

SUMMARY OF NEW YORK CITY SCIENCE PERFORMANCE STANDARDS

S1 PHYSICAL SCIENCES CONCEPTS

The student produces evidence that demonstrates understanding of:

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
|-------------------|---|---------------|---|-------------|--|
| S1a | Properties of objects and materials, such as similarities and differences in the size, weight, and color of objects; the ability of materials to react with other substances; and different states of materials | S1a | Properties and changes of properties in matter, such as density and boiling point; chemical reactivity; and conservation of matter | S1a | Structure of atoms, such as atomic composition, nuclear forces, and radioactivity |
| S1b | Position and motion of objects, such as how the motion of an object can be described by tracing and measuring its position over time; and how sound is produced by vibrating objects | S1b | Motions and forces, such as inertia and the net effects of balanced and unbalanced forces | S1b | Structure and properties of matter, such as elements and compounds; bonding and molecular interaction; and characteristics of phase changes. |
| S1c | Light, heat, electricity, and magnetism, such as the variation of heat and temperature; how light travels in a straight line until it strikes an object or how electrical circuits work | S1c | Transfer of energy, such as transformation of energy as heat; light, mechanical motion, and sound; and the nature of a chemical reaction. | S1c | Chemical reactions, such as everyday examples of chemical reactions; electrons, protons, and energy transfer; and factors that affect reaction rates such as catalysts. |
| | | | | S1d | Motions and forces, such as gravitational and electrical; net forces and magnetism |
| | | | | S1e | Conservation of energy and increase in disorder, such as kinetic and potential energy; energy conduction, convection, and radiation; random motion; and effects of heat and pressure |
| | | | | S1f | Interactions of energy and matter, such as waves, absorption and emission of light, and conductivity. |

S3 Earth and Space Sciences Concepts

The student produces evidence that demonstrates understanding of:

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
|-------------------|--|---------------|--|-------------|--|
| S3a | Properties of Earth materials, such as water and gases; and the properties of rocks and soils, such as texture, color, and ability to retain water | S3a | Structure of the Earth System, such as crustal plates and land forms; water and rock cycles; oceans, weather and climate | S3a | Energy in the Earth system, such as radioactive decay, gravity, the Sun’s energy, convection, and changes in global climate.q |
| S3b | Objects in the sky, such as Sun, Moon, planets, and other objects that can be observed and described; and the importance of the Sun to provide the light and heat necessary for survival | S3b | Earth’s history, such as Earth processes, including erosion and movement of plates; change over time and fossil evidence | S3b | Geochemical cycles, such as conservation of matter; chemical resources and movement of matter between chemical reservoirs. |
| S3c | Changes in Earth and sky, such as changes caused by weathering, volcanism, and earthquakes; and the patterns of movement of objects in the sky | S3c | Earth in the Solar System, such as the predictable motion of planets , moons, and other objects in the Solar System, including days, years, moon phases, and eclipses; and the role of the Sun as the major source of energy for phenomena on the Earth’s surface. | S3c | Origin and evolution of the Earth system, such as geologic time and the age of life forms; origin of life, and evolution of the Solar System |
| | | S3d | Natural resource management | S3d | Origin and evolution of the universe, such as the “big bang” theory; formation of stars and elements; and nuclear reactions. |
| | | | | S3e | Natural resource management |

S4 Scientific Connections and Applications

The student produces evidence that demonstrates understanding of

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
|-------------------|---|---------------|--|-------------|--|
| S4a | Big ideas and unifying concepts, such as order and organization; models, forms, and function; change and constancy; and cause and effect | S4a | Big ideas and unifying concepts, such as order and organization; models, forms, and function; change and constancy; and cause and effect | S4a | Big ideas and unifying concepts, such as order and organization; models, forms, and function; change and constancy; and cause and effect |
| S4b | The designed world, such as development of agricultural techniques and the viability of technological designs | S4b | The designed world, such as development of agricultural techniques and the viability of technological designs | S4b | The designed world, such as development of agricultural techniques and the viability of technological designs |
| S4c | Personal health, such as nutrition, substance abuse, and exercise; germs and toxic substances; personal and environmental safety | S4c | Health, such as nutrition, exercise, and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress | S4c | Health, such as nutrition and exercise; disease and epidemiology; personal and environmental safety; and resources, environmental stress, and population growth. |
| S4d | Science as a human endeavor, such as communication, cooperation, and diverse input in scientific research; and the importance of reason, intellectual honesty, and skepticism | S4d | Impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions. | S4d | Impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions. |
| | | S4e | Impact of science, such as historical and contemporary contributions; and interactions between science and society. | S4e | Impact of science, such as historical and contemporary contributions; and interactions between science and society. |

S5 Scientific Thinking

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
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| The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense, and conceptual understanding from Science Standards 1 to 4, and appropriate methods to investigate the natural world; that is, the student: | | The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense, and conceptual understanding from Science Standards 1 to 4, and appropriate methods to investigate the natural world; that is, the student: | | The student demonstrates skill in scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and diverse conceptual understanding, and appropriate ideas and methods to investigate science; that is, the student | |
| S5a | Asks questions about natural phenomena; objects and organisms; and events and discoveries | S5a | Frames questions to distinguish cause and effect; and identifies or controls variables in experimental and non-experimental research settings | S5a | Frames questions to distinguish cause and effect; and identifies or controls variables in experimental and non-experimental research settings |
| S5b | Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena | S5b | Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena | S5b | Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena |
| S5c | Uses evidence from reliable sources to construct explanations | S5c | Uses evidence from reliable sources to develop descriptions, explanations, and models | S5c | Uses evidence from reliable sources to develop descriptions, explanations, and models; and makes appropriate adjustments and improvements based on additional data or logical arguments |
| S5d | Evaluates different points of view using relevant experiences, observations, and knowledge; and distinguishes between fact and opinion | S5d | Proposes, recognizes, analyzes, considers, and critiques alternative explanations; and distinguishes between fact and opinion | S5d | Proposes, recognizes, analyzes, considers, and critiques alternative explanations; and distinguishes between fact and opinion |
| S5e | Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations | S5e | Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations | S5e | Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations |
| S5f | Works individually and in teams to collect and share information and ideas | S5f | Works individually and in teams to collect and share information and ideas | S5f | Works individually and in teams to collect and share information and ideas |

S6 Scientific Tools and Technologies

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
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| The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student: | | The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student: | | The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student: | |
| S6a | Uses technology and tools (such as rulers, computers, balances, thermometers, watches, magnifiers, and microscopes) to gather data and extend the senses | S6a | Uses technology and tools (such as traditional laboratory equipment, video, and computer aids) to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely | S6a | Uses technology and tools (such as traditional laboratory equipment, video, and computer aids) to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely, with appropriate consideration of accuracy and precision |
| S6b | Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as average, data displays, graphing, variability, and sampling | S6b | Records and stores data using a variety of formats, such as data bases, audiotapes, and videotapes | S6b | Records and stores data using a variety of formats, such as data bases, audiotapes, and videotapes |
| S6c | Acquires information from multiple sources, such as experimentation and print and non-print sources | S6c | Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as mean, median, and mode; outcome probability and reliability; and appropriate data displays. | S6c | Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as mean, median, and mode; outcome probability and reliability; and appropriate data displays. |
| | | S6d | Acquires information from multiple sources, such as print, the Internet, computer data bases, and experimentation. | S6d | Acquires information from multiple sources, such as print, the Internet, computer data bases, and experimentation. |
| | | S6e | Recognizes sources of bias in data, such as observer and sampling biases | S6e | Recognizes and limits sources of bias in data, such as observer and sample biases. |

S7 Scientific Communication

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
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| The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student: | | The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student: | | The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student: | |
| S7a | Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing | S7a | Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing | S7a | Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing; and selects the most effective way to convey the scientific information |
| S7b | Uses facts to support conclusions | S7b | Argues from evidence, such as data produced through his or her own experimentation or by others | S7b | Argues from evidence, such as data produced through his or her own experimentation or data produced by others |
| S7c | Communicates in a form suited to the purpose and the audience, such as writing instructions that others can follow | S7c | Critiques published materials | S7c | Critiques published materials, such as popular magazines and academic journals |
| S7d | Critiques written and oral explanations, and uses data to resolve disagreements | S7d | Explains a scientific concept or procedure to other students | S7d | Explains a scientific concept or procedure to other students |
| | | S7e | Communicates in a form suited to the purpose and the audience, such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements | S7e | Communicates in a form suited to the purpose and the audience, such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements |

S8 Scientific Investigation

| ELEMENTARY SCHOOL | | MIDDLE SCHOOL | | HIGH SCHOOL | |
|---|---|---|---|---|-----------------------|
| The student demonstrates scientific competence by completing projects drawn from the following kinds of investigations, including a least one full investigation each year and, over the course of elementary school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation: | | The student demonstrates scientific competence by completing projects drawn from the following kinds of investigations, including a least one full investigation each year and, over the course of elementary school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation: | | The student demonstrates scientific competence by completing projects drawn from the following kinds of investigations, including a least one full investigation each year and, over the course of elementary school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation: | |
| S8a | An experiment, such as conducting a fair test | S8a | Controlled experiment | S8a | Controlled experiment |
| S8b | A systematic observation, such as a field study | S8b | Fieldwork | S8b | Fieldwork |
| S8c | A design, such as building a model or scientific apparatus | S8c | Design | S8c | Design |
| S8d | Non-experimental research using print and electronic information, such as journals, video, or computers | S8d | Secondary research, such as use of others' data | S8d | Secondary research |
| <p>A single project may draw on more than one kind of investigation. A full investigation includes:</p> <ul style="list-style-type: none"> • Questions that can be studied using the resources available • Procedures that are safe, humane, and ethical; and that respect privacy and property rights • Data that have been collected and recorded (see also Science Standard 6) in ways that others can verify and analyze using skills expected at this grade level (see also Mathematics Standard 4) • Data and results that have been represented (see also Science Standard 7) in ways that fit the context • Recommendations, decisions, and conclusions based on evidence • Acknowledgment of references and contributions of others • Results that are communicated appropriately to audiences • Reflection and defense of conclusions and recommendations from other sources and peer review. | | | | | |