Course Title – MD Physical Science

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Unit #3 – Energy

Transfer Goal –

Students will be able to independently use their learning to describe the different ways energy can be used and reused in the environment. In doing so, students will act as stewards of the environment through energy conservation efforts and use of renewable resources. (Science 1,2,3,4,5,Special Education 5)

Stage 1 – Desired Results

Established Goals

HS-PS3 Energy
PS3.A: Definitions of Energy
HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

21st Century Themes
(www.21stcenturyskills.org)

_x__ Global Awareness
___Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
_x__Health Literacy
__x_Environmental Literacy

HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). **HS-PS3-4.** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics) ***ELA/Literacy -*** **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS3-1)* **MP.4** Model with mathematics. (HS-PS3-1) **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS3-1)	**21st Century Skills** *Learning and Innovation Skills:* _x__Creativity and Innovation _x__Critical Thinking and Problem Solving _x__Communication and Collaboration *Information, Media and Technology Skills:* _x__Information Literacy _x__Media Literacy _x__ICT (Information, Communications and Technology) Literacy *Life and Career Skills:* _x__Flexibility and Adaptability _x__Initiative and Self-Direction _x__Social and Cross-Cultural Skills _x__Productivity and Accountability ___Leadership and Responsibility
Enduring Understandings: *Students will understand that . . .* *EU 1* energy takes many forms. *EU 2* energy may transfer into or out of a system and it may change forms, but the total energy cannot change. *EU 3* renewable energy sustains the environment whereas energy stored in resources must be transformed into more useful forms and transported before it can be helpful to us.	**Essential Questions:** *EU 1* • How do we use energy? • How can energy be measured? • How do we know if something has energy? • What is the most useful type of energy? • What benefits can be derived from heat as an energy source? *EU 2* • How does energy change? • How can the properties of energy be applied in our everyday lives? • How does a child's swing depict energy conservation?

EU 4 using simple machines can reduce the amount of force needed to do work.	*EU 3* • How can energy be used responsibly? • Why is renewable energy good for the planet? • How can renewable energy sources replace nonrenewable sources? *EU 4* • How can the amount of work to complete a task be reduced? • How are a lever and ramp simple machines? • How do simple and complex machines differ?
Knowledge: *Students will know . . .* *EU 1* • energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. (HS-PS3-2) • where energy comes from. • the difference between kinetic and potential energy. • different forms of energy include mechanical, electrical, heat, chemical, light and nuclear. *EU 2* • within an isolated system, energy is continually transferred from one object to another and between its various forms. (HS-PS3-2) • heat flows from warmer to cooler objects. • the three main ways heat is transferred. • the Law of Conservation of Energy states that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) *EU 3* • sources of renewable and nonrenewable energy. • the difference between renewable and nonrenewable forms of energy and how each is derived or created. *EU 4* • a simple machine consists of few parts. • a wheel, pulley, lever, wedge and screws are all simple machines and are used to reduce the force needed to do work.	**Skills:** *Students will be able to . . .* *EU 1* • explain how energy changes from potential to kinetic. • demonstrate potential and kinetic energy. • describe different forms of energy. *EU 2* • model and explain the flow of energy. (HS-PS3-1) • compare and contrast conduction and convection. • explain examples of energy moving between one place and another, between objects and/or fields, or between systems in real world scenarios. • plan and conduct an investigation to produce data to serve as the basis of evidence. (HS-PS3-4) *EU 3* • research forms of renewable and nonrenewable energy. • differentiate and debate about the pros and cons of each source of energy. • explain various forms of energy sources and their use in the local and global environment. • describe how difference sources of energy come from different parts of the Earth and atmosphere. • demonstrate strategies for conserving energy. *EU 4* • identify simple and compound machines in everyday life.

• a compound machine is two or more simple machines. • a bicycle is a compound machine.	• describe how using simple and compound machines impacts effort needed to move a load. • develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2)

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

You are coaching a high school soccer team during the summer and there has been some parent concern about their children not performing well in the second half of the game because of lack of energy. You must hold a meeting for parents and students to explain how energy can be transferred, conserved, and used correctly to keep kids active. You will create a PowerPoint or a handout that addresses where kids can get energy, how potential and kinetic energy differ, and what the kids can do to conserve, use, and restore energy. (EU 1)

You are a Girl or Boy Scout leader and must teach your troop how to prepare food at a campsite. You will create a poster to show the kids the transfer of heat and heat flow. Examples could include heating soup, roasting marshmallows, grilling hot dogs or making ice cold lemonade. Remember to include the heat source and the direction of the heat flow. You will also need to apply what you know about the conservation of energy to explain how heat escapes each scenario causing food to get cold or heat transferring in unwanted ways (i.e. burning mouth, food cooling, and overcooked/burnt food). (EU 2)

You are a member of the Environmental Protection Agency (EPA) tasked with debating with an oil company in front of the United Nations. Your argument should defend the use of renewable energy sources on Earth to combat the negative environmental effects we are experiencing from depleting nonrenewable sources. Your argument must include an explanation of what renewable energy is, three sources of renewable energy, and how each can be used in the United States to replace nonrenewable energy. You will present your argument to a panel at the UN using a PowerPoint presentation. You will be assessed using the UN's rubric on your argument and presentation. (EU 3)

You represent the ACME construction union. Workers are asking for the following devices at all construction sites: pulley, lever, ramp and wheel/axle. Justify to the Board why the use of these simple machines would increase productivity on the job by demonstrating their use in various scenarios. To do so, build smaller models of each machine (material unlimited) and list 3 potential benefits of each. (EU4)

Other Recommended Evidence:

- Teacher created notes and worksheets
- Journal responses
- Teacher observation during class discussion
- Tests and quizzes

- Labs and lab reports
- Visual representation of topic material (i.e poster, brochure, handout, etc)

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

- Fill in notes on energy (definition, sources, uses) during class reading activity (A)
- Create a magazine collage of different sources of energy (A,M)
- Label parts of a roller coaster where potential or kinetic energy can be found (A,M)
- Demonstrate examples of potential and kinetic energy using body (M)
- List examples of potential versus kinetic energy (A,M)
- Describe scenarios in which potential energy can be changed to kinetic energy (M)
- Build a roller coaster in the classroom using foam tubing and a marble (T)
- Debate the misconception that people “run out of energy” (T)
- Create a concept map of definitions related to work and energy (A,M)
- Diagram the flow of energy through a local ecosystem (M,T)
- Venn diagram conduction and convection (A)
- Diagram the use of solar energy from the sun to your house via the use of solar panels (M,T)
- Chart the pros and cons of driving a hybrid car (M,T)
- Define forms of energy and state examples of each (A)
- Watch and take notes on Bill Nye Energy (A)
- Match examples of energy to their source (A,M)
- Map locations in the United States where different types of renewable energy sources are prevalent (M,T)
- Research potential home repairs you could make to conserve energy (T)
- Timeline the use of nonrenewable and renewable energy sources around the world (M,T)
- Describe an energy change from your own experience (ie. Riding a bike, driving a car) (M)
- Document in a video about efforts in your community to use more renewable energy (M,T)
- Create a solar oven to make s'mores (M,T)
- Read, take notes and draw pictures of simple machines (A)
- Snap photos of simple machines around the school and identify their form and function. (M)
- Build a model of simple machines and answer questions about their application in everyday life (M, T)