

8th Grade Science Curriculum

Engineering Design

Students who demonstrate understanding can...

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.

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. (MS-ETS1-1)

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-ETS1-2), (MS-ETS1-3)

Influence of Science, Engineering, and Technology on Society and the Natural World

☐☐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. (MS-ETS1-1)

☐☐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-ETS1-1)

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. (MS-ETS1-1)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ETS1-1)

Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-ETS1-4)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

MS-ETS1-2.

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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-ETS1-2), (MS-ETS1-3)

Engaging in Argument from Evidence

☐☐Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2), (MS-ETS1-3)

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.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)

Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-ETS1-4)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

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.

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-ETS1-2), (MS-ETS1-3)

☐☐ Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)

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. (MS-ETS1-3)

Analyzing and Interpreting Data

☐☐ Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

RST.6-8.7 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). (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2), (MS-ETS1-3)

Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-ETS1-4)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3)

MS-ETS1-4.

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.

ETS1.B: Developing Possible Solutions

☐☐ A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)

☐☐ Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

☐☐ 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. (MS-ETS1-4)

Developing and Using Models

☐☐ Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

ELA/Literacy

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ETS1-4)

Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-ETS1-4)

History of Earth

Students who demonstrate understanding can...

08-ESS1-4.

Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

ESS1.C: The History of Planet Earth

☐☐The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (08-ESS1-4)

☐☐Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to 06-ESS2-3)

Scale Proportion and Quantity

☐☐Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (08-ESS1-4), (06-ESS2-2)

Constructing Explanations and Designing Solutions

☐☐Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (08-ESS1-4), (06-ESS2-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (08-ESS1-4), (06-ESS2-2),(06-ESS2-3)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (08-ESS1-4), (06-ESS2-2)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (06-ESS2-2)

Mathematics

MP.2 Reason abstractly and quantitatively. (06-ESS2-2), (06-ESS2-3)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS1-4), (06-ESS2-2),(06-ESS2-3)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS1-4), (06-ESS2-2), (06-ESS2-3)

Earth's Systems

Students who demonstrate understanding can...

08-ESS3-1.

Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

ESS3.A: Natural Resources

☐☐Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (08-ESS3-1)

Cause and Effect

☐☐Cause and effect relationships may be used to predict phenomena in natural or designed systems. (08-ESS3-1)

Influence of Science, Engineering, and Technology on Society and the Natural World

☐☐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. (08-ESS3-1)

Constructing Explanations and Designing Solutions

☐☐Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (08-ESS3-1)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (08-ESS3-1)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (08-ESS3-1)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (08-ESS3-1)

Mathematics

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS3-1)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS3-1)

Space Systems

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (07-LS1-4), (07-LS1-5),(08-LS3-1),(08-LS3-2),(08-LS4-5)

RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (08-LS3-1), (08-LS3-2)

RST.6-8.7 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). (08-LS3-1), (08-LS3-2)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (08-LS4-5)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (08-LS3-1),(08-LS3-2)

Mathematics

MP.4 Model with mathematics. (08-LS3-2)

6.SP.B.5 Summarize numerical data sets in relation to their context. (08-LS3-2)

Weather and Climate

Students who demonstrate understanding can...

08-ESS3-2.

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

ESS3.B: Natural Hazards

☐☐Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (08-ESS3-2)

Patterns

☐Graphs, charts, and images can be used to identify patterns in data. (08-ESS3-2)

Influence of Science, Engineering, and Technology on Society and the Natural World

☐The uses of technologies and limitations on their use are driven by people's 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. (08-ESS3-2), (08-ESS3-3)

Analyzing and Interpreting Data

☐Analyze and interpret data to determine similarities and differences in findings. (08-ESS3-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (08-ESS3-2), (08-ESS3-4)

RST.6-8.7 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). (08-ESS3-2)

Mathematics

MP.2 Reason abstractly and quantitatively. (08-ESS3-2)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

08-ESS3-3.

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

[Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

ESS3.C: Human Impacts on Earth Systems

☐Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (08-ESS3-3)

☐Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (08-ESS3-3), (08-ESS3-4)

Cause and Effect

☐Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (08-ESS3-3)

Influence of Science, Engineering, and Technology on Society and the Natural World

☐The uses of technologies and limitations on their use are driven by people's 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. (08-ESS3-2), (08-ESS3-3)

Constructing Explanations and Designing Solutions

☐Apply scientific principles to design an object, tool, process or system. (08-ESS3-3)

ELA/Literacy

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. (08-ESS3-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (08-ESS3-3)

Mathematics

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (08-ESS3-3), (08-ESS3-4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (08-ESS3-3), (08-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

08-ESS3-4.

Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

ESS3.C: Human Impacts on Earth Systems

☐☐ Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (08-ESS3-3)

☐☐ Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (08-ESS3-3), (08-ESS3-4)

Cause and Effect

☐☐ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (08-ESS3-4)

Influence of Science, Engineering, and Technology on Society and the Natural World

☐☐ 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. (08-ESS3-4)

Science Addresses Questions About the Natural and Material World

☐☐ Science knowledge can describe consequences of actions but does not make the decisions that society takes. (08-ESS3-4)

Engaging in Argument from Evidence

☐☐ Construct an oral and written argument 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. (08-ESS3-4)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (08-ESS3-2), (08-ESS3-4)

WHST.6-8.1 Write arguments focused on discipline content. (08-ESS3-4)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (08-ESS3-4)

Mathematics

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (08-ESS3-3), (08-ESS3-4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (08-ESS3-3), (08-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS3-2), (08-ESS3-3), (08-ESS3-4)

08-ESS3-5.

Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

[Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

ESS3.D: Global Climate Change

☐☐ Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (08-ESS3-5)

Stability and Change

☐☐ Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (08-ESS3-5)

Asking Questions and Defining Problems

☐☐ Ask questions to identify and clarify evidence of an argument. (08-ESS3-5)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (06-ESS2-5), (08-ESS3-5)

Mathematics

MP.2 Reason abstractly and quantitatively. (06-ESS2-5), (08-ESS3-5)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-ESS3-5)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (08-ESS3-5)

Interdependent Relationships in Ecosystems

Students who demonstrate understanding can...

08-LS2-5.

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

☐☐Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (08-LS2-5)

LS4.D: Biodiversity and Humans

☐☐Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to 08-LS2-5)

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. (secondary to 08-LS2-5)

Stability and Change

☐☐Small changes in one part of a system might cause large changes in another part. (08-LS2-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

☐☐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. (08-LS2-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

☐☐Scientific knowledge can describe consequence of actions but does not make the decisions that society takes. (08-LS2-5)

Engaging in Argument from Evidence

☐☐Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (08-LS2-5)

ELA/Literacy

RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (08-LS2-5)

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (08-LS2-5)

Mathematics

MP.4 Model with mathematics. (08-LS2-5)

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (08-LS2-5)

Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can...

08-LS2-4.

Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

☐ Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (08-LS2-4)

Stability and Change

☐ Small changes in one part of a system might cause large changes in another part. (08-LS2-4)

Engaging in Argument from Evidence

☐ Construct an oral and written argument 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. (08-LS2-4)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

☐ Science disciplines share common rules of obtaining and evaluating empirical evidence. (08-LS2-4)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (07-LS1-6),(06-LS2-1),(08-LS2-4)

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (08-LS2-4)

WHST.6-8.1 Write arguments to support claims with clear reasons and relevant evidence. (08-LS2-4)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (07-LS1-6),(08-LS2-4)

Energy

Students who demonstrate understanding can...

08-PS3-1.

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. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]

PS3.A: Definitions of Energy

☐ 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. (08-PS3-1)

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. (08-PS3-1),(07-PS3-4)

Analyzing and Interpreting Data

☐ Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (08-PS3-1)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (08-PS3-1),(07-PS3-5)

RST.6-8.7 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). (08-PS3-1)

Mathematics

MP.2 Reason abstractly and quantitatively. (08-PS3-1),(07-PS3-4),(07-PS3-5)

6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (08-PS3-1),(07-PS3-5)

6.RP.A.2 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. (08-PS3-1)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (08-PS3-1),(07-PS3-5)

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (08-PS3-1)

8.EE.A.2 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. (08-PS3-1)

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (08-PS3-1),(07-PS3-5)

Structure, Function, and Information Processing

Students who demonstrate understanding can...

08-LS1-8.

Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

LS1.D: Information Processing

Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (08-LS1-8)

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural systems. (08-LS1-8)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods.

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (08-LS1-8)

ELA/Literacy

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (08-LS1-8)

Growth, Development, and Reproduction Organisms

Students who demonstrate understanding can...

08-LS3-1.

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

[Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

LS3.A: Inheritance of Traits

Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (08-LS3-1)

LS3.B: Variation of Traits

In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (08-LS3-1)

Structure and Function

Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function. (08-LS3-1)

Developing and Using Models

Develop and use a model to describe phenomena. (08-LS3-1),(08-LS3-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (07-LS1-4),(07-LS1-5),(08-LS3-1),(08-LS3-2),(08-LS4-5)

RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (08-LS3-1),(08-LS3-2)

RST.6-8.7 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). (08-LS3-1),(08-LS3-2)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (08-LS3-1),(08-LS3-2)

08-LS3-2.

Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

LS1.B: Growth and Development of Organisms

☐☐ Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to 08-LS3-2)

LS3.A: Inheritance of Traits

☐☐ Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (08-LS3-2)

LS3.B: Variation of Traits

☐☐ In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (08-LS3-2)

Cause and Effect

☐☐ Cause and effect relationships may be used to predict phenomena in natural systems. (08-LS3-2)

Developing and Using Models

☐☐ Develop and use a model to describe phenomena. (08-LS3-1),(08-LS3-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (07-LS1-4),(07-LS1-5),(08-LS3-1),(08-LS3-2),(08-LS4-5)

RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (08-LS3-1),(08-LS3-2)

RST.6-8.7 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). (08-LS3-1),(08-LS3-2)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (08-LS3-1),(08-LS3-2)

Mathematics

MP.4 Model with mathematics. (08-LS3-2)

6.SP.B.5 Summarize numerical data sets in relation to their context. (08-LS3-2)

08-LS4-5.

Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

[Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

LS4.B: Natural Selection

▪ In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (08-LS4-5)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

▪ Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (08-LS4-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

▪ Science knowledge can describe consequences of actions but does not make the decisions that society takes. (08-LS4-5)

Obtaining, Evaluating, and Communicating Information

▪ Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (08-LS4-5)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (07-LS1-4),(07-LS1-5),(08-LS3-1),(08-LS3-2),(08-LS4-5)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (08-LS4-5)

Natural Selection and Adaptations

Students who demonstrate understanding can...

08-LS4-1.

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]

LS4.A: Evidence of Common Ancestry and Diversity

☐☐The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (08-LS4-1)

Patterns

☐☐Graphs, charts, and images can be used to identify patterns in data. (08-LS4-1), (08-LS4-3)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

☐☐Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (08-LS4-1), (08-LS4-2)

Analyzing and Interpreting Data

☐☐Analyze and interpret data to determine similarities and differences in findings. (08-LS4-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

☐☐Science knowledge is based upon logical and conceptual connections between evidence and explanations. (08-LS4-1)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (08-LS4-1),(08-LS4-2),(08-LS4-3),(08-LS4-4)

RST.6-8.7 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). (08-LS4-1),(08-LS4-3)

Mathematics

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-LS4-1),(08-LS4-2)

08-LS4-2.

Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]

LS4.A: Evidence of Common Ancestry and Diversity

☐☐Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (08-LS4-2)

Patterns

☐☐Patterns can be used to identify cause and effect relationships. (08-LS4-2)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

☐☐Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (08-LS4-1), (08-LS4-2)

Constructing Explanations and Designing Solutions

☐☐Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (08-LS4-2)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (08-LS4-1),(08-LS4-2),(08-LS4-3),(08-LS4-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (08-LS4-2),(08-LS4-4)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (08-LS4-2),(08-LS4-4)

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (08-LS4-2),(08-LS4-4)

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (08-LS4-2),(08-LS4-4)

Mathematics

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (08-LS4-1),(08-LS4-2)

08-LS4-3.

Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]

LS4.A: Evidence of Common Ancestry and Diversity

☐☐Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (08-LS4-3)

Patterns

☐☐Graphs, charts, and images can be used to identify patterns in data. (08-LS4-1), (08-LS4-3)

Analyzing and Interpreting Data

☐☐Analyze displays of data to identify linear and nonlinear relationships. (08-LS4-3)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (08-LS4-1),(08-LS4-2),(08-LS4-3),(08-LS4-4)

RST.6-8.7 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). (08-LS4-1),(08-LS4-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (08-LS4-3),(08-LS4-4)

08-LS4-4.

Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations]

LS4.B: Natural Selection

☐☐Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (08-LS4-4)

Cause and Effect

☐☐Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (08-LS4-4), (08-LS4-6)

Constructing Explanations and Designing Solutions

☐☐Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (08-LS4-4)

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (08-LS4-1),(08-LS4-2),(08-LS4-3),(08-LS4-4)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (08-LS4-3),(08-LS4-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (08-LS4-2),(08-LS4-4)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (08-LS4-2),(08-LS4-4)

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (08-LS4-2),(08-LS4-4)

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (08-LS4-2),(08-LS4-4)

Mathematics

RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (08-LS4-4),(08-LS4-6)

6.SP.B.5 Summarize numerical data sets in relation to their context. (08-LS4-4),(08-LS4-6)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (08-LS4-4),(08-LS4-6)

08-LS4-6.

Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

LS4.C: Adaptation

☐☐ Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (08-LS4-6)

Cause and Effect

☐☐ Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (08-LS4-4), (08-LS4-6)

Using Mathematics and Computational Thinking

☐☐ Use mathematical representations to support scientific conclusions and design solutions. (08-LS4-6)

Mathematics

MP.4 Model with mathematics. (08-LS4-6)

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (08-LS4-4),(08-LS4-6)

6.SP.B.5 Summarize numerical data sets in relation to their context. (08-LS4-4),(08-LS4-6)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (08-LS4-4),(08-LS4-6)