NGSS CORRELATIONS

ENERGY

Crosscutting Concepts		Activity number
Cause and Effect	Cause and effect relationships may be used to predict phenomena in natural or designed systems.	1, 2, 4
Energy and Matter	The transfer of energy can be tracked as energy flows through a designed or natural system.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
	Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).	2, 3, 4, 5, 6, 7, 9, 11, 12, 15
Patterns	Patterns can be used to identify cause and effect relationships.	2, 4
	Graphs, charts, and images can be used to identify patterns in data.	11
	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.	11
Structure and Function	Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	10
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.	4, 5, 9
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.	4, 7, 8
	The observed function of natural and designed systems may change with scale.	7
Connections to the Nature of Science	Scientists and engineers are guided by habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.	8
	Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.	14, 15

Science and Engineering Practices		Activity number
Analyzing and Interpreting Data	Analyze and interpret data to determine similarities and differences in findings.	7, 8, 10
	Analyze and interpret data to provide evidence for phenomena.	1, 2, 4, 7, 11, 14
	Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible.	4
Asking Questions and Defining Problems	Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.	1
Constructing Explanations and Designing Solutions	Construct an explanation that includes qualitative or quantitative relationships between variables that predict or describe phenomena.	3, 7, 12
	Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.	10
	Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system.	10, 13
	Apply scientific ideas to construct an explanation for real world phenomena, examples, or events.	11
Developing and Using Models	Develop a model to describe unobservable mechanisms.	3
	Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.	13
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.	5, 6, 13
	Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.	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.	5, 9, 15

Science and Engineering Practices		Activity number
Planning and Carrying Out Investigations	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.	2, 7, 8
	Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.	4, 7, 14
Connections to the Nature of Science	Scientific knowledge is based on logical and conceptual connections between evidence and explanations.	5, 6, 7
Disciplinary Core Ideas		**Activity number**
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.	10, 13
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.	10, 13
	Models of all kinds are important for testing solutions.	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.	13
	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.	13

Disciplinary Core Ideas		Activity number
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.	2, 3, 4, 6
	A system of objects may also contain stored (potential) energy, depending on their relative positions.	2, 3, 6, 9
	Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.	1, 7, 8, 10, 11, 12, 13, 14
	The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.	5, 7, 8, 10, 12, 14
Conservation of Energy and Energy Transfer (PS3.B)	When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time.	2, 3, 4, 5, 6, 9, 12, 15
	The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.	1, 4, 6, 7, 8, 11, 14, 15
	Energy is spontaneously transferred out of hotter regions or objects and into colder ones.	1, 7, 8, 9, 10, 12, 13, 15
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.	2, 4
Performance Expectations		**Activity number**
Energy (PS3)	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.* (MS-PS3-3)	13
	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS-PS3-4)	8
	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. (MS-PS3-5)	6
Engineering Design (ETS1)	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.	13

COMMON CORE STATE STANDARDS CORRELATIONS

ENERGY

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
	Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks. (RST.6-8.3)	2, 4, 7, 10, 11, 14
Speaking and Listening (SL)	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound and valid reasoning, and well-chosen details: use appropriate eye contact, adequate volume, and clear pronunciation. (SL.8.4)	13
Writing in History/ Social Studies, Science, and Technological Subjects (WHST)	Write arguments focused on discipline-specific content. (WHST.6-8.1)	5, 6
	Draw evidence from informational texts to support analysis, reflection, and research. (WHST.6-8.9)	1, 3, 5, 6, 9, 12, 15
Common Core State Standards – Mathematics		**Activity number**
Mathematical Practice (MP)	Reason abstractly and quantitatively. (MP.2)	2, 3, 4, 7, 8, 11, 14, 15
Expressions and Equations (EE)	Write, read, and evaluate expressions in which letters stand for numbers. (6.EE.A.2)	11, 14
	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 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)	2, 4, 7