Science
Honors Geophysical Science
Unit 4: Energy

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What is energy? ▪ How are work and energy related? ▪ How is energy conserved? ▪ What factors determine the amount of thermal energy in an object?
Essential Knowledge	▪ Energy can be neither created nor destroyed but can be changed from one form to another. ▪ Work is a transfer of energy through motion. ▪ Simple machines transfer energy/work. ▪ Compound machines are two or more simple machines combined. ▪ Efficiency is work out divided by work in. ▪ All objects have thermal energy. ▪ Different objects absorb/release different amounts of energy. ▪ Positive heat values represent heat gained, and negative heat values represent heat lost.
Vocabulary	▪ <u>Terms</u>: ○ energy, work, potential energy, kinetic energy, mechanical energy, thermal energy, heat, temperature, specific heat, machine, mechanical advantage, efficiency
Essential Skills	▪ Use appropriate formulas to calculate work and energy relationships ($W = Fd$; $E_P = mgh$; $E_K = \frac{1}{2}mv^2$) ▪ Determine the thermal energy of an object using $E_T = Q = m\,\Delta T\,C$ ▪ Determine both positive and negative heat values based upon information provided. ▪ Calculate mechanical advantages of simple machines.
Related Maine Learning Results	<u>Science and Technology</u> B. The Skills and Traits of Scientific Inquiry and Technological Design B1. The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and

Science
Honors Geophysical Science
Unit 4: Energy

	evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas.
Related Maine Learning Results	D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a. Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. b. Describe Earth's internal energy sources and their role in plate tectonics. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release.

Science
Honors Geophysical Science
Unit 4: Energy

	h. Describe the radioactive decay and half-life. i. Explain the relationship 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 vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions. D. The Physical Setting D4. Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Coke Can/Calorimeter Laboratory ▪ Work and Power Stair Laboratory ▪ Rubber band (Elastic Potential Energy) Laboratory ▪ Specific Heat / Paraffin Wax Demonstration ▪ Design a Rube-Goldberg machine calculating total mechanical advantage.
Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Energy Quizzes ▪ Laboratory Reports ▪ Laboratory exercises ▪ Portfolio Project (science content and literacy)

Science
Honors Geophysical Science
Unit 4: Energy

Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: The Mechanical Universe o Video: The Connections Series