Science
Biology: Honors
Unit 7: Interdependence of Organisms

Essential Understandings	▪ Atoms and molecules compose living and nonliving things and recycle through the biosphere. ▪ Energy flows through ecosystems in one direction from photosynthetic or chemosynthetic organisms to herbivores to carnivores to decomposers. ▪ Organisms cooperate and compete in ecosystems. ▪ Humans modify ecosystems due to technology, growth, and consumption. ▪ Living organisms have the ability to produce populations of infinite size, but the environment and resources are finite.
Essential Questions	▪ How do atoms and molecules move through the biosphere? ▪ How does energy flow through an ecosystem? ▪ How are organisms related to each other and to their environment? ▪ How do humans impact the biosphere? ▪ How do finite resources impact population growth?
Essential Knowledge	▪ Matter cycles through the biosphere. ▪ Energy is utilized in different forms throughout the biosphere. ▪ Organisms cooperate and compete in the ecosystem. ▪ Human activities impact both living and nonliving factors in an ecosystem. ▪ Populations can grow unchecked unless limited by resources.
Vocabulary	▪ Terms: ○ biogeochemical cycles, levels of organization, atoms, molecules, photosynthesis, chemosynthesis, autotroph/ producers, heterotroph/carnivore, herbivores, carnivores, omnivores, food chain, food web, trophic level, niche, habitat, ecological pyramids, land biomes, aquatic ecosystems, symbiotic relationships, predator/prey relationships, logistic growth, exponential growth, density dependent factor, density independent factor, demography, age-structure diagrams, sustainable use, biodiversity, renewable resources, nonrenewable resources, primary and secondary succession, conservation biology
Essential Skills	▪ Construct a food web. ▪ Identify symbiotic relationships. ▪ Characterize biomes. ▪ Relate topics to current events.

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Related Maine Learning Results	Science B. The Skills and Traits of Scientific Inquiry and Technological Design B1. 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 and models 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 C1. Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, 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 argument and verifiable results. C2. Understandings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. c. Provide examples that illustrate how technological solutions to problems sometimes lead to new problems or new fields of inquiry.

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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. 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. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.

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Related Maine Learning Results	E. The Living Environment E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. c. Explain the concept of carrying capacity and list factors that determine the amount of life that any environment can support. d. Describe the critical role of photosynthesis and how energy and the chemical elements that make up molecules are transformed in ecosystems and obey basic conservation laws. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.

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Sample Lessons and Activities	▪ Build a food web ▪ Complete a Biome Web Quest ▪ Construct Population Growth Graphs ▪ Water Quality Tests ▪ Transect a small ecosystem ▪ Biodiversity of Pond Water
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Lab Reports
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine ▪ Videos: o Cycle of Life videos