Course Title: Integrated Science

Implement Start Year: 2017-2018

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Unit #3 - Energy

Transfer Goal –

Students will be able to independently use their learning to interpret energy transfer within a system in order to explain the physical and natural world (5).

Stage 1 – Desired Results

Established Goals **Next Generation Science Standards**	**21st Century Themes** **(www.21stcenturyskills.org)**
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 flow in and out of the system are known. 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	____ Global Awareness ___Financial, Economic, Business and Entrepreneurial Literacy ___Civic Literacy ___Health Literacy ___Environmental Literacy

	<u>21st Century Skills</u> *Learning and Innovation Skills:* _X__Creativity and Innovation _X__Critical Thinking and Problem Solving _X__Communication and Collaboration *Information, Media and Technology Skills:* ___Information Literacy ___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 _X__Leadership and Responsibility
<u>Enduring Understandings:</u> *Students will understand that. . .* *EU 1* work is required to change the energy of an object, and the rate of that energy change is power. *EU 2* energy can neither be created nor destroyed, though it is continually transferred from one object to another and between its various possible forms.	**<u>Essential Questions:</u>** *EU 1* ● How can work be done most efficiently? ● How can it be determined if an object has energy? ● What is the most useful type of energy? *EU 2* ● Where does energy come from? ● How important is heat when it comes to mechanical energy being transformed? ● What is the best way to keep track of the energy in a system?
<u>Knowledge:</u> *Students will know . . .* *EU 1* ● models such as diagrams, drawings, descriptions, simulations, graphs, and equations can be used to account for energy changes in a system. ● that work done on an object depends on the orientation of the applied force with the displacement of the object. ● that simple machines can change the input force necessary to gain the	**<u>Skills:</u>** *Students will be able to . . .* *EU 1* ● describe qualitatively how work can change the mechanical energy of a system. ● calculate the input force necessary to move an object with a simple machine. ● calculate the work done on an object when the applied force and

same workload output. ● energy manifests itself in multiple ways including motion, sound, light, and thermal energy. ● kinetic energy of an object depends on the mass and speed of the object. ● potential energy of an object or system can be thought of as stored energy and depends on the position of the object or objects. ● power is the rate at which energy is transformed or work is done. *EU 2* ● at the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3) ● conservation of energy means 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) ● mechanical energy can be modeled as a combination of energy associated with the motion and position of particles. (HS-PS3-2) ● energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) ● the conservation of energy can be used to predict system behavior. (HS-PS3-1) ● the availability of energy limits what can occur in any system. (HS-PS3-1) ● models can be used to predict and show the relationship between systems or between energy within a system and the components of that system. ● mechanical energy is the sum of potential and kinetic energy.	displacement are known. ● develop a computational model to illustrate that the mechanical energy of an object can be accounted for by its motion and its position relative to other objects. ● differentiate between work and power. ● plan and carry out an experiment to determine the power generated by a person or device. *EU 2* ● develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. ● create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) ● design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS3-3) ● design, build, and refine a device that converts energy from one form to another.

Stage 2 – Assessment Evidence

Other Recommended Evidence:

- Tests/Quizzes on energy Transfer
- Informal lab investigations
- Formal lab write ups
- Kinetic/Potential Energy investigation
- Checked homework
- Class discussion
- Summarizers

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.*

- Introduction to Energy Chart- What are sources of energy in students' daily lives (A, M)
- Identifying types of energy from presented images (A, M)
- Solar Cooker Challenge - students will design an activity to transfer light energy into heat energy in order to roast a marshmallow (M, T)
- Graphic Organizer identifying Types of Energy (Motion, Sound, Light, Thermal), Examples, Life Applications, and Visual Images (A)
- BrainPOP videos on Energy (A)
- SItuational scenarios where the students will explain the transfer of energy and how that energy is maintained (conservation) (ex. Person Running is Chemical Energy → Mechanical Energy, Playing Violin is Mechanical Energy → Sound Energy)(M)
- Flowchart explaining the transfer of energy between separate systems and relation to the motion and position of an object (A, M)
- Analyze energy biomass pyramid to explain the transfer of energy in systems (Chemical → Mechanical) (M)
- Brainstorm web organizer of real life examples where energy is transferred through separate systems (A, M)
- Interpret scientific literature on the transfer of energy in systems, write summary response and include how it is applicable to their daily lives (M, T)
- Student demonstrations using objects to explain the transfer of energy through separate systems (M, T)
- Venn Diagrams to explain the difference between Kinetic and Potential Energy; Work and Power (A, M)
- Word problems explaining how potential and kinetic energy make up mechanical energy (M, T)
- Graphic organizer expressing the relationships of potential and kinetic energy to mechanical energy (A, M)
- Visual aids and diagrams to explain the importance of gravitational potential energy (M)
- Student led discussions on the significance of gravitational potential energy, potential energy, and kinetic energy in their daily lives (M, T)
- Problem solving scenarios on the relationship of power, work, and energy (M, T)
- Solve quantitative real-world problems where there are altering variables of force, displacement, and work within a system (M, T)
- Student led demonstrations/presentations on the significance of how work affects the mechanical energy of a system of their choice (M, T)
- Identify hypothetical scenario of an object's mechanical energy based off its motion and position in relation to other objects (M, T)
- Calculate the power generated from a force exerted upon an object of choice within the building (A, M, T)
- Simple Machines Scavenger Hunt students look for simple machines within the building (A, M, T)
- SImple Machines teacher demonstrations (Wedge and Lever, Pulley, Inclined Plane, Wheel and Axle) (A, M)
- Mouse trap game to describe simple machines (M)
- Equation triangle for organization of equations on energy, work, and power (A, M)
- Conservation of Energy Lab - using a marble and a ramp to demonstrate how energy is transferred in a system (M)
- Graphic Organizers, diagrams, simulations, and other visual aids to demonstrate energy as a system (A, M)