Science
Physics: Honors
Unit 4: Work and Energy

Essential Understandings	▪ Conceptual: o The reoccurring fundamental principles elaborated in physics have uses and implications in every dimension of modern life. o Physics seeks to analyze and understand every system as a demonstration of the cause-effect relationship. ▪ Computational: o Physics quantifies each variable of a system in order to describe, analyze and understand it. o A variety of problem solving techniques make use of a system's quantities to investigate the conceptual relationships evidenced within the system. o Numerical problem solving is an essential component in developing a clear understanding of the conceptual relationships identified within any system.
Essential Questions	▪ How do the everyday and scientific definitions of work differ? ▪ What is the difference between conservative and non-conservative work? ▪ How are work and power related?
Essential Knowledge	▪ Work is the transfer of energy that occurs when a force causes an object to move. ▪ Energy can neither be created nor destroyed. ▪ Work equals force time distance. ▪ If work is done, the force and distance must be in the same direction. ▪ Work is done when the kinetic energy changes. ▪ Gravitation Potential Energy is proportional to the mass and to the height of the object. ▪ Springs can store elastic potential energy.
Vocabulary	▪ Terms: o work, joule, kinetic energy, potential energy, power, work-energy theorem, equipotentials
Essential Skills	▪ Calculate kinetic energy and potential energy. ▪ Calculate work and power. ▪ Use the Law of Conservation of Energy to write balanced equations. ▪ Investigate energy transformations.

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Related Maine Learning Results	Science and Technology A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. B. The Skills and Traits of Scientific Inquiry and Technological Design B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design, process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide example of criteria that distinguish scientific explanations from pseudoscientific ones.

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Related Maine Learning Results	D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. i. Explain the relations between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibrations) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. D4.Force and Motion Students understand that the laws of force and motion are the same across the universe. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained in a filed (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Read the textbook and complete the examples presented. ▪ Individually answer conceptual questions and solve problems. ▪ Collectively discuss the answers and solutions in class. ▪ Discuss real world examples of concepts presented in the textbook. and encountered in the real world. ▪ Pasco Data Studio introductory laboratory. ▪ "Release Your Potential" laboratory exercise.
Sample Classroom Assessment Methods	▪ Homework assignments. ▪ Assess understanding in classroom discussions. ▪ Written formative and summative assessments with real world conceptual questions and numerical problems.
Sample Resources	▪ Publications: o Physics - James S. Walker ▪ Videos: o Mechanical Universe series ▪ Other Resources: o Companion Website: http://physics.prenhall.com/walker o Physics demonstrations in mechanics