Unit 3: Energy (Physical Science)

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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Science: Grade 6

Unit 3: 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 & NGSS)

SEP - Developing and Using Models

SEP - Analyzing and Interpreting Data

SEP - Planning and Carrying Out Investigations

SEP - Constructing Explanations and Designing Solutions

SEP - Engaging in Argument from Evidence

SEP - Scientific knowledge is based on Empirical Evidence

DCI - Definitions of Energy

DCI - Conservation of Energy and Energy Transfer

DCI - Defining and Delimiting an Engineering Problem

DCI - Developing Possible Solutions

DCI - Relationship Between Energy and Forces

DCI - Defining and Delimiting Engineering Problems

DCI - Developing Possible Solutions

CCC - Energy and Matter

CCC - Scale, Proportion, and Quantity

CCC - Systems and System Models

NextGen Science Standards

6-8.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.
6-8.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.
6-8.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.
6-8.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.
6-8.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Interdisciplinary Connections

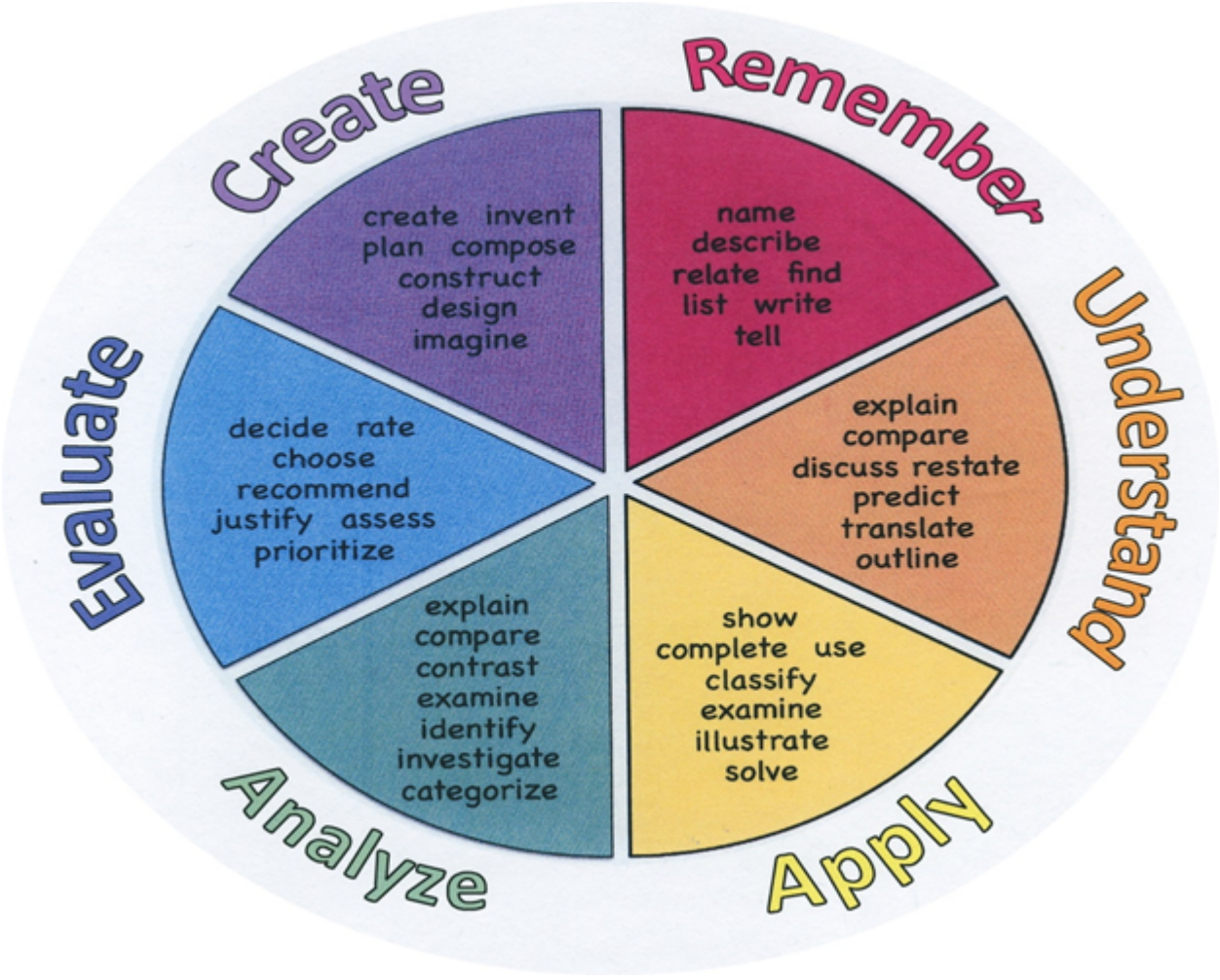
Complete Do the Math! sections embedded within the Unit

Math: 6.EE.C.9

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 interpret graphical displays of data that show 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 & Best Practices

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

Assessment Evidence - Checking for Understanding (CFU)

- Admit Tickets
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- HMH End-of-Year Test (Benchmark)
- HMH Mid-Year Test (Benchmark)
- HMH Performance-based Assessment (Alternative)
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Outline
- Question Stems
- Quickwrite
- Quizzes (Formative)
- Red Light, Green Light
- Self- assessments

- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests (Summative)
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

HMH Science Dimensions: Teacher Edition, Student workbooks, online resources

HMH Equipment & Safety Kits

Ancillary Resources

Science Weekly, Scholastic News, NewsELA, YouTube/TeacherTube, National Geographics Kids, Science Channel

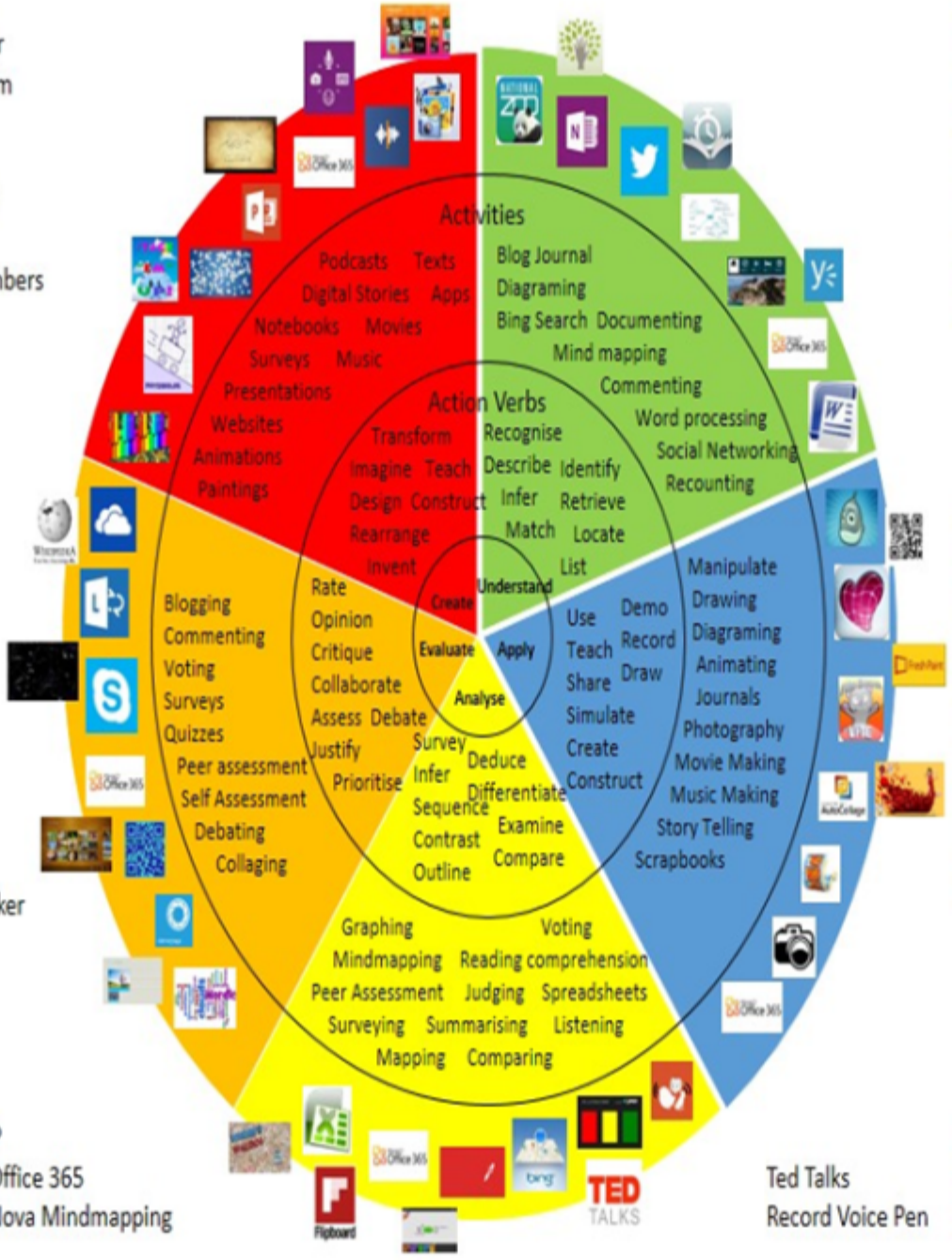
Technology Infusion

- Discovery Education video streams
- YouTube
- BrainPOP Video Streams
- Khan Academy

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

21st Century Skills/Interdisciplinary Themes

- 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

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health 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
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments

- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

- 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
- Provide modifications as dictated in the student's IEP/504 plan
- 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 (ELL)

- 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
- 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

At Risk

- 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

Talented and Gifted Learning (T&G)

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge