



One Pair of Eyes© Science Education Standards

Grade 7 Science Standards

Life Sciences	Investigate the great variety of body plans and internal structures found in multi-cellular organisms.
Physical Sciences	<p>Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion.</p> <p>Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic).</p> <p>Explain how energy can change forms but the total amount of energy remains constant.</p> <p>Trace energy transformation in a simple closed system (e.g., a flashlight).</p>
Science and Technology	<p>Explain how needs, attitudes and values influence the direction of technological development in various cultures.</p> <p>Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other.</p> <p>Recognize that science can only answer some questions and technology can only solve some human problems.</p> <p>Design and build a product or create a solution to a problem given two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).</p>
Scientific Inquiry	<p>Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence.</p> <p>Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density).</p>
Scientific Ways of Knowing	Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism and openness).

Grade 8 Science Standards

Physical Science	<p>Describe how the change in the position (motion) of an object is always judged and described in comparison to a reference point.</p> <p>Explain that motion describes the change in the position of an object (characterized by a speed and direction) as time changes.</p> <p>Explain that an unbalanced force acting on an object changes that object's speed and/or direction.</p>
Science and Technology	<p>Examine how science and technology have advanced through the contributions of many different people, cultures and times in history.</p> <p>Examine how choices regarding the use of technology are influenced by constraints caused by various unavoidable factors (e.g., geographic location, limited resources, social, political and economic considerations).</p> <p>Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects).</p> <p>Evaluate the overall effectiveness of a product design or solution.</p>
Scientific Inquiry	<p>Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations.</p> <p>Describe the concepts of sample size and control and explain how these affect scientific investigations.</p> <p>Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols).</p> <p>Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode).</p>
Scientific Ways of Knowing	<p>Identify the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance and importance).</p> <p>Explain why it is important to examine data objectively and not let bias affect observations.</p>

Grade 9 Science Standards

Physical Science	<p>Demonstrate that the pH scale (0-14) is used to measure acidity and classify substances or solutions as acidic, basic, or neutral.</p> <p>Explain how an object's kinetic energy depends on its mass and its speed ($KE = \frac{1}{2}mv^2$).</p> <p>Trace the transformations of energy within a system (e.g., chemical to electrical to mechanical) and recognize that energy is conserved. Show that these transformations involve the release of some thermal energy.</p> <p>Demonstrate that thermal energy can be transferred by conduction, convection or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation).</p> <p>Demonstrate that motion is a measurable quantity that depends on the observer's frame of reference and describe the object's motion in terms of position, velocity, acceleration and time.</p> <p>Demonstrate that any object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced (net) force acts on it.</p> <p>Explain the change in motion (acceleration) of an object. Demonstrate that the acceleration is proportional to the net force acting on the object and inversely proportional to the mass of the object. ($F_{net} = ma$. Note that weight is the gravitational force on a mass.)</p> <p>Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object.</p> <p>Demonstrate the ways in which frictional forces constrain the motion of objects (e.g., a car traveling around a curve, a block on an inclined plane, a person running, an airplane in flight).</p> <p>Describe advances and issues in physical science that have important, long-lasting effects on science and society (e.g., atomic theory, quantum theory, Newtonian mechanics, nuclear energy, nanotechnology, plastics, ceramics and communication technology).</p>
Science and Technology	Describe means of comparing the benefits with the risks of technology and how science can inform public policy.

	<p>Identify a problem or need, propose designs and choose among alternative solutions for the problem.</p> <p>Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined.</p>
<p>Scientific Inquiry</p>	<p>Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets [MSDS], eyewash, goggles and ventilation).</p> <p>Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts.</p> <p>Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology.</p> <p>Draw logical conclusions based on scientific knowledge/evidence from investigations.</p>
<p>Scientific Ways of Knowing</p>	<p>Comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques and have different standards of evidence but share a common purpose - to better understand a portion of our universe.</p> <p>Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations.</p> <p>Demonstrate that reliable scientific evidence improves the ability of scientists to offer accurate predictions.</p> <p>Explain how support of ethical practices in science (e.g., individual observations and confirmations, accurate reporting, peer review/publication) is required to reduce bias.</p> <p>Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data.</p> <p>Recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge.</p> <p>Illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work and their efforts to advance scientific knowledge in their area of study.</p> <p>Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.</p>

Grade 10 Science Standards

Life Sciences	<p>Relate diversity and adaptation to structures and their functions in living organisms (e.g., adaptive radiation).</p> <p>Explain how living things interact with biotic and abiotic components of the environment (e.g., predation, competition, natural disasters and weather).</p> <p>Illustrate how uses of resources at local, state, regional, national, and global levels have affected the quality of life (e.g., energy production and sustainable vs. non-sustainable agriculture).</p> <p>Describe advances in life sciences that have important long-lasting effects on science and society (e.g., biological evolution, germ theory, biotechnology and discovering germs).</p> <p>Analyze and investigate emerging scientific issues (e.g., genetically modified food, stem cell research, genetic research and cloning).</p>
Science and Technology	<p>Cite examples of ways that scientific inquiry is driven by the desire to understand the natural world and how technology is driven by the need to meet human needs and solve human problems.</p> <p>Describe examples of scientific advances and emerging technologies and how they may impact society.</p> <p>Explain that when evaluating a design for a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced and disposed of in addition to who will sell, operate and take care of it. Explain how the costs associated with these considerations may introduce additional constraints on the design.</p>
Scientific Inquiry	<p>Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g. OSHA, MSDS, eyewash, goggles and ventilation).</p> <p>Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps and available technology.</p> <p>Use mathematical models to predict and analyze natural phenomena.</p> <p>Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations.</p> <p>Explain how new scientific data can cause any existing scientific explanation to be supported, revised or rejected.</p>
Scientific Ways of Knowing	<p>Discuss science as a dynamic body of knowledge that can lead to the development of entirely new disciplines.</p> <p>Describe that scientists may disagree about explanations of phenomena, about</p>

	<p>interpretation of data or about the value of rival theories, but they do agree that questioning, response to criticism and open communication are integral to the process of science.</p> <p>Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena.</p> <p>Recognize that ethical considerations limit what scientists can do.</p> <p>Recognize that research involving voluntary human subjects should be conducted only with the informed consent of the subjects and follow rigid guidelines and/or laws.</p> <p>Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.</p>
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Grade 11 Science Standards

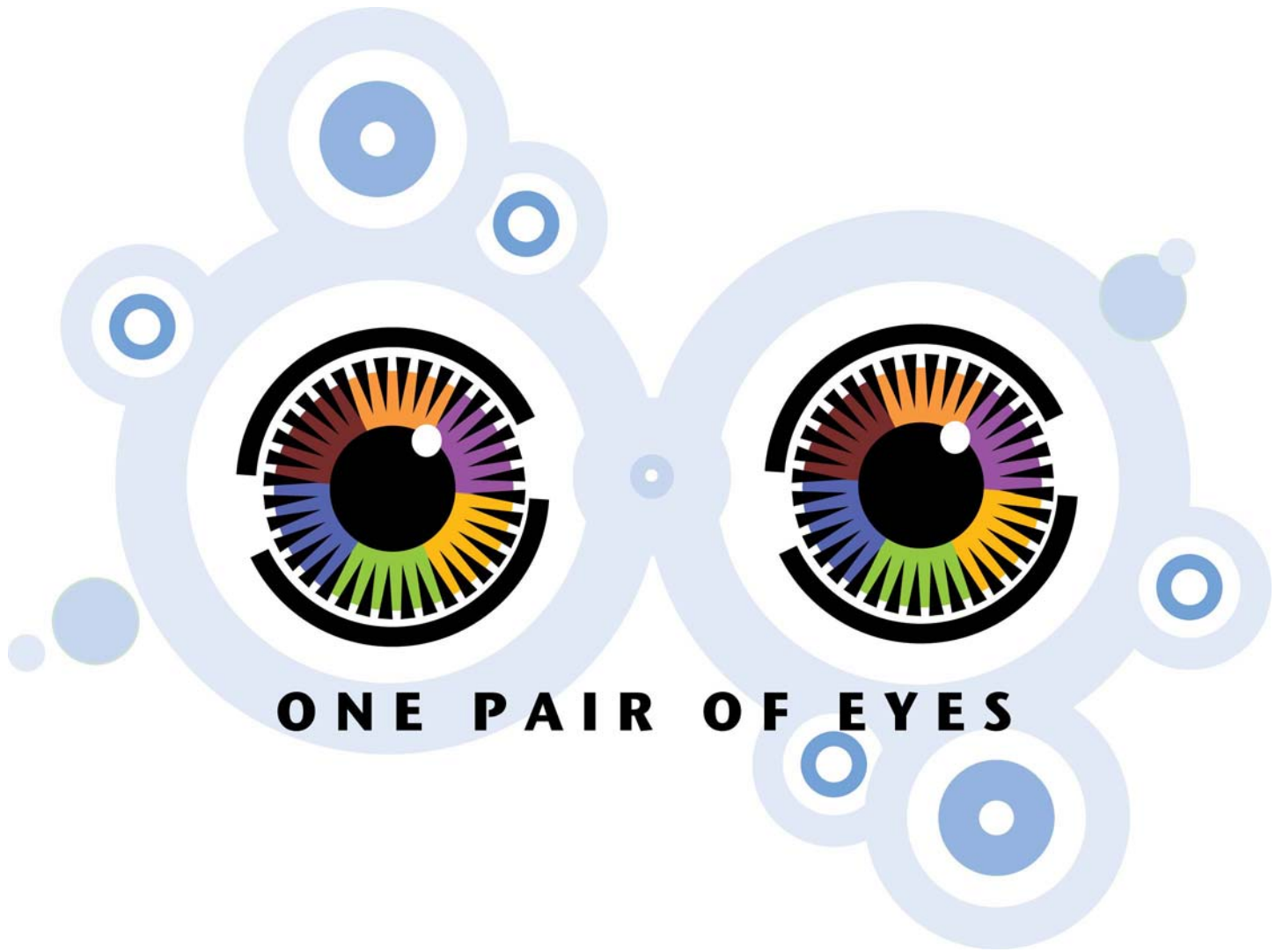
Science and Technology	<p>Identify that science and technology are essential social enterprises but alone they can only indicate what can happen, not what should happen. Realize the latter involves human decisions about the use of knowledge.</p> <p>Predict how decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment and/or humans.</p> <p>Explore and explain any given technology that may have a different value for different groups of people and at different points in time (e.g., new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to reproduce new characteristics).</p> <p>Explain why basic concepts and principles of science and technology should be a part of active debate about the economics, policies, politics and ethics of various science-related and technology-related challenges.</p>
Scientific Inquiry	<p>Evaluate assumptions that have been used in reaching scientific conclusions.</p> <p>Design and carry out scientific inquiry (investigation), communicate and critique results through peer review.</p>

	<p>Explain why the methods of an investigation are based on the questions being asked.</p> <p>Summarize data and construct a reasonable argument based on those data and other known information.</p>
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Grade 12 Science Standards

Life Science	<p>Explain why specialized cells/structures are useful to plants and animals (e.g., stoma, phloem, xylem, blood, nerve, muscle, egg and sperm).</p> <p>Relate diversity and adaptation to structures and functions of living organisms at various levels of organization.</p>
Physical Science	<p>Use and apply the laws of motion to analyze, describe and predict the effects of forces on the motions of objects mathematically.</p> <p>Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., nuclear energy, quantum theory and theory of relativity).</p> <p>Describe concepts/ideas in physical sciences that have important, long-lasting effects on science and society (e.g., quantum theory, theory of relativity, age of the universe).</p>
Science and Technology	<p>Explain how science often advances with the introduction of new technologies and how solving technological problems often results in new scientific knowledge.</p> <p>Describe how new technologies often extend the current levels of scientific understanding and introduce new areas of research.</p> <p>Research how scientific inquiry is driven by the desire to understand the natural world and how technological design is driven by the need to meet human needs and solve human problems.</p> <p>Explain why basic concepts and principles of science and technology should be a part of active debate about the economics, policies, politics and ethics of various science-related and technology-related challenges.</p>
Scientific Inquiry	<p>Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation.</p> <p>Derive simple mathematical relationships that have predictive power from experimental data (e.g., derive an equation from a graph and vice versa, determine whether a linear or</p>

	<p>exponential relationship exists among the data in a table).</p> <p>Research and apply appropriate safety precautions when designing and/or conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggles and ventilation).</p> <p>Create/clarify the method/procedures/controls/variables in complex scientific investigations.</p> <p>Use appropriate summary statistics to analyze and describe data.</p>
<p>Scientific Ways of Knowing</p>	<p>Give examples that show how science is a social endeavor in which scientists share their knowledge with the expectation that it will be challenged continuously by the scientific community and others.</p> <p>Evaluate scientific investigations by reviewing current scientific knowledge and the experimental procedures used, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence and suggesting alternative explanations for the same observations.</p> <p>Describe how individuals and teams contribute to science and engineering at different levels of complexity (e.g., an individual may conduct basic field studies, hundreds of people may work together on major scientific questions or technical problem).</p> <p>Explain that scientists may develop and apply ethical tests to evaluate the consequences of their research when appropriate.</p> <p>Describe the current and historical contributions of diverse peoples and cultures to science and technology and the scarcity and inaccessibility of information on some of these contributions.</p> <p>Recognize that individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them.</p> <p>Recognize the appropriateness and value of basic questions "What can happen?" "What are the odds?" and "How do scientists and engineers know what will happen?"</p> <p>Recognize that social issues and challenges can affect progress in science and technology. (e.g., Funding priorities for specific health problems serve as examples of ways that social issues influence science and technology.)</p> <p>Research how advances in scientific knowledge have impacted society on a local, national or global level.</p>



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