Physics - Unit 5 - Work and Energy

Unit Focus

Students will explore three different types of mechanical energy: kinetic energy, potential gravitational energy and potential elastic/spring energy as well as conservation of energy, the work-energy theorem and power. Students will begin with analyzing the three common types of mechanical energy (kinetic, potential gravitational, and potential elastic). They will analyze transformation between these types of energy to uncover the conservation of energy theorem. They will continue with analyzing the transformation of work in energy and energy into work in order to uncover the work-energy theorem. Students will also explore the six types of simple machines and their advantages and disadvantages and uncover how to calculate actual mechanical advantage, ideal mechanical advantage and efficiency. Finally they will uncover that the rate the energy transfers is called power. As a part of this unit, students will also spend time looking at the importance of units and unit conversions in calculations and understanding of what units and numbers really mean.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards (DCI)
Science: 10

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. *PS3.9.A2*
- 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. *PS3.9.B1*
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. *PS3.9.B2*

Madison Public Schools Profile of a Graduate
Creative Thinking

- Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)

Transfer

T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.

Meaning

Understanding(s)	Essential Question(s)
U1 Each form of energy can be converted into other forms of energy or into work (e.g. kinetic to potential, mechanical to electrical). **U2** While energy within a system is continually changing forms, and being transferred, the total energy of the system is conserved.	**Q1** Where does the energy of a system come from? How does it change? Where does it go? **Q2** How can I thoughtfully improve my design based on my data?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 in order to change the energy of an object, work must be done on the object **K2** kinetic and potential together are the mechanical energy of an object **K3** potential energy is stored energy and can be chemical, nuclear, elastic or gravitational **K4** non conservative forces can remove mechanical energy from an object and convert it to heat **K5** work can be positive or negative ; it can add or remove mechanical energy of an object **K6** the total energy of an object is conserved if only conservative forces act on the object	**S1** calculate gravitational potential energy, elastic potential energy and kinetic energy of an object **S2** use the conservation of energy to solve problems **S3** use the work energy theory to analyze objects that have friction acting on them **S4** apply kinematics and force principles to predict the motion of objects involving transfer of energy