Standards By Design:

High School for Science (2009)

Acknowledgment

The Oregon Department of Education gratefully acknowledges the Indiana Department of Education for allowing the modification of some of their materials for use in this document.

Science (2009)

High School

High School students refine their understanding of systems' characteristics, form, function, interactions, and changes. They deepen their knowledge of atomic structure, the Periodic Table, physical and chemical properties of compounds, the law of conservation of mass, types and strengths of bonds, and chemical reactions. Students apply the laws of motion and gravitation to describe motion. They study interactions of energy and matter and the law of conservation of energy. Life science study includes cellular structures and processes, energy and matter flow in biological systems, the laws of heredity, DNA, reproduction, genetic diversity, natural selection, biological evolution, and change in ecosystems. Students deepen their understanding of our solar system, galaxy and universe, and Earth's atmosphere, geosphere, and hydrosphere. They evaluate the impact of human activities on Earth systems, and how environmental factors influence resource management. Students use their scientific inquiry skills to design an investigation, collect, organize, display, summarize, analyze, and interpret data, and propose and communicate explanations supported by data. They learn how scientific knowledge is modified and how technology and science interact. Students use their engineering design skills to formulate problem statements, identify criteria and constraints, propose and test possible solutions, incorporate modifications, and communicate recommendations. They evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how their work impacts human society and the environment.

*It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

H.1 Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

H.1P.1 Explain how atomic structure is related to the properties of elements and their position in the Periodic Table. Explain how the composition of the nucleus is related to isotopes and radioactivity.

H.1P.2 Describe how different types and strengths of bonds affect the physical and chemical properties of compounds.

H.1L.1 Compare and contrast the four types of organic macromolecules. Explain how they compose the cellular structures of organisms and are involved in critical cellular processes.

H.1L.2 Describe the chemical structure of DNA and its relationship to chromosomes. Explain the role of DNA in protein synthesis.

H.1L.3 Explain and apply laws of heredity and their relationship to the structure and function of DNA.

Science Numbering Key Example: K.2P.1
K = Grade
2 = Core Standard strand (strands are 1=Structure and Function; 2=Interaction and change; 3=Scientific Inquiry; 4=Engineering Design)
P = Science Discipline (disciplines are P = Physical; L = Life; E = Earth and Space; S = Scientific inquiry; D = Engineering Design)
1 = Number of the content standard for this grade, strand, and discipline

H.1L.4 Explain how cellular processes and cellular differentiation are regulated both internally and externally in response to the environments in which they exist.

H.1E.1 Classify the bodies in our solar system based on properties and composition. Describe attributes of our galaxy and evidence for multiple galaxies in the universe.

H.1E.2 Describe the structure and composition of Earth's atmosphere, geosphere, and hydrosphere.

H.2 Interaction and Change: The components in a system can interact in dynamic ways that may result in change. In systems, changes occur with a flow of energy and/or transfer of matter.

H.2P.1 Explain how chemical reactions result from the making and breaking of bonds in a process that absorbs or releases energy. Explain how the rate of a chemical reaction is affected by temperature, pressure, and concentration.

H.2P.2 Explain how physical and chemical changes demonstrate the law of conservation of mass.

H.2P.3 Describe the interactions of energy and matter including the law of conservation of energy.

H.2P.4 Apply the laws of motion and gravitation to describe the interaction of forces acting on an object and the resultant motion.

H.2L.1 Explain how energy and chemical elements pass through systems. Describe how chemical elements are combined and recombined in different ways as they cycle through the various levels of organization in biological systems.

H.2L.2 Explain how ecosystems change in response to disturbances and interactions. Analyze the relationships among biotic and abiotic factors in ecosystems.

H.2L.3 Describe how asexual and sexual reproduction affect genetic diversity.

H.2L.4 Explain how biological evolution is the consequence of the interactions of genetic variation, reproduction and inheritance, natural selection, and time.

H.2L.5 Explain how multiple lines of scientific evidence support biological evolution.

H.2E.1 Identify and predict the effect of energy sources, physical forces, and transfer processes that occur in the Earth system. Describe how matter and energy are cycled between system components over time.

H.2E.2 Explain how Earth's atmosphere, geosphere, and hydrosphere change over time and at varying rates. Explain techniques used to elucidate the history of events on Earth.

H.2E.3 Describe how the universe, galaxies, stars, and planets evolve over time.

H.2E.4 Evaluate the impact of human activities on environmental quality and the sustainability of Earth systems. Describe how environmental factors influence resource management.

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H.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world by a systematic process that includes proposing a testable question or hypothesis and developing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.

H.3S.1 Based on observations and science principles formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.

H.3S.2 Design and conduct a controlled experiment, field study, or other investigation to make systematic observations about the natural world, including the collection of sufficient and appropriate data.

H.3S.3 Analyze data and identify uncertainties. Draw a valid conclusion, explain how it is supported by the evidence, and communicate the findings of a scientific investigation.

H.3S.4 Identify examples from the history of science that illustrate modification of scientific knowledge in light of challenges to prevailing explanations.

H.3S.5 Explain how technological problems and advances create a demand for new scientific knowledge and how new knowledge enables the creation of new technologies.

H.4 Engineering Design: Engineering design is a process of formulating problem statements, identifying criteria and constraints, proposing and testing possible solutions, incorporating modifications based on test data, and communicating the recommendations.

H.4D.1 Define a problem and specify criteria for a solution within specific constraints or limits based on science principles. Generate several possible solutions to a problem and use the concept of trade-offs to compare them in terms of criteria and constraints.

H.4D.2 Create and test or otherwise analyze at least one of the more promising solutions. Collect and process relevant data. Incorporate modifications based on data from testing or other analysis.

H.4D.3 Analyze data, identify uncertainties, and display data so that the implications for the solution being tested are clear.

H.4D.4 Recommend a proposed solution, identify its strengths and weaknesses, and describe how it is better than alternative designs. Identify further engineering that might be done to refine the recommendations.

H.4D.5 Describe how new technologies enable new lines of scientific inquiry and are largely responsible for changes in how people live and work.

H.4D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment.

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