Work, Energy, Power Objectives

1. Students should understand the definition of work, including when it is positive, negative, or zero, so they can:
   - Calculate the work done by a specified constant force on an object that undergoes a specified displacement.
   - Relate the work done by a force to the area under a graph of force as a function of position, and calculate this work in the case where the force is a linear function of position.

2. Students should understand and be able to apply the work-energy theorem, so they can:
   - Calculate the change in kinetic energy or speed that results from performing a specified amount of work on an object.
   - Apply the theorem to determine the change in an object's kinetic energy and speed that results from the application of specified forces, or to determine the force that is required in order to bring an object to rest in a specified distance.

3. Students should understand the concepts of mechanical energy and of total energy, so they can describe and identify situations in which mechanical energy is converted to other forms of energy.

4. Students should understand conservation of energy, so they can:
   - Construct and defend models and mathematical representations that show that over time the total energy within an isolated system is constant, including the motion and interactions of matter and radiation within the system.
   - Identify situations in which mechanical energy is or is not conserved.
   - Apply conservation of energy in analyzing the motion of objects that move under the influence of springs.

5. Students should understand the definition of power, so they can:
   - Calculate the power required to raise an object at a constant rate.
   - Calculate the work performed by a force that supplies constant power, or the average power supplied by a force that performs a specified amount of work.

6. Students should be able to:
   - Identify problems and suggest design solutions to optimize the energy transfer into and out of a system.
   - Analyze data to support claims that closed systems move toward more uniform energy distribution.
• Design a solution to minimize or slow a system’s inclination to degrade to identify the effects on the flow of the energy in the system.
• Construct models to show that energy is transformed and transferred within and between living organisms.
• Construct models to represent and explain that all forms of energy can be viewed as either the movement of particles or energy stored in fields.
• Construct representations that show that some forms of energy may be best understood at the molecular or atomic scale.
• Design, build and evaluate devices that convert one form of energy into another form of energy.