NGSS CORRELATIONS

FIELDS AND INTERACTIONS

Crosscutting Concepts		Activity number
Cause and Effect	Cause and effect relationships may be used to predict phenomena in natural or designed systems.	5, 7, 8, 9, 10, 12, 13, 14
Patterns	Graphs, charts, and images can be used to identify patterns in data.	4, 12
Scale, Proportion, and Quantity	Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.	11
Systems and System Models	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.	1, 3, 4, 6, 7, 10, 11
Connections to Engineering, Technology, and Applications of Science	The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time.	2, 6, 15
	All human activity draws on natural resources and has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment.	3, 6
Science and Engineering Practices		**Activity number**
Analyzing and Interpreting Data	Analyze and interpret data to determine similarities and differences in findings.	1, 2, 3, 4, 5, 6, 13, 15
	Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).	9
Asking Questions and Defining Problems	Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	1, 3, 6
	Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	7, 8, 10, 12, 13
	Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.	12
	Ask questions that require sufficient and appropriate empirical evidence to answer.	9

Science and Engineering Practices		Activity number
Constructing Explanations and Designing Solutions	Construct an explanation that includes qualitative or quantitative relationships between variables that predict or describe phenomena.	4, 10
	Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.	6, 13
Developing and Using Models	Develop a model to describe unobservable mechanisms.	3, 6, 7, 11
	Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.	3, 6, 11, 12, 13
	Evaluate limitations of a model for a proposed object or tool.	15
Using Mathematics and Computational Thinking	Create algorithms (a series of ordered steps) to solve a problem	1
	Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.	15
Engaging in Argument from Evidence	Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	3, 4, 7
	Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	6, 13, 15
	Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.	15
Planning and Carrying Out Investigations	Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.	5, 9, 12
Connections to the Nature of Science	Scientific knowledge is based on logical and conceptual connections between evidence and explanations.	3, 4, 7, 14

Disciplinary Core Ideas		Activity number
Types of Interactions (PS2.B)	Electrical and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	7, 8, 9, 12, 13, 14
	Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass (e.g., Earth and the sun).	3, 4, 6, 7
	Forces that act at a distance (electrical, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, a magnet, or a ball respectively).	5, 7, 9, 10, 12
Definitions of Energy (PS3.A)	A system of objects may also contain stored (potential) energy, depending on their relative positions.	3, 6, 7, 10, 11
Relationship Between Energy and Forces (PS3.C)	When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.	4, 5, 7, 11
Defining and Delimiting Engineering Problems (ETS1.A)	The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions.	2, 3, 6
Developing Possible Solutions (ETS1.B)	A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.	2, 3, 6, 11, 13
	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	6, 13, 15
	Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.	6, 12, 13, 15
	Models of all kinds are important for testing solutions	1, 2, 6, 11, 13
Optimizing the Design Solution (ETS1.C)	Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design.	6, 13, 15
	The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	2, 6, 11, 13

Performance Expectations		Activity number
Engineering Design (ETS1)	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS-ETS1-1)	6
	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)	15
	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3)	15
	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)	13
Motion and Stability: Forces and Interactions (PS2)	Ask questions about data to determine the factors that affect the strength of electrical and magnetic forces. (MS-PS2-3)	13
	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4)	7
	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (MS-PS2-5)	12
Energy (PS3)	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS-PS3-2)	11

COMMON CORE STATE STANDARDS CORRELATIONS

FIELDS AND INTERACTIONS

Common Core State Standards – English Language Arts		Activity number
Reading in Science and Technical Subjects (RST)	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (RST.6-8.1)	2, 3, 14, 15
	Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks. (RST.6-8.3)	5, 9, 10, 12
	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (RST.6-8.7)	6
Writing in History/ Social Studies, Science, and Technological Subjects (WHST)	Write arguments focused on discipline-specific content. (WHST.6-8.1)	4, 7
	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (WHST6-8.7)	9, 10
	Draw evidence from informational texts to support analysis, reflection, and research. (WHST.6-8.9)	15
Speaking and Listening (SL)	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (SL.8.5)	1, 2, 3, 4, 6
Common Core State Standards – Mathematics		**Activity number**
Mathematical Practice (MP)	Reason abstractly and quantitatively. (MP.2)	2, 3, 7, 11, 12, 13, 14, 15
Expressions and Equations (EE)	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (6.EE.C.9)	4, 9