The Tech
Museum of Innovation

High School: Grades 9-12
Standards Connections for Labs

		Physics of Roller Coasters	Chemicals of Innovation	Down the Drain	Engineering for Earthquakes	Simplicity of Electricity	Chemistry of Plastination	DNA and Genetics
Next Generation Science Standards								
Engineering Design								
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	✓	N/A	N/A	✓	N/A		
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	✓	N/A	N/A	✓	N/A		
Physical Science: Forces and Interactions								
HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	✓	N/A	N/A		N/A		
HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.		N/A	N/A		N/A		
Physical Science: Energy								
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	✓	N/A	N/A		N/A		
Earth and Space Science: History of Earth								
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.		N/A	N/A	✓	N/A		
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.		N/A	N/A	✓	N/A		
Earth and Space Sciences: Earth's Systems								
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.		N/A	N/A	✓	N/A		
HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.		N/A	N/A	✓	N/A		
Earth and Space Sciences: Human Sustainability								
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.		N/A	N/A		N/A		
Life Sciences								
HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.		N/A	N/A		N/A		✓
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.		N/A	N/A		N/A		✓
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.		N/A	N/A		N/A		✓

Science and Engineering Practices								
Practice 1	Asking questions and defining problems	✓	N/A	N/A	✓	N/A		
Practice 2	Developing and using models	✓	N/A	N/A	✓	N/A	✓	✓
Practice 3	Planning and carrying out investigations	✓	N/A	N/A	✓	N/A	✓	✓
Practice 4	Analyzing and interpreting data	✓	N/A	N/A		N/A		
Practice 5	Using mathematics and computational thinking	✓	N/A	N/A		N/A		
Practice 6	Constructing explanations and designing solutions	✓	N/A	N/A	✓	N/A		
Practice 7	Engaging in argument from evidence		N/A	N/A		N/A	✓	
Practice 8	Obtaining, evaluating, and communicating information		N/A	N/A		N/A	✓	
Disciplinary Core Ideas								
LS1.A	*Structure and Function* • Systems of specialized cells within organisms help them perform the essential functions of life. • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.		N/A	N/A		N/A		✓
LS3.A	*Inheritance of Traits* • Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA/ All cells in an organism have the same genetic content, but the genes used (expressed) by the cell by be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have a no as-yet known function.		N/A	N/A		N/A		✓
LS3.B	*Variation of Traits* • Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.		N/A	N/A		N/A		✓
ESS2.A	*Earth Materials and Systems* • Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior.		N/A	N/A	✓	N/A		
ESS2.B	*Plate Tectonics and Large-Scale System Interactions* • Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history.		N/A	N/A	✓	N/A		
ESS3.C	*Human Impacts on Earth Systems* • The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. • Scientists and engineers can make major contributions by developing technologies that produce less pollution and wast and that preclude ecosystem degradation.		N/A	N/A		N/A		
PS1.A	*Structure and Properties of Matter* • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.		N/A	N/A		N/A		

PS3.B	*Conservation of Energy and Energy Transfer* • Conservation of energy means that the total change of energy in any given system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system.	✓	N/A	N/A		N/A		
ETS1.A	*Defining and Delimiting an Engineering Problem* • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.	✓	N/A	N/A	✓	N/A		
ETS1.B	*Developing Possible Solutions* • When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability, and aesthetics and to consider social, cultural and environmental impacts.	✓	N/A	N/A	✓	N/A		
ETS1.C	*Optimizing the Design Solution* • Criteria may need to broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed.	✓	N/A	N/A	✓	N/A		
Crosscutting Concepts								
Energy and Matter	• The total amount of energy and matter in closed systems is conserved • Energy cannot be created or destroyed - only moves between one place and another place, between objects and/or fields, or between systems.	✓	N/A	N/A		N/A		
Systems and System Models	Models can be used to simulate systems and interactions - including energy, matter, and information flows - within and between systems at different scales.	✓	N/A	N/A	✓	N/A	✓	
Structure and Function	Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.	✓	N/A	N/A	✓	N/A	✓	✓
Common Core Language Arts								
Speaking and Listening								
SL.**9-10**.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	✓	N/A	N/A	✓	N/A	✓	✓
SL.9-10.1b	Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, and presentation of alternate views), clear goals and deadlines, and individual roles as needed.	✓	N/A	N/A	✓	N/A	✓	✓
SL.9-10.1c	Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.	✓	N/A	N/A	✓	N/A	✓	✓
SL.9-10.1d	Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.	✓	N/A	N/A	✓	N/A	✓	✓
SL.**11-12**.1	Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on Grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	✓	N/A	N/A	✓	N/A	✓	✓

SL.11-12.1b	Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.	✓	N/A	N/A	✓	N/A	✓	✓
SL.11-12.1c	Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.	✓	N/A	N/A	✓	N/A	✓	✓
SL.11-12.1d	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.	✓	N/A	N/A	✓	N/A	✓	✓

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