NGSS CORRELATIONS

FORCE AND MOTION

Crosscutting Concepts		Activity number
Cause and Effect	Cause and effect relationships may be used to predict phenomena in natural or designed systems.	1, 3, 4, 6, 7, 9
Energy and Matter	Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).	3, 4, 5
Patterns	Patterns can be used to identify cause and effect relationships.	12, 14
	Graphs, charts, and images can be used to identify patterns in data.	2, 3, 4, 5
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.	2, 3, 4, 5, 7, 8, 9
Stability and Change	Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale.	6, 7, 8, 9, 10, 13
	Small changes in one part of a system might cause large changes in another part.	14
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.	10, 11, 12, 13, 15
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.	1, 12, 14, 15
Science and Engineering Practices		**Activity number**
Analyzing and Interpreting Data	Analyze and interpret data to provide evidence for phenomena.	14
	Construct and interpret graphical displays of data to identify linear and nonlinear relationships.	2, 3, 4, 5, 6, 7, 8
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, 10, 14, 15

Science and Engineering Practices		Activity number
Constructing Explanations and Designing Solutions	Apply scientific ideas or principles to design an object, tool, process or system.	10, 11, 12, 13, 15
	Construct an explanation that includes qualitative or quantitative relationships between variables that predict or describe phenomena.	3, 4, 5, 8, 9
	Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.	15
Developing and Using Models	Develop a model to describe unobservable mechanisms.	11
	Develop a model to predict and/or describe phenomena.	10
Engaging in Argument from Evidence	Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.	6, 13
Obtaining, Evaluating, and Communicating Information	Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.	1, 9
Planning and Carrying Out Investigations	Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.	13
	Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	3, 4, 6, 7, 13
Using Mathematics and Computational Thinking	Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.	2, 5, 8
Connections to the Nature of Science	Scientific knowledge is based on logical and conceptual connections between evidence and explanations.	6, 7, 13
Performance Expectations		**Activity number**
Motion and Stability: Forces and Interactions (PS2)	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* (MS-PS2-1)	12
Motion and Stability: Forces and Interactions (PS2)	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (MS-PS2-2)	13
Energy (PS3)	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. (MS-PS3-1)	5

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)	15
Disciplinary Core Ideas		**Activity number**
Forces and Motion (PS2.A)	For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).	1, 10, 11, 12
	The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.	1, 6, 7, 8, 9, 13, 14
	All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.	1, 6, 7, 8, 9, 13
Definitions of Energy (PS3.A)	Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.	1, 2, 3, 4, 5
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.	1, 3, 4, 5, 10, 14
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.	1, 10, 11, 13, 14, 15

COMMON CORE STATE STANDARDS CORRELATIONS

FORCE AND MOTION

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)	9, 11
	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (RST.6-8.2)	9
	Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks. (RST.6-8.3)	3, 6, 7, 10, 12, 13, 14
	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)	1, 2, 5, 7, 8, 15
Writing in History/ Social Studies, Science, and Technological Subjects (WHST)	Write informative/explanatory texts to examine and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (WHST.6-8.2)	4, 5
Common Core State Standards – Mathematics		**Activity number**
Expressions and Equations (EE)	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational. (8.EE.A.2)	5
	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations or inequalities to solve problems by reasoning about the quantities. (7.EE.B.4)	8
Mathematical Practice (MP)	Reason abstractly and quantitatively. (MP.2)	9, 10, 14, 15
Ratios and Proportional Reasoning (RP)	Recognize and represent proportional relationships between quantities. (7.RP.A.2)	2, 3, 4, 5, 7, 8
	Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (6.RP.A.2)	9
Statistics and Probability (SP)	Summarize numerical data sets in relation to their context. (6.SP.B.5)	3, 4, 5, 7