Oregon Science
K-HS Content Standards

Science Standards

Science is a way of knowing about the natural world based on tested explanations supported by accumulated empirical evidence. These science standards define the scientific content knowledge and process skills that all students are expected to learn during science instruction in K-8 and three years in high school. The adopted science content standards include four core standards at each grade from kindergarten through eighth grade and for high school. These core standards provide the major unifying concepts and processes that will be the primary focus of teaching and learning across the grades. Underneath each of these core standards are from one to seven content standards which provide the details necessary for instruction and assessment.

The adopted science content standards are attached (pp. 3-13). Also attached are:

1. A Science Standards Framework that shows the big ideas in each science discipline in the core strands (p. 14);
2. A diagram depicting the flow and interaction of the Science Processes of Scientific Inquiry and Engineering Design (p. 15);
3. A Vertical Articulation of the big ideas and content from kindergarten through high school within each of the three disciplines of physical, life, and Earth and space science (p. 16);
4. A Vertical Articulation of the Core Standards that shows the grade-by-grade progression from kindergarten through high school (p. 17);
5. A Vertical Articulation of the Core and Content Standards within each of the three disciplines of physical, life, and Earth and space science, and the science processes of scientific inquiry and engineering design (pp. 18-26).

Purpose

The K-HS Science Content Standards define what all students are expected to know and be able to do. The standards are intended to guide instruction and serve as a basis for statewide and local assessments. It is also important to point out what the standards are not. The standards are not the curriculum. The standards do not specify courses, teaching methods, or instructional materials. We are currently providing the grade level standards as guidance. Sequencing of instruction and choice of curriculum are local decisions. The purpose of the standards is solely to specify what students are to know and be able to do as a result of science instruction.

National Trends

Two of the main referents used in development of most state science standards in the United States are the National Science Education Standards (NSES) and the American Association for the Advancement of Science (AAAS) Benchmarks for Science Literacy. The NSES lists science standards in grade bands of K-4, 5-8, and 9-12, while the AAAS Benchmarks lists science standards in grade bands of K-2, 3-5, 6-8, and 9-12. Since both the NSES and AAAS are not grade-specific, many decisions have to be made regarding the precise grade placement of science topics. The results are states' standards that have considerable variation in the sequencing and grade placement of their topics. Researchers, who analyzed the results of the Trends in International Mathematics and Science Study (TIMSS), have stated that curricula, textbooks, and teaching in the United States are "a mile wide and an inch deep." Recent science education reports have recommended that science standards be organized by a small number of big ideas which are essential for all people to understand. Organizing K-12 concepts and abilities by big ideas offers a way to prioritize critical content for students to study, and provides a coherent vision of what students should know and be able to do that builds throughout a K-12 science education program. As states revise their science standards many are using the big ideas of science to organize them.

The Review Process

The Oregon review of the science standards began in August 2007 with a two-day work session for the science panel provided by national and international science education experts to review the latest science education research. Links to the research, sources, and reference documents that informed this review are posted on the ODE's website at http://www.ode.state.or.us/search/page/?id=1642.

In November 2007 the science panel began work on a framework for the science standards and the development of the standards. The panel wrote the first draft of the standards in January and April 2008. A small focus group of science teachers from Portland State University's Oregon Teacher Scholars Program met in December 2007 to provide additional input on the framework and in May 2008 to provide a vertical alignment review of the initial draft standards. An external science education expert provided a preliminary review of the initial draft in June 2008. The science panel met in October, November, and December 2008 to consider feedback and produce revised drafts of the science standards. The final adopted science content standards provided here were crafted at the December meeting.

In between these panel meetings, the various drafts were made available on ODE's website at http://www.ode.state.or.us/search/page/?id=1606. The ODE also posted news announcements when each draft was available and sent out messages via the Superintendent's Pipeline, the Curriculum Director's listserv, the ESD Instructional Leadership Council's listserv, the *Oregon Science Teacher Update* monthly e-newsletter, the monthly EII regional update, and to science professional organizations, universities, and community colleges. In addition, ODE representatives gave presentations on the science standards revision at conferences and board meetings around the state, including the Oregon Association for Comprehensive Education, Closing the Achievement Gap, Oregon Association of Science Teachers, Oregon Science Education Council, National Science Teachers Association, Oregon Science Teachers Association, Oregon Physics Teachers Association, Teachers Standards and Practices Commission, Oregon State Board of Geologist Examiners, and presentations for various university faculty meetings, science teacher professional development sessions, pre-service teacher classes, and district, school, and ESD meetings.

Feedback was collated and then carefully reviewed by the panel prior to updating each draft. Several of those providing feedback have commented they were gratified their input had been valued and had influenced future drafts. Various drafts also have been reviewed by external science education experts, and aligned to our current standards, the 2009 National Assessment of Educational Progress science framework, the WestEd Oregon Core Standards Identification Report, and to other state and international science standards.

What has changed from the 2001 Science Standards

The 2001 science standards were organized according to four strands (Physical Science, Life Science, Earth and Space Science, and Scientific Inquiry.) Each strand was subdivided into three or four topics. Each topic had several Common Curriculum Goals (CCG) that were identical at all benchmark grades. Each of these CCGs had content standards, several benchmark standards, and multiple eligible content statements for each benchmark. In addition, the 2001 science standards specified four additional strands (Unifying Concepts and Processes, History and Nature of Science, Science in Personal and Social Perspectives, and Science and Technology) with 12 additional CCGs. While the overall breadth of the science standards remains, the standards have been revised and organized using the Core Standards Structure to clearly articulate the developmental progressions of the big ideas in science across grades K-8 and in high school.

These 2009 adopted science standards are organized under four core standards at each grade in K-8 and for high school. The Core Standard statements describe the unifying concepts and processes in science. Content standards under Core Standard one, *Structure and Function*, and two, *Interaction and Change*, describe the big ideas in the three science disciplines of physical (P), life (L), and Earth and space (E). Content standards under Core Standard three, *Scientific Inquiry*, and four, *Engineering Design*, describe the science process skills and understandings that characterize the nature and practice of science (S) and engineering design (D). These process standards are intended to be interwoven with content in the three science disciplines.

In addition to this content standards document, ODE will develop content specifications for the science standards to clearly outline the content boundaries, give examples, list key understandings, and provide sample grade level units. ODE also plans to provide science concepts maps which show the vertical progression and within grade connections of the science content standards, and a detailed comparison between the 2001 and the 2009 science standards. In addition, ODE will develop connections which are a grade-by-grade list of topics that do not appear in the content standards but are strongly tied to them. The connections will be guidance for teachers to provide a richer science experience for students, emphasize the Oregon Essential Skills, identify connections to math, English language arts, technology, and other content areas, and help with differentiation of instruction.

Science
K-HS Content Standards

Kindergarten

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

K.1 Structure and Function: **The natural world includes living and non-living things.**

K.1P.1 Compare and contrast characteristics of living and non-living things.
K.1L.1 Compare and contrast characteristics of plants and animals.
K.1E.1 Gather evidence that the sun warms land, air, and water.

K.2 Interaction and Change: **Living and non-living things move.**

K.2P.1 Examine the different ways things move.
K.2E.1 Identify changes in things seen in the sky.

K.3 Scientific Inquiry: **Science explores the natural world through observation.**

K.3S.1 Explore questions about living and non-living things and events in the natural world.
K.3S.2 Make observations about the natural world.

K.4 Engineering Design: **Engineering design is used to design and build things.**

K.4D.1 Create structures using natural or designed materials and simple tools.
K.4D.2 Show how components of designed structures can be disassembled and reassembled.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 1

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

1.1 Structure and Function: **Living and non-living things have characteristics and properties.**

1.1P.1 Compare and contrast physical properties and composition of objects.
1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
1.1E.1 Examine characteristics and physical properties of Earth materials.

1.2 Interaction and Change: **Living and non-living things interact.**

1.2P.1 Describe the motion of objects when a force is applied.
1.2L.1 Describe the basic needs of living things.

1.3 Scientific Inquiry: **Science explores the natural world using evidence from observations.**

1.3S.1 Identify and use tools to make careful observations and answer questions about the natural world.
1.3S.2 Record observations with pictures, numbers, or written statements.
1.3S.3 Describe why recording accurate observations is important in science.

1.4 Engineering Design: **Engineering design is used to design and build things to meet a need.**

1.4D.1 Identify basic tools used in engineering design.
1.4D.2 Demonstrate that designed structures have parts that work together to perform a function.
1.4D.3 Show how tools are used to complete tasks every day.

Grade 2

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

2.1 Structure and Function: **Living and non-living things vary throughout the natural world.**

2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.

2.2 Interaction and Change: **Living and non-living things change.**

2.2P.1 Compare and contrast how objects and materials respond to magnetic forces.
2.2L.1 Describe life cycles of living things.
2.2E.1 Observe and record the patterns of apparent movement of the sun and the moon.
2.2E.2 Record and summarize daily and seasonal temperature changes.

2.3 Scientific Inquiry: **Scientific inquiry is a process used to explore the natural world using evidence from observations.**

2.3S.1 Observe, measure, and record properties of objects and substances using simple tools to gather data and extend the senses.
2.3S.2 Make predictions about living and non-living things and events in the environment based on observed patterns.
2.3S.3 Make, describe, and compare observations, and organize recorded data.

2.4 Engineering Design: **Engineering design is a process used to design and build things to solve problems or address needs.**

2.4D.1 Use tools to construct a simple designed structure out of common objects and materials.
2.4D.2 Work with a team to complete a designed structure that can be shared with others.
2.4D.3 Describe an engineering design that is used to solve a problem or address a need.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 3

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

3.1 Structure and Function: **Living and non-living things vary in their characteristics and properties.**

3.1P.1 Compare and contrast the properties of states of matter.
3.1L.1 Compare and contrast the characteristics of offspring and parents.

3.2 Interaction and Change: **Living and non-living things interact with energy and forces.**

3.2P.1 Describe how forces cause changes in an object's position, motion, and speed.
3.2L.1 Compare and contrast the life cycles of plants and animals.
3.2E.1 Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.

3.3 Scientific Inquiry: **Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.**

3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.
3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.
3.3S.3 Explain why when a scientific investigation is repeated, similar results are expected.

3.4 Engineering Design: **Engineering design is a process that uses science to solve problems or address needs or aspirations.**

3.4D.1 Identify a problem that can be addressed through engineering design, propose a potential solution, and design a prototype.
3.4D.2 Describe how recent inventions have significantly changed the way people live.
3.4D.3 Give examples of inventions that enable scientists to observe things that are too small or too far away.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 4

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

4.1 Structure and Function: **Living and non-living things can be classified by their characteristics and properties.**

4.1P.1 Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.
4.1L.1 Compare and contrast characteristics of fossils and living organisms.
4.1E.1 Identify properties, uses, and availability of Earth materials.

4.2 Interaction and Change: **Living and non-living things undergo changes that involve force and energy.**

4.2P.1 Describe physical changes in matter and explain how they occur.
4.2L.1 Describe the interactions of organisms and the environment where they live.
4.2E.1 Compare and contrast the changes in the surface of Earth that are due to slow and rapid processes.

4.3 Scientific Inquiry: **Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

4.3S.1 Based on observations identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.
4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.
4.3S.3 Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.

4.4 Engineering Design: **Engineering design is a process of using science principles to solve problems generated by needs and aspirations.**

4.4D.1 Identify a problem that can be addressed through engineering design using science principles.
4.4D.2 Design, construct, and test a prototype of a possible solution to a problem using appropriate tools, materials, and resources.
4.4D.3 Explain how the solution to one problem may create other problems.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 5

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

5.1 Structure and Function: **Living and non-living things are composed of related parts that function together to form systems.**

5.1L.1 Explain that organisms are composed of parts that function together to form a living system.
5.1E.1 Describe the Sun-Earth-Moon system.

5.2 Interaction and Change: **Force, energy, matter, and organisms interact within living and non-living systems.**

5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.
5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.
5.2E.1 Explain how the energy from the sun affects Earth's weather and climate.

5.3 Scientific Inquiry: **Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.
5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.
5.3S.3 Explain the reasons why similar investigations may have different results.

5.4 Engineering Design: **Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.**

5.4D.1 Using science principles describe a solution to a need or problem given criteria and constraints.
5.4D.2 Design and build a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.
5.4D.3 Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 6

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

6.1 Structure and Function: **Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.**

6.1P.1 Describe physical and chemical properties of matter and how they can be measured.
6.1P.2 Compare and contrast the characteristic properties of forms of energy.
6.1L.1 Compare and contrast the types and components of cells. Describe the functions and relative complexity of cells, tissues, organs, and organ systems.
6.1E.1 Describe and compare the properties and composition of the layers of Earth.
6.1E.2 Describe the properties of objects in the solar system. Describe and compare the position of the sun within the solar system, galaxy, and universe.

6.2 Interaction and Change: **The related parts within a system interact and change.**

6.2P.1 Describe and compare types and properties of waves and explain how they interact with matter.
6.2P.2 Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.
6.2L.1 Describe the relationships and interactions between and among cells, tissues, organs, and organ systems.
6.2L.2 Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.
6.2E.1 Explain the water cycle and the relationship to landforms and weather.

6.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.**

6.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.
6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
6.3S.3 Explain why if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.

6.4 Engineering Design: **Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.**

6.4D.1 Define a problem that addresses a need and identify science principles that may be related to possible solutions.
6.4D.2 Design, construct, and test a possible solution to a defined problem using appropriate tools and materials. Evaluate proposed engineering design solutions to the defined problem.
6.4D.3 Describe examples of how engineers have created inventions that address human needs and aspirations.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 7

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

7.1 Structure and Function: **Living and non-living systems are composed of components which affect the characteristics and properties of the system.**

7.1P.1 Explain that all matter is made of atoms, elements are composed of a single kind of atom, and compounds are composed of two or more different elements.
7.1L.1 Compare and contrast sexual and asexual reproduction. Explain why reproduction is essential to the continuation of every species.
7.1L.2 Distinguish between inherited and learned traits, explain how inherited traits are passed from generation to generation, and describe the relationships among phenotype, genotype, chromosomes, and genes.

7.2 Interaction and Change: **The components and processes within a system interact.**

7.2P.1 Identify and describe types of motion and forces and relate forces qualitatively to the laws of motion and gravitation.
7.2L.1 Explain how organelles within a cell perform cellular processes and how cells obtain the raw materials for those processes.
7.2L.2 Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.
7.2E.1 Describe and evaluate the environmental and societal effects of obtaining, using, and managing waste of renewable and non-renewable resources.
7.2E.2 Describe the composition of Earth's atmosphere, how it has changed over time, and implications for the future.
7.2E.3 Evaluate natural processes and human activities that affect global environmental change and suggest and evaluate possible solutions to problems.
7.2E.4 Explain how landforms change over time at various rates in terms of constructive and destructive forces.

7.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.**

7.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.
7.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.
7.3S.3 Evaluate the validity of scientific explanations and conclusions based on the amount and quality of the evidence cited.

7.4 Engineering Design: **Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.**

7.4D.1 Define a problem that addresses a need and identify constraints that may be related to possible solutions.
7.4D.2 Design, construct, and test a possible solution using appropriate tools and materials. Evaluate the proposed solutions to identify how design constraints are addressed.
7.4D.3 Explain how new scientific knowledge can be used to develop new technologies and how new technologies can be used to generate new scientific knowledge.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Grade 8

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

8.1 Structure and Function: **Systems and their components function at various levels of complexity.**

8.1P.1 Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds.
8.1P.2 Explain how the Periodic Table is an organization of elements based on their physical and chemical properties.
8.1P.3 Explain how the motion and spacing of particles determines states of matter.
8.1L.1 Explain how genetics and anatomical characteristics are used to classify organisms and infer evolutionary relationships.

8.2 Interaction and Change: **Systems interact with other systems.**

8.2P.1 Compare and contrast physical and chemical changes and describe how the law of conservation of mass applies to these changes.
8.2P.2 Explain how energy is transferred, transformed, and conserved.
8.2L.1 Explain how species change through the process of natural selection. Describe evidence for evolution.
8.2E.1 Explain how gravity is the force that keeps objects in the solar system in regular and predictable motion and describe the resulting phenomena. Explain the interactions that result in Earth's seasons.
8.2E.2 Describe the processes of Earth's geosphere and the resulting major geological events.
8.2E.3 Explain the causes of patterns of atmospheric and oceanic movement and the effects on weather and climate.
8.2E.4 Analyze evidence for geologic, climatic, environmental, and life form changes over time.

8.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.**

8.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.
8.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.
8.3S.3 Explain how scientific explanations and theories evolve as new information becomes available.

8.4 Engineering Design: **Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.**

8.4D.1 Define a problem that addresses a need, and using relevant science principles investigate possible solutions given specified criteria, constraints, priorities, and trade-offs.
8.4D.2 Design, construct, and test a proposed engineering design solution and collect relevant data. Evaluate a proposed design solution in terms of design and performance criteria, constraints, priorities, and trade-offs. Identify possible design improvements.
8.4D.3 Explain how creating a new technology requires considering societal goals, costs, priorities, and trade-offs.

High School

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.
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, function, 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 different factors can affect the rate of a chemical reaction.
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.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

High School

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

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.

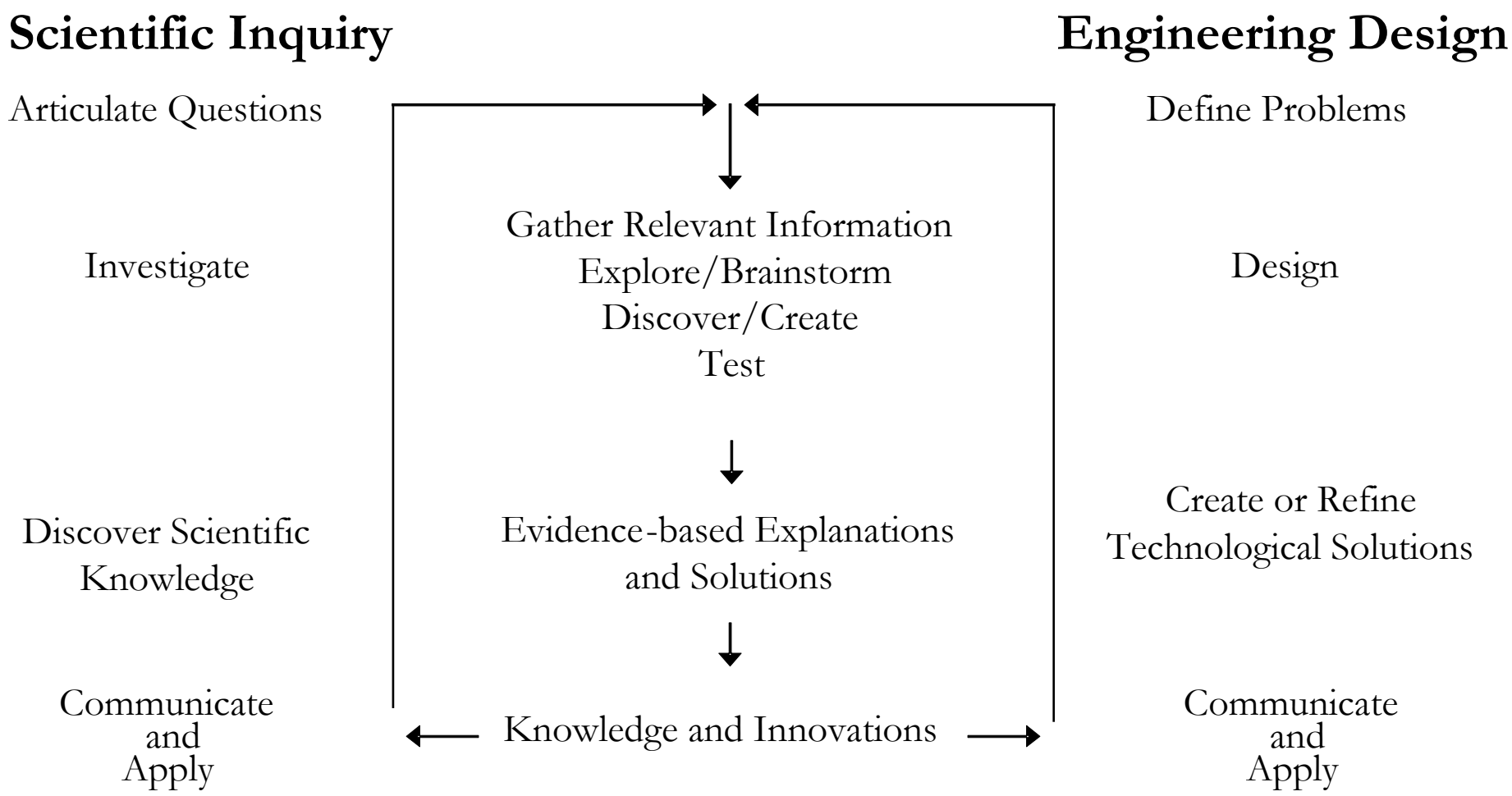
Science Standards Framework

The big ideas organized by science discipline and core strand

	Science Content Knowledge		***Science Process Skills***	
	Structure and Function	**Interaction and Change**	**Scientific Inquiry**	**Engineering Design**
Physical	*Properties of Matter* *Forms of Energy*	*Changes in Matter* *Energy Transfer and Conservation* *Forces and Motion*	*Abilities to do Scientific Inquiry* *Nature, History, and Interaction of Science and Technology*	*Abilities to do Engineering Design* *Nature, History, and Interaction of Technology and Science*
Life	*Organization of Living Systems*	*Matter and Energy Transformations in Living Systems* *Interdependence* *Evolution and Diversity*		
Earth and Space	*Properties of Earth Materials* *Objects in the Universe*	*Matter and Energy Transformations in Earth Systems* *History of Earth*		

Science Processes

Align with the Oregon Essential Skills



Vertical Articulation of the Big Ideas in the Science Disciplines

This chart shows the grade-by-grade progression of the big ideas and content standards within each science discipline. It outlines a coherent progression in science content from kindergarten through high school.

	Physical	Life	Earth and Space
K	Properties of Matter: Characteristics of living and non-living things Forces and Motion: Motion	Organization of Living Systems: Characteristics of plants and animals	Objects in the Universe: Objects in sky Matter and Energy: Sun warms land, air, water
1	Properties of Matter: Properties of objects Forces and Motion: Force and motion	Organization of Living Systems: Characteristics of living things Matter and Energy: Needs of living things	Properties of Earth Materials: Properties of Earth materials
2	Forces and Motion: Objects and magnetic forces	Matter and Energy: Describe life cycles Diversity: Variety in living and non-living things	Objects in the Universe: Patterns of change in objects seen in the sky Matter and Energy: Temperature changes
3	Properties of Matter: States of matter Forces and Motion: Position, motion, speed	Matter and Energy: Compare and contrast life cycles Diversity: Characteristics of offspring and parents	Objects in the Universe: Earth as a planet Matter and Energy: Seasonal weather changes
4	Forms of Energy: Properties of energy Changes in Matter: Physical changes	Interdependence: Plants, animals, and environment Diversity: Fossils	Properties of Earth Materials: Properties, uses, and availability of Earth materials Matter and Energy: Earth surface changes
5	Forces and Motion: Effects of friction, gravity, and magnetic forces on objects	Organization of Living Systems: Living things are composed of parts Interdependence: Plants, animals, and environment Diversity: adaptation and survival	Objects in the Universe: Sun-Earth-Moon System Matter and Energy: Sun's energy affects weather and climate
6	Properties of Matter: Physical and chemical properties of matter Forms of Energy: Properties of forms of energy and waves Energy Transfer: Electricity, magnetism, waves	Organization of Living Systems: Components, types and complexity of cells, tissues, organs, and organ systems Matter and Energy: Interactions within organisms Interdependence: Organisms, populations, and resources in ecosystems	Objects in the Universe: Objects in our solar system, galaxy, and universe Matter and Energy: Water cycle, landforms, and weather
7	Properties of Matter: Atoms, elements, and compounds Forces and Motion: Types of motion and forces and gravitation	Matter and Energy: Energy and materials for growth and metabolism of organisms, Evolution and Diversity: Reproduction, life cycles, inherited and learned traits, genes, chromosomes	History of Earth: Changes in Earth's atmosphere and landforms Matter and Energy: Use of Earth's resources, natural processes, human activities, and global environmental changes
8	Properties of Matter: Atomic model, physical and chemical properties of elements and compounds, Periodic Table Changes in Matter: Physical and chemical changes and conservation of mass Energy Transfer and Conservation: Conservation of energy	Organization of Living Systems: Classification, internal and external structures, relationships among organisms Evolution and Diversity: Natural selection, evidence for evolution	History of Earth: Geologic, climatic, environmental and life form changes Matter and Energy: Processes of Earth's atmosphere, oceans, and geosphere, and gravity, motions, and Earth changes
H	Properties of Matter: Atomic structure, Periodic Table, isotopes, radioactivity, types and strengths of bonds and properties of compounds Changes in Matter: Chemical reactions and conservation of mass Energy Transfer and Conservation: Interactions of energy and matter, conservation of energy Forces and Motion: Interaction of forces on an object and the resultant motions	Organization of Living Systems: Organic macromolecules, cellular processes, DNA, proteins Matter and Energy: Energy and elements cycle through biological systems Interdependence: Relationships between biotic and abiotic factors and disturbances and change in ecosystems Evolution and Diversity: Reproduction, genetic diversity, and multiple lines of evidence for evolution	Objects in the Universe: Properties and classification of objects in our solar system, galaxy, and universe Properties of Earth Materials: Structure and composition of Earth's atmosphere, geosphere, and hydrosphere History of Earth: Evolution of universe, galaxies, stars, and planets Matter and Energy: Effects of energy, forces, processes, and human activities on Earth systems, cycling of matter and energy

Vertical Articulation of the Core Standards

This chart shows the grade-by-grade progression of the core standards. It outlines a coherent progression in knowledge and skills from kindergarten through high school.

	Structure and Function	Interaction and Change	Scientific Inquiry	Engineering Design
K	The natural world includes living and non-living things.	Living and non-living things move.	Science explores the natural world through observation.	Engineering Design is used to design and build things.
1	Living and non-living things have characteristics and properties.	Living and non-living things interact.	Science explores the natural world using evidence from observations.	Engineering Design is used to design and build things to meet a need.
2	Living and non-living things vary throughout the natural world.	Living and non-living things change.	Scientific Inquiry is a process used to explore the natural world using evidence from observations.	Engineering Design is a process used to design and build things to solve problems or address needs.
3	Living and non-living things vary in their characteristics and properties.	Living and non-living things interact with energy and forces.	Scientific Inquiry is a process used to explore the natural world using evidence from observations and investigations.	Engineering Design is a process that uses science to solve problems or address needs or aspirations.
4	Living and non-living things can be classified by their characteristics and properties.	Living and non-living things undergo changes that involve force and energy.	Scientific Inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	Engineering Design is a process of using science principles to solve problems generated by needs and aspirations.
5	Living and non-living things are composed of related parts that function together to form systems.	Force, energy, matter, and organisms interact within living and non-living systems.	Scientific Inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	Engineering Design is a process of using science principles to make modifications in the world to meet human needs and aspirations.
6	Living and non-living systems are organized groups of related parts that function together and have characteristic properties.	The related parts within a system interact and change.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.	Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.
7	Living and non-living systems are composed of components that affect the defining characteristics and properties of the system.	The components and processes within a system interact.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.	Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.
8	Systems and their components function at various levels of complexity.	Systems interact with other systems.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.	Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.
H	A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.	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.	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.	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.

Core Standards for Physical, Life, and Earth and Space Science
Grades K-High School

This list provides the core standards for physical, life and Earth and space science organized by grade to show the progression of the standards from kindergarten through high school.

K.1 Structure and Function: **The natural world includes living and non-living things.**

K.2 Interaction and Change: **Living and non-living things move.**

1.1 Structure and Function: **Living and non-living things have characteristics and properties.**

1.2 Interaction and Change: **Living and non-living things interact.**

2.1 Structure and Function: **Living and non-living things vary throughout the natural world.**

2.2 Interaction and Change: **Living and non-living things change.**

3.1 Structure and Function: **Living and non-living things vary in their characteristics and properties.**

3.2 Interaction and Change: **Living and non-living things interact with energy and forces.**

4.1 Structure and Function: **Living and non-living things can be classified by their characteristics and properties.**

4.2 Interaction and Change: **Living and non-living things undergo changes that involve force and energy.**

5.1 Structure and Function: **Living and non-living things are composed of related parts that function together to form systems.**

5.2 Interaction and Change: **Force, energy, matter, and organisms interact within living and non-living systems.**

6.1 Structure and Function: **Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.**

6.2 Interaction and Change: **The related parts within a system interact and change.**

7.1 Structure and Function: **Living and non-living systems are composed of components which affect the characteristics and properties of the system.**

7.2 Interaction and Change: **The components and processes within a system interact.**

8.1 Structure and Function: **Systems and their components function at various levels of complexity.**

8.2 Interaction and Change: **Systems interact with other systems.**

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

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.**

Physical Science Content Standards
Grades K-High School

This list provides the content standards organized by science discipline to show the progression of the physical science standards from kindergarten through high school in physical science.

K.1P.1 Compare and contrast characteristics of living and non-living things.
K.2P.1 Examine the different ways things move.
1.1P.1 Compare and contrast physical properties and composition of objects.
1.2P.1 Describe the motion of objects when a force is applied.
2.2P.1 Compare and contrast how objects and materials respond to magnetic forces.
3.1P.1 Compare and contrast the properties of states of matter.
3.2P.1 Describe how forces cause changes in an object's position, motion, and speed.
4.1P.1 Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.
4.2P.1 Describe physical changes in matter and explain how they occur.
5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.
6.1P.1 Describe physical and chemical properties of matter and how they can be measured.
6.1P.2 Compare and contrast the characteristic properties of forms of energy.
6.2P.1 Describe and compare types and properties of waves and explain how they interact with matter.
6.2P.2 Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.
7.1P.1 Explain that all matter is made of atoms, elements are composed of a single kind of atom, and compounds are composed of two or more different elements.
7.2P.1 Identify and describe types of motion and forces and relate forces qualitatively to the laws of motion and gravitation.
8.1P.1 Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds.
8.1P.2 Explain how the Periodic Table is an organization of elements based on their physical and chemical properties.
8.1P.3 Explain how the motion and spacing of particles determines states of matter.
8.2P.1 Compare and contrast physical and chemical changes and describe how the law of conservation of mass applies to these changes.
8.2P.2 Explain how energy is transferred, transformed, and conserved.
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.2P.1 Explain how chemical reactions result from the making and breaking of bonds in a process that absorbs or releases energy. Explain how different factors can affect the rate of a chemical reaction.
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.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

Life Science Content Standards
Grades K-High School

This list provides the content standards organized by science discipline to show the progression of the life standards from kindergarten through high school in life science.

K.1L.1 Compare and contrast characteristics of plants and animals.
1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
1.2L.1 Describe the basic needs of living things.
2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.
2.2L.1 Describe life cycles of living things.
3.1L.1 Compare and contrast the characteristics of offspring and parents.
3.2L.1 Compare and contrast the life cycles of plants and animals.
4.1L.1 Compare and contrast characteristics of fossils and living organisms.
4.2L.1 Describe the interactions of organisms and the environment where they live.
5.1L.1 Explain that organisms are composed of parts that function together to form a living system.
5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.
6.1L.1 Compare and contrast the types and components of cells. Describe the functions and relative complexity of cells, tissues, organs, and organ systems.
6.2L.1 Describe the relationships and interactions between and among cells, tissues, organs, and organ systems.
6.2L.2 Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.
7.1L.1 Compare and contrast sexual and asexual reproduction. Explain why reproduction is essential to the continuation of every species.
7.1L.2 Distinguish between inherited and learned traits, explain how inherited traits are passed from generation to generation, and describe the relationships among phenotype, genotype, chromosomes, and genes.
7.2L.1 Explain how organelles within a cell perform cellular processes and how cells obtain the raw materials for those processes.
7.2L.2 Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.
8.1L.1 Explain how genetics and anatomical characteristics are used to classify organisms and infer evolutionary relationships.
8.2L.1 Explain how species change through the process of natural selection. Describe evidence for evolution.
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.
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.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.

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Earth and Space Science Content Standards
Grades K-High School

This list provides the content standards organized by science discipline to show the progression of the Earth and space standards from kindergarten through high school in Earth and space science.

K.1E.1 Gather evidence that the sun warms land, air, and water.
K.2E.1 Identify changes in things seen in the sky.
1.1E.1 Describe characteristics and physical properties of Earth materials.
2.2E.1 Observe and record the patterns of apparent movement of the sun and moon.
2.2E.2 Record and summarize daily and seasonal temperature changes.
3.2E.1 Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.
4.1E.1 Identify properties, uses, and availability of Earth materials.
4.2E.1 Compare and contrast the changes in the surface of the Earth that are due to slow and rapid processes.
5.1E.1 Describe the Sun-Earth-Moon system.
5.2E.1 Explain how the energy from the sun affects Earth's weather and climate.
6.1E.1 Describe and compare the properties and composition of the layers of Earth.
6.1E.2 Describe the properties of objects in the solar system. Describe and compare the position of the sun within the solar system, galaxy, and universe.
6.2E.1 Explain the water cycle and the relationship to landforms and weather.
7.2E.1 Describe and evaluate the environmental and societal effects of obtaining, using, and managing waste of renewable and non-renewable resources.
7.2E.2 Describe the composition of Earth's atmosphere, how it has changed over time, and implications for the future.
7.2E.3 Evaluate natural processes and human activities that affect global environmental change and suggest and evaluate possible solutions to problems.
7.2E.4 Explain how landforms change over time at various rates in terms of constructive and destructive forces.
8.2E.1 Explain how gravity is the force that keeps objects in the solar system in regular and predictable motion and describe the resulting phenomena. Explain the interactions that produce Earth's seasons.
8.2E.2 Describe the processes of Earth's geosphere and the resulting major geological events.
8.2E.3 Explain the causes of patterns of atmospheric and oceanic movement and the effects on weather and climate.
8.2E.4 Analyze evidence for geologic, climatic, environmental, and life form changes over time.
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, function, and composition of Earth's atmosphere, geosphere, and hydrosphere.
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.

Core Standards for Scientific Inquiry

Grades K-High School

This list provides the core standards for scientific inquiry organized by grade to show the progression of the standards from kindergarten through high school.

K.3 **Science explores the natural world through observation.**

1.3 **Science explores the natural world using evidence from observations.**

2.3 **Scientific inquiry is a process used to explore the natural world using evidence from observations.**

3.3 **Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.**

4.3 **Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

5.3 **Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

6.3 **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.**

7.3 **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.**

8.3 **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.**

H.3 **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.**

Scientific Inquiry Standards
Grades K-High School

This list provides the content standards organized to show the progression of the standards from kindergarten through high school in scientific inquiry.

K.3S.1 Explore questions about living and non-living things and events in the natural world.
K.3S.2 Make observations about the natural world.
1.3S.1 Identify and use tools to make careful observations and answer questions about the natural world.
1.3S.2 Record observations with pictures, numbers, or written statements.
1.3S.3 Describe why recording accurate observations is important in science.
2.3S.1 Observe, measure, and record properties of objects and substances using simple tools to gather data and extend the senses.
2.3S.2 Make predictions about living and non-living things and events in the environment based on observed patterns.
2.3S.3 Make, describe, and compare observations, and organize recorded data.
3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.
3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.
3.3S.3 Explain why when a scientific investigation is repeated, similar results are expected.
4.3S.1 Based on observations identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.
4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.
4.3S.3 Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.
5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.
5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.
5.3S.3 Explain the reasons why similar investigations may have different results.
6.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.
6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
6.3S.3 Explain why if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.
7.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.
7.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.
7.3S.3 Evaluate the validity of scientific explanations and conclusions based on the amount and quality of the evidence cited.
8.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.

P=Physical science; L=Life science; E=Earth and Space science; S=Scientific inquiry; D=Design (engineering)

8.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.

8.3S.3 Explain how scientific explanations and theories evolve as new information becomes available.

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

Core Standards for Engineering Design

Grades K-High School

This list provides the core standards for engineering design organized by grade to show the progression of the standards from kindergarten through high school.

K.4 **Engineering design is used to design and build things.**

1.4 **Engineering design is used to design and build things to meet a need.**

2.4 **Engineering design is a process used to design and build things to solve problems or address needs.**

3.4 **Engineering design is a process that uses science to solve problems or address needs or aspirations.**

4.4 **Engineering design is a process of using science principles to solve problems generated by needs and aspirations.**

5.4 **Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.**

6.4 **Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.**

7.4 **Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.**

8.4 **Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.**

H.4 **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.**

Engineering Design Standards
Grades K-High School

This list provides the content standards organized to show the progression of the standards from kindergarten through high school in engineering design.

K.4D.1 Create structures using natural or designed materials and simple tools.
K.4D.2 Show how components of designed structures can be disassembled and reassembled.
1.4D.1 Identify basic tools used in engineering design.
1.4D.2 Demonstrate that designed structures have parts that work together to perform a function.
1.4D.3 Show how tools are used to complete tasks every day.
2.4D.1 Use tools to construct a simple designed structure out of common objects and materials.
2.4D.2 Work with a team to complete a designed structure that can be shared with others.
2.4D.3 Describe an engineering design that is used to solve a problem or address a need.
3.4D.1 Identify a problem that can be addressed through engineering design, propose a potential solution, and design a prototype.
3.4D.2 Describe how recent inventions have significantly changed the way people live.
3.4D.3 Give examples of inventions that enable scientists to observe things that are too small or too far away.
4.4D.1 Identify a problem that can be addressed through engineering design using science principles.
4.4D.2 Design, construct, and test a prototype of a possible solution to a problem using appropriate tools, materials, and resources.
4.4D.3 Explain how the solution to one problem may create other problems.
5.4D.1 Using science principles, describe a solution to a need or problem given criteria and constraints.
5.4D.2 Design and build a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.
5.4D.3 Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.
6.4D.1 Define a problem that addresses a need and identify science principles that may be related to possible solutions.
6.4D.2 Design, construct, and test a possible solution to a defined problem using appropriate tools and materials. Evaluate proposed engineering design solutions to the defined problem.
6.4D.3 Describe examples of how engineers have created inventions that address human needs and aspirations.
7.4D.1 Define a problem that addresses a need and identify constraints that may be related to possible solutions.
7.4D.2 Design, construct, and test a possible solution using appropriate tools and materials. Evaluate proposed solutions to identify how design constraints are addressed.
7.4D.3 Explain how new scientific knowledge can be used to develop new technologies and how new technologies can be used to generate new scientific knowledge.
8.4D.1 Define a problem that addresses a need, and using relevant science principles investigate possible solutions given specified criteria, constraints, priorities, and trade-offs.
8.4D.2 Design, construct, and test a proposed solution and collect relevant data. Evaluate a proposed solution in terms of design and performance criteria, constraints, priorities, and trade-offs. Identify possible design improvements.
8.4D.3 Explain how creating a new technology requires considering societal goals, costs, priorities, and trade-offs.
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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