Science
Geophysical Science
Unit 7: Atomic Structure

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 different models of the atom have been developed? ▪ What subatomic particles compose the atom? ▪ What are the relative locations of the subatomic particles in an atom? ▪ What characteristics typify the various subatomic particles? ▪ How do the subatomic particles interact?
Essential Knowledge	▪ Protons determine elemental identity. ▪ The nucleus occupies a very small portion of an atom's volume, but possesses the vast majority of the atom's mass. ▪ Element properties repeat periodically based on the arrangement of their electrons. ▪ As scientists gather new data new models of the atom are developed.
Vocabulary	▪ <u>Terms</u>: ○ atom, nuclear region (nucleus), electron cloud region, valence, subatomic particle, proton, neutron, electron, quark, atomic number, mass number, atomic weight (average atomic mass), isotope, periodicity
Essential Skills	▪ Use the Periodic Table to retrieve the Atomic Number, Average Atomic Mass, Chemical Symbol and valence electrons of an element. ▪ Use the Periodic Table to identify the periodic characteristics of elements. ▪ Describe basic characteristics of the subatomic particles. ▪ Describe at least two models of the atom.
Related Maine Learning Results	<u>Science and Technology</u> A. Unifying Themes A2.Models Students evaluate the effectiveness of a model by comparing its predications to actual observations from the physical setting, the living environment, and the technological world.

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Related Maine Learning Results	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 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. C. The Scientific and Technological Enterprise C2.Understandihngs About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. c. Provide examples that illustrate how technological solutions to problems sometimes lead to new problems of new fields of inquiry.

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Related Maine Learning Results	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 and provide examples of 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 worlds can bias scientists. d. Provide examples 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 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. 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.
Sample Lessons And Activities	▪ Lecture ▪ Diagramming electron configurations ▪ Grouping misc. items (development of periodic table) ▪ Flame tests ▪ Nuclear worksheets ▪ History of the atom

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Sample Classroom Assessment Methods	▪ Quizzes ▪ Chapter tests ▪ Laboratory experiments and reports ▪ Formative classroom assessments
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases* o GALE Resource Data bases** ▪ Videos: o Connections Series o The World of Chemistry