

Science Performance Standards (Grade Level Expectations) for Grades 9

The Science Content Standards are grouped into seven strands, A-1 through G-1.

A1-Science as Inquiry And Process

- SA** Students develop an understanding of the processes and applications of scientific inquiry.
- SA1** Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
- SA2** Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.
- SA3** Students develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

Each PSGLE includes a bolded statement called the "stem." Each stem is the same or similar across the grades for a given PSGLE and is meant to communicate the main curriculum and instructional focus of the PSGLE across the grades.

PSGLEs repeated with no changes across grade levels are marked with asterisks to indicate that the PSGLE assumes increasing complexity to indicate the growth in the PSGLE.

Grade 3	Grade 4	Grade 5
<p>The student develops an understanding of the processes of science by:</p> <p>[3] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.</p> <p>[3] SA1.2 observing and describing their world to answer simple questions.</p>	<p>The student develops an understanding of the processes of science by:</p> <p>[4] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating. *</p> <p>[4] SA1.2 observing, measuring and collecting data from explorations and using this information to classify, predict, and communicate.</p>	<p>The student demonstrates an understanding of the processes of science by:</p> <p>[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating. *</p> <p>[5] SA1.2 using quantitative and qualitative observations to create their own inferences and predictions.</p>
<p>The student will demonstrate an understanding of the attitudes and approaches to scientific inquiry by:</p> <p>[3] SA2.1 answering, "how do you know?" questions with reasonable answers.</p>	<p>The student will demonstrate an understanding of the attitudes and approaches to scientific inquiry by:</p> <p>[4] SA2.1 supporting their ideas with observations and peer review. (L)</p>	<p>The student demonstrates an understanding of the attitudes and approaches to scientific inquiry by:</p> <p>[5] SA2.1 supporting their statements with facts from a variety of resources and by identifying their sources. (L)</p>
<p>The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:</p> <p>[3] SA3.1 observing local conditions that determine which plants and/or animals survive. (L)</p>	<p>The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:</p> <p>[4] SA3.1 identifying the local limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive. (L)</p>	<p>The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:</p> <p>[5] SA3.1 <u>identifying the limiting factors</u> (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive.</p>

The number in brackets indicates the grade level

Note: Items differentiated with an "i.e." indicate that statewide assessment items may only be written to the content contained within the statement in the parentheses. Items differentiated with an "e.g." do not limit assessment items to that content, but indicate examples of content that may be used in statewide assessment items.

Some PSGLEs have been identified as Local. They are for local assessments and will not be on a state assessment.

The number indicates the Science Content Standard and the Grade Level Expectation number. Thus PSGLE [4] SA3.1 represents Science Content Standard SA3, and the first PSGLE for that Content Standard for grade 4.

Differences between grade levels are underlined.

Participants in the development of the GLEs actively researched the concepts and skills contained within this document.

References

National Research Council (U.S.). (1996). *National Science Education Standards : observe, interact, change, learn*. Washington, DC: National Academy Press.

Project 2061 (American Association for the Advancement of Science). (2001). *Atlas of Science Literacy*. Washington, DC: American Association for the Advancement of Science: National Science Teachers Association

Science Performance Standards (Grade Level Expectations) Grade 9
A1—Science as Inquiry and Process

- SA** Students develop an understanding of the processes and applications of scientific inquiry.
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Grade 9

<p>The student develops an understanding of the processes of science by:</p> <p>[9] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating. *</p> <p>[9] SA1.2 hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.</p>	<p>The student will demonstrate an understanding of the attitudes and approaches to scientific inquiry by:</p> <p>[9] SA2.1 formulating conclusions that are logical and supported by evidence.</p>	
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*Same concept at a higher level

**Science Performance Standards (Grade Level Expectations) Grade 9
B1—Concepts of Physical Science**

- SB** Students develop an understanding of the concepts, models, theories, universal principles, and facts that explain the physical world.
- SB1** Students develop an understanding of the characteristic properties of matter and the relationship of these properties to their structure and behavior.
- SB2** Students develop an understanding that energy appears in different forms, can be transformed from one form to another, can be transferred or moved from one place or system to another, may be unavailable for use, and is ultimately conserved.
- SB3** Students develop an understanding of the interactions between matter and energy, including physical, chemical, and nuclear changes, and the effects of these interactions on physical systems.
- SB4** Students develop an understanding of motions, forces, their characteristics and relationships, and natural forces and their effects.

Grade 9

<p>The student demonstrates an understanding of the structure and properties of matter by:</p> <p>[9] SB1.1 describing atoms and their base components (i.e., protons, neutrons, electrons).</p>	<p>The student demonstrates an understanding of how energy can be transformed, transferred, and conserved by:</p> <p>[9] SB2.1 applying the concepts of heat transfer (i.e., conduction, convection, radiation) to Alaskan dwellings.</p> <p>[9] SB2.2 recognizing simple electrical circuits.</p>	<p>The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by:</p> <p>[9] SB3.1 recognizing that a chemical reaction has taken place.</p> <p>[9] SB3.2 explaining that in chemical and nuclear reactions, energy (e.g., heat, light, mechanical, and electrical) is transferred into and out of a system.</p> <p>[9] SB3.3 recognizing that atoms emit and absorb electromagnetic radiation.</p>	<p>The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by:</p> <p>[9] SB4.1 explaining the relationship of motion to an object's mass, and the applied force.</p> <p>[9] SB4.2 recognizing that the gravitational attraction between objects is proportional to their masses and decreasing with their distance.</p> <p>[9] SB4.3 describing the interactions of waves (i.e., reflection, refraction, wave addition).</p>
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*Same concept at a higher level

**Science Performance Standards (Grade Level Expectations) Grade 9
C1—Concepts of Life Science**

- SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.
- SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.
- SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.
- SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

Grade 9

<p>The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection and biological evolution by:</p> <p>[9] SC1.1 recognizing that all organisms have chromosomes made of DNA and that DNA determines traits.</p> <p>[9] SC1.2 using probabilities to recognize patterns of inheritance (e.g., Punnett Squares).</p> <p>[9] SC1.3 inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history).</p>	<p>The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:</p> <p>[9] SC2.1 describing and comparing the characteristics of phyla/divisions from each kingdom.</p> <p>[9] SC2.3 stating the function of major physiological systems (i.e., circulatory, excretory, digestive, respiratory, reproductive, nervous, immune, endocrine, musculoskeletal, and integumentary).</p> <p>SC2.2 is not addressed in grade 9.</p>	<p>The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:</p> <p>[9] SC3.1 describing the carbon and nitrogen cycle within an ecosystem and how the continual input of energy from sunlight keeps the process going. (L)</p> <p>[9] SC3.3 identifying dynamic factors (e.g., carrying capacity, limiting factors, biodiversity, and productivity) that affect population size.</p>
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*Same concept at a higher level

**Science Performance Standards (Grade Level Expectations) Grade 9
D1—Concepts of Earth Science**

SD Students develop an understanding of the concepts, processes, theories, models, evidence, and systems of earth and space sciences.
SD1 Students develop an understanding of Earth's geochemical cycles.
SD2 Students develop an understanding of the origins, ongoing processes, and forces that shape the structure, composition, and physical history of the Earth.
SD3 Students develop an understanding of the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system.
SD4 Students develop an understanding of the theories regarding the **evolution** of the universe.

Grade 9

<p>The student demonstrates an understanding of geochemical cycles by:</p> <p>[9] SD1.1 using a model to demonstrate the rock cycle. (L)</p> <p>[9] SD1.2 applying knowledge of the water cycle to explain changes in the Earth's surface. *</p>	<p>The student demonstrates an understanding of the forces that shape Earth by:</p> <p>[9] SD2.1 recognizing the dynamic interaction of erosion and deposition including human causes.</p> <p>[9] SD2.2 describing how the theory of plate tectonics explains the dynamic nature of its surface.</p>	<p>The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by:</p> <p>[9] SD3.1 recognizing the effect of the moon and sun on tides.</p> <p>[9] SD3.2 explaining the phenomena of the aurora.</p>	<p>The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by:</p> <p>[9] SD4.1 recognizing that a star changes over time.</p> <p>[9] SD4.2 <u>explaining</u> that the position of stars changes in the expanding universe.</p> <p>[9] SD4.4 identifying the Big Bang Theory.</p>
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SD4.3 is not continued in 9-11.
 *Same concept at a higher level

**Science Performance Standards (Grade Level Expectations) Grade 9
E1—Science and Technology**

- SE** Students develop an understanding of the relationships among science, technology, and society.
- SE1** Students develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.
- SE2** Students develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.
- SE3** Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.

Grade 9

<p>The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by:</p> <p>[9] SE1.1 recognizing that the value of any given technology may be different for different groups of people and at different points in time (e.g., different uses of snow machines in different regions of Alaska).</p>	<p>The student demonstrates an understanding that solving problems involves different ways of thinking by:</p> <p>[9] SE2.1 <u>questioning, researching, modeling, simulating,</u> and testing a solution to a problem. (L)</p>	<p>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by:</p> <p>[9] SE3.1 <u>predicting and evaluating</u> the possible effects of a recent scientific discovery, invention, or scientific breakthrough. (L)</p>
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**Science Performance Standards (Grade Level Expectations) Grade 9
F1—Cultural, Social, Personal Perspectives, and Science**

- SF** Students develop an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives.
- SF1** Students develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.
- SF2** Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
- SF3** Students develop an understanding of the importance of recording and validating cultural knowledge.

Grade 9

<p>The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by:</p> <p>[9] SF1.1-SF3.1 describing the scientific principles involved in a subsistence activity (e.g., hunting, fishing, gardening). (L), Cross referenced with SA3.1, grade 8</p>		
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**Science Performance Standards (Grade Level Expectations) Grade 9
G1—History and Nature of Science**

- SG** Students develop an understanding of the history and nature of science.
- SG1** Students develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.
- SG2** Students develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.
- SG3** Students develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).
- SG4** Students develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

Grade 9

<p>The student demonstrates an understanding of changes in historical perspectives of science by:</p> <p>[9] SG1.1 identifying those perspectives (i.e., cultural, political, religious, philosophical) that have impacted the advancement of science.</p>	<p>Students demonstrate an understanding of the bases of the advancement of scientific knowledge by:</p> <p>[9] SG2.1 explaining the importance of innovations (i.e., microscope, immunization, computer).</p>	<p>The student demonstrates an understanding that scientific knowledge is ongoing and subject to change by:</p> <p>[9] SG3.1 describing the role of serendipity in scientific discoveries.</p>
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