.5-6.5.2.6.E.c	Friction is a force that acts to slow or stop the motion of objects.
SCI.5-6.5.2.6.E.d	Sinking and floating can be predicted using forces that depend on the relative densities of

	objects and materials.
SCI.5-6.5.4.6.E.1	Generate a conclusion about energy transfer and circulation by observing a model of convection currents.
SCI.5-6.5.4.6.E.a	The Sun is the major source of energy for circulating the atmosphere and oceans.
SCI.MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
SCI.MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
SCI.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
SCI.MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
SCI.MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Interdisciplinary Connections

MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.6.RP.A.2	Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.
MA.6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
MA.6.RP.A.3a	Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.RP.A.3c	Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
MA.6.RP.A.3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
MA.6.NS.A	Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
MA.6.NS.B	Compute fluently with multi-digit numbers and find common factors and multiples.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
MA.6.NS.C	Apply and extend previous understandings of numbers to the system of rational numbers.
LA.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections

	contribute to the whole and to an understanding of the topic.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.1.A	Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.WHST.6-8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.WHST.6-8.1.D	Establish and maintain a formal/academic style, approach, and form.
LA.WHST.6-8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
MA.6.EE.A	Apply and extend previous understandings of arithmetic to algebraic expressions.
MA.6.EE.A.2	Write, read, and evaluate expressions in which letters stand for numbers.
MA.6.EE.A.2a	Write expressions that record operations with numbers and with letters standing for numbers.
MA.6.EE.A.2b	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
MA.6.EE.A.2c	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
LA.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.
LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
MA.6.EE.B	Reason about and solve one-variable equations and inequalities.
MA.6.SP.A	Develop understanding of statistical variability.

Learning Objectives

- Observe and explain how energy can be transfered and transformed.
- Differentiate between kinetic and potential energy and the different forms it can take.
- Examine energy transformation in everyday life in context of energy flows.
- Analyze the flow of energy within natural and designed systems.
- Identify and diagram unobservable forces such as kinetic and potential energy, and gravity.

- Construct and interperet graphical displays of data that show the the relationships such as kinetic energy - mass and speed
- Model, analyze, and predict the changes in the kinetic and potential energy in a system of objects.
- Analyze data from a prototype system to propose methods for optimizing its design while solving a problem.
- Gather evidence to explain how in a designed system, motion (kinetic energy) is able to produce light.
- Model the transfers and transformations of energy.
- Examine how simple and complex machines can apply energy transfer to reduce human effort/work.
- Analyze the transfer of between objects as hotter objects transfer out energy into colder objects.
- Explain the Law of Conservation of Energy.
- Explore the three ways that energy is transferred between objects as heat.
- Examine how the nature of the matter of an object affects the magnitude of the thermal conductivity of a substance.

Suggested Activities

From HMH Curriculum Activities:

- Engage: Lesson Phenomenons
- Explore/Explain: Hands on Labs and Engineer It
- Unit Projects
- Unit Performance Tasks

From Defined Stem:

- Performance Tasks
- Literacy Tasks
- Constructed Response

Evidence of Student Learning - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining

- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources & Materials

HMH Module I Workbook

Laboratory Kits and Materials

Defined Stem

BrainPop

Ancillary Resources

Guest Speakers

Other Internet sources

Outdoor area of school

Laptop Carts for further research

Technology Infusion

- Smart board
- DefinedStem.com
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- You Tube video streams
- Brain-pop video streams
- Laptops
- Khan Academy
- Power Point presentation
- MS Word

Alignment to 21st Century Skills & Technology

These skills will be aligned to the following core content areas:

- English Language Arts; reading informational text, following procedural steps, orally presenting predictions and opinions, and creating written laboratory reports
- Mathematics; measuring
- Science and Scientific Inquiry (Next Generation); see above
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics; hisitory of science and how the Scientific method has connections to World and American history expansion. Discuss the inpactof scence on society and what kind of moral questions scientists must address.
- World languages; discussion of root words and linguistic origin of vocabulary words.
- Technology; see above
- Visual and Performing Arts: oral and graphic presentation of procedures, results, and conclusion.

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy

- Information Literacy
- Life and Career Skills
- Media Literacy

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy - Science Dollars
- Guided Notes
- Teacher reads assessments allowed
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Dictation to scribe

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
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Lo-Prep Differentiations

- Exploration by interest
- Flexible grouping
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied journal prompts
- Correcting summative and formative assessments
- Retaking the test

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Special Education Learning

- printed copy of board work/notes provided
- additional time for skill mastery

- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- Provide native language translation whenever possible
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Sample Lesson

Unit Name: Energy

NJSLS: See link

Interdisciplinary Connection: Math & ELA

Statement of Objective: SWDAT predict the behavior of heat as it travels through variuos materials and identify the type of heat transfer of each.

Do Now: On a half sheet of paper create three multiple choice questions about Potential and Kinetic energy.

Anticipatory Set: SW view two short Brainpop videos as a review of heat and temperature.
https://www.brainpop.com/science/energy/heat/ 2:35 minutes
https://www.brainpop.com/science/energy/temperature/ 2:37 minutes

Learning Activity:
1) Do Now 5 minutes
2) Anticipatory set 6 minutes
3) TW will explain the procedure for a demonstration of each each type of heat transfer method.
4) SW record a prediction about each procedure
5) SW observe as teacher carries out each of the demonstartions. SW record if their prediction was accurate and identify the method of heat transfer involved.
6) Closure - Class discussion and debriefing.

Student Assessment/CFU's: See link, Do Now, Student predicitons and answers to above questions, Student response and participation in bebriefing.

Materials: Candles, Glass rod, metal scewer, Glass beaker, water, hot plate, food coloring, Spot light, glass bottles, thermometers, corks.

21st Century Themes and Skills: See link

Differentiation: See link rephrasing, asking students to repeat directions, visual

Integration of Technology: Smartboard, BrainPop videos

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