Next Generation Science Standards (NGSS) and Common Core State Standards (CCSS)			
Student Learning Objectives	Science and Engineering Practices with Additional Skills Students will be able to:	Disciplinary Core Ideas (DCI) with extended knowledge Students will know:	Cross-Cutting Concepts Students will apply:
5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or **atmosphere** interact. *[Clarification Statement: Examples could include the influence of . . . the atmosphere. . . The geosphere, hydrosphere, **atmosphere**, and biosphere are each a system]*		**ESS2.A: Earth Materials and Systems** [One of] Earth's major systems [is] . . . the atmosphere . . . These systems interact in multiple ways to affect Earth's surface materials and processes.	**Systems and System Models** A system can be described in terms of its components and their interactions.
5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down. *[Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth]*	**Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Support an argument with . . . a model	**PS2.B: Types of Interactions** The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.	**Cause and Effect** Cause and effect relationships are routinely identified and used to explain change.
MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. *[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide . . .]*	**Planning and Carrying Out Investigations** Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. • 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.	**ESS2.D: Weather and Climate** Because these patterns are so complex, weather can only be predicted probabilistically.	**Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems.

MS-PS2-2: Plan an investigation to provide that the change in an object's motion depends on the sun of the forces on the object and the mass of the object. *[Clarification Statement: Emphasis is on balanced (**Newton's First Law**) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (**Newton's Second Law**), frame of reference, and specification of units]*	**Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. • 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.	**PS2.A: Forces and Motion** The motion of an object is determined by the sum of the forces acting on it . . .	
MS-ETS1-1: 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.	**Asking Questions and Defining Problems** Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. • 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.	**ETS1.A: Defining and Delimiting Engineering Problems** 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 are likely to limit possible solutions.	**Influence of Science, Engineering, and Technology on Society and the Natural World** The uses of technologies and 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.
MS-ETS1-2: Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. using a systematic process to determine how well they meet the criteria and constraints of the problem.	**Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	**ETS1.B: Developing Possible Solutions** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	

MS-ETS1-3: 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.	**Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings.	**ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. **ETS1.C: Optimizing the Design Solution** • 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 those characteristics may be incorporated into the new design.	
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.	**Analyzing and Interpreting Data** Analyzing data in 9–12 builds on K–8 and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. • Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Theories and laws provide explanations in science. • Laws are statements or descriptions of the relationships among observable phenomena.	**PS2.A: Forces and Motion** Newton's second law accurately predicts changes in the motion of macroscopic objects.	**Cause and Effect** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	**Asking Questions and Defining Problems** Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. • Analyze complex real-world problems by specifying criteria and constraints for successful solutions.	**ETS1.A: Defining and Delimiting Engineering Problems** 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.	***Connections to Engineering, Technology, and Applications of Science*** Influence of Science, Engineering, and Technology on Society and the Natural World • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.
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.	**Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories. • Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	**ETS1.C: Optimizing the Design Solution** Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.	
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.	**Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories. • Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	**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.	***Connections to Engineering, Technology, and Applications of Science*** Influence of Science, Engineering, and Technology on Society and the Natural World • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.

Connections to other DCIs across grade bands:
H.ESS2.C; HS-ESS3-2; HS-ESS3-4; HS-PS1-6; HS-PS2-3; HS-PS3-3; HS.ESS1.A; HS.ESS1.C; HS.PS3.C; MS-PS1-6; MS-PS3-3; MS.ESS2.C; MS.PS1.A; MS.PS2.A; MS.PS3.A; MS.PS3.B

Articulation of DCIs across grade bands:
2.ESS2.A; 3-5.ETS1.A; 3-5.ETS1.B; 35.ETS1.C; 3.ESS2.D; 3.PS2.A; 3.PS2.B; 4.ESS2.A; 5.ESS2.A; HS.ESS1.B; HS.ESS2.C; HS.ESS2.D; HS.ETS1.A; HS.ETS1.B; HS.ETS1.C; HS.PS2.A; HS.PS3.B; MS.ESS1.B; MS.ESS2.A; MS.ESS2.C; MS.ESS2.D; MS.ETS1.A; MS.ETS1.B; MS.ETS1.C; MS.PS2.A; MS.PS2.B; MS.PS3.C

Common Core State Standards Connections:

ELA/Literacy -	
RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgably. (5-PS-2-1)
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5, MS-ETS1-1, MS-ETS1-3)
RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-2)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text without a version of that information expressed visually . . . (MS-ETS1-3)
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS2-1, HS-ETS1-1, HS-ETS1-3)
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1, HS-ETS1-3)
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1, HS-ETS1-3)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
WHST.6-8.7	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. (MS-ETS1-2)
WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS2-1)