Science
Environmental Geoscience
Unit 1: The Lithosphere

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. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ How can the idea of a system help us understand the lithosphere and our relationship with it? ▪ What is a system and how does one work? ▪ What is the lithosphere? ▪ What sub-systems are involved in the lithosphere and how are they thought to work? ▪ What components of the lithosphere do scientists study around the world and Maine? ▪ How is the world's population affected by lithospheric system systems? (i.e., why do we care about the lithosphere?) ▪ What remains unclear about the lithosphere and/or our relationships with it, and how might a systems-type lens help uncover the answers?
Essential Knowledge	▪ The world can be more thoroughly understood as one system with interrelated components. There is no such thing as a process "operating in a vacuum." ▪ Physics and chemistry concepts were not left behind in those courses; they are present in the world around us. ▪ The lithosphere plays a key role in ethical, philosophical, and economic debates. ▪ The lithosphere system follows the laws of conservation of mass, conservation of energy, and uniformitarianism (the present is the key to the past.
Vocabulary	▪ <u>Terms</u>: o Lithosphere, asthenosphere, mesosphere, inner/outer core o Density o Systems components (steady state, reservoir, upper/lower boundaries, inputs/outputs, positive and negative feedbacks, open/closed system) o Continental drift, tectonic plates, convergent and divergent plate boundaries o Earthquakes, fault lines, volcanoes, hotspots, ring of fire o The rock cycle (Igneous, sedimentary, and metamorphic rocks) o Weathering (chemical and physical) and erosion
Essential Skills	▪ Draw a labeled, accurate cross-section of the lithosphere system, with inputs (subduction) and outputs (volcanism). ▪ Identify, distinguish, and name a formation environment for igneous, metamorphic, and sedimentary rock specimens.

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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 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. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, and that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical arguments and verifiable 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.

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Related Maine Learning Results	D3. Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship 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 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	▪ Igneous rocks lab (identifying hand samples and formation environments) ▪ Diagram of Earth's interior ▪ Library Research Project (Topic: "What components of the lithosphere do scientists study around the world and in Maine?")
Sample Classroom	▪ Quizzes on class lectures ▪ Laboratory and project grades

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Assessment Methods	▪ Examination at the end of unit
Sample Resources	▪ Publications: o "Laboratory Manual: Physical Geology," James H. Zumberge et al., Plummer/McGeary, 1996. ▪ Other Resources: o Science Resource Center (Library online database)