Grade 9 Science

Yearly Process Skills

STANDARD	PERFORMANCE INDICATORS	PLAN #	RESOURCES (Print, Visual, Technology, Manipulatives)	ASSESSMENT (Evidence & Scoring Guides)
S.I 1.1	**Scientific Inquiry:** The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.			
S.I. 1.1A	• Students elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent their thinking.			
S.I. 1.1A1	• Scientific explanations are built by combining evidence that can be observed with what people already know about the world.			
S.I. 1.1A2	• Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.			
S.I.1.1A3	• Science provides knowledge, but values are also essential to making effective and ethical decisions about the application of scientific knowledge.			
S.I. 1.1B	• Students hone ideas through reasoning, library research, and discussion with others, including experts.			

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S.I. 1.1B1	• Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources.			
S.I. 1.1B2	• Inquiry involves making judgments about the reliability of the source and relevance of information.			
S.I. 1.1C	• Students work toward reconciling competing explanations; clarifying points of agreement and disagreement.			
S.I. 1.1C2	• All scientific explanations are tentative and subject to change or improvement. Each new bit of evidence can create more questions than it answers. This leads to increasingly better understanding of how things work in the living world.			
S.I. 1.1D	• Students coordinate explanations at different levels of scale, points of focus, and degrees of complexity and specificity and recognize the need for such alternative representations of the natural world.			
S.I 1.1D1	• Well-accepted theories are ones that are supported by different kinds of scientific investigations often involving the contributions of individuals from different disciplines.			
S.I. 1.2	**Scientific Inquiry:** Beyond the use of reasoning and			

	consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.			
S.I. 1.2A	• Students devise ways of making observations to test proposed explanations.			
S.I. 1.2B	• Students refine their research ideas through library investigations, including electronic information retrieval and reviews of the literature, and through peer feedback obtained from review and discussion.			
S.I. 1.2B1	• Development of a research plan involves researching background information and understanding the major concepts in the area being investigated. Recommendations for methodologies, use of technologies, proper equipment, and safety precautions should also be included.			
S.I. 1.2C	• Students develop and present proposals including formal hypotheses to test their explanations. (i.e. they predict what should be observed under specified conditions if the explanation is true).			
S.I. 1.2C1	• Hypotheses are predictions based upon both research and observation.			
S.I. 1.2C2	• Hypotheses are widely used in science for determining what data to collect and as a guide for interpreting the			

	data.			
S.I. 1.2C3	• Development of a research plan for testing a hypothesis requires planning to avoid bias (e.g., repeated trials, large sample size, and objective data collection techniques).			
S.I. 1.2D	• Students carry out their research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary.			
S.I 1.3	**Scientific Inquiry:** The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.			
S.I 1.3A	• Students use various means of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.			
S.I.1.3A1	• Interpretation of data leads to development of additional hypotheses, the formulation of generalizations, or explanations of natural phenomena.			
S.I. 1.3B	• Students apply statistical analysis techniques when appropriate to test if chance alone explains the result.			
S.I. 1.3C	• Students assess correspondence between the predicted			

	result contained in the hypothesis and the actual result and reach a conclusion as to whether or not the explanation on which the prediction was based is supported.			
S.I. 1.3D	• Students revise the explanation and contemplate additional research based on the results of the test and through public discussion.			
S.I. 1.3D1	• Hypotheses are valuable, even if they turn out not to be true, because they may lead to further investigation.			
S.I. 1.3D2	• Claims should be questioned if the data are based on samples that are very small, biased, or inadequately controlled or if the conclusions are based on the faulty, incomplete, or misleading use of numbers.			
S.I. 1.3D3	• Claims should be questioned if fact and opinion are intermingled, if adequate evidence is not cited, or if the conclusions do not follow logic.			
S.I. 1.3E	• Students develop a written report for public scrutiny that describes their proposed explanation, including a literature review, the research they carried out, its result, and suggestions for further research.			
S.I. 1.3E1	• One assumption of science is that other individuals could arrive at the same explanation if they had access to similar evidence. Scientists make the results of their investigations public; they should describe the			

	investigations in ways that enable other to repeat the investigations.			
S.I. 1.3E2	• Scientists use peer to review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations.			
	Standard 1: Mathematical Analysis			
M.A. 1.1	• Abstraction and symbolic representation are used to communicate mathematically.			
M.A. 1.2	• Deductive and inductive reasoning are used to reach mathematical conclusions.			
M.A. 1.3	• Critical thinking skills are used in the solution of mathematical problems.			
	Standard 1: Engineering Design			
E.D. 1.1	• Engineering design is an iterative process involving modeling and optimization (finding the best solution within given constraints); this process is used to develop technological solutions to problems within given constraints.			
	Standard 2: Information Systems			

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	Students will access, generate, process, and transfer information, using appropriate technologies.			
I.S. 2.1	• Information technology is used to retrieve, process, and communicate information as a tool to enhance learning.			
I.S. 2.2	• Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.			
I.S. 2.3	• Information technology can have positive and negative impacts on society, depending upon how it is used.			
	Standard 6: Interconnectedness / Common Themes			
	Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.			
C.T. 6.1	• Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.			
C.T. 6.2	• Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.			
C.T. 6.3	• The grouping of magnitudes of size, time, frequency,			

	and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.			
C.T. 6.4	• Equilibrium is a state of stability due either to a lack of change (static equilibrium) or a balance between opposing forces (dynamic equilibrium).			
C.T. 6.5	• Identifying patterns of change is necessary for making predictions about future behavior and conditions.			
C.T. 6.6	• In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.			
	Standard 7: Interdisciplinary Problem Solving			
	Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.			
P.S. 7.1	• The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.			
P.S. 7.2	• Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits, gathering and processing information,			

	generating and analyzing ideas, realizing ideas, making connections among the common themes of mathematics, science and technology, and presenting results.			