Kentucky Science

Grade 8

Adopted 2022

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Physical Science

8-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. 8-PS1-3

8-SEP1-3. 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. 8-SEP1-3

1A. Structure and Properties of Matter - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. 8-DCI.PS1.PS1.1A

1B. Chemical Reactions - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. 8-DCI.PS1.PS1.1B

1A. 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 geological processes (link to ESS2.B). Renewable energy resources, and the technologies to exploit them, are being rapidly developed. 8-DCI.PS1.ESS3.1A

PS1-3. 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. 8-CC.PS1-3

Life Science

8-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. 8-LS1-4

8-SEPLS1-4. Engaging in Argument from Evidence - Use 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. 8-SEPLS1-4

4B. Growth and Development of Organisms - Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. 8-DCI.LS1.4B

LS1-4. Cause and Effect - Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. 8-CC.LS1-4

8-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. 8-LS1-5

8-SEPLS1-5. 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. 8-SEPLS1-5

5B. Growth and Development of Organisms - Genetic factors as well as local conditions affect the growth of the adult plant. 8-DCI.LS1.5B

LS1-5. Cause and Effect - Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. 8-CC.LS1-5

8-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. 8-LS2-4

8-SEPLS2-4. 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. 8-SEPLS2-4

4C. 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 8-DCI.LS2.4C

4D. Social Interactions and Group Behavior - Groups often dissolve if they no longer function to meet individuals' needs, if dominant members lose their place, or if other key members are removed from the group through death, predation, or exclusion by other members. 8-DCI.LS2.4D

LS2-4. Stability and Change - Small changes in one part of a system might cause large changes in another part. 8-CC.LS2-4

8-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. 8-LS2-5

8-SEPLS2-5. Engaging in Argument from Evidence - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. 8-SEPLS2-5

2C. 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. 8-DCI.LS2.2C

2D. 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. 8-DCI.LS4.2D

2B. Developing Possible Solutions - There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. 8-DCI.ETS1.2B

LS2-5. Stability and Change - Small changes in one part of a system might cause large changes in another part. 8-CC.LS2-5

8-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. 8-LS3-1

8-SEPLS3-1. Developing and Using Models - Develop and use a model to describe phenomena. 8-SEPLS3-1

1A. 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. 8-DCI.LS3.1A

1B. 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. 8-DCI.LS3.1B

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 structures/systems can be analyzed to determine how they function. 8-CC.LS3-1

8-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. 8-LS3-2

8-SEPLS3-2. Developing and Using Models - Develop and use a model to describe phenomena. 8-SEPLS3-2

3B. Growth and Development of Organisms - Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. 8-DCI.LS1.3B

3A. 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. 8-DCI.LS3.3A

3B. 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. 8-DCI.LS3.3B

LS3-2. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural systems. 8-CC.LS3-2

8-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. 8-LS4-1

8-SEPLS4-1. Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings. 8-SEPLS4-1

1A. 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. 8-DCI.LS4.1A

LS4-1. Patterns - Graphs, charts, and images can be used to identify patterns in data. 8-CC.LS4-1

8-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. 8-LS4-2

8-SEPLS4-2. Constructing Explanations and Designing Solutions - Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. 8-SEPLS4-2

2A. 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. 8-DCI.LS4.2A

LS4-2. Patterns - Patterns can be used to identify cause-and-effect relationships. 8-CC.LS4-2

8-LS4-3. Analyze data to compare patterns in the embryological development across multiple species to identify relationships not evident in the fully formed adult anatomy. 8-LS4-3

8-SEPLS4-3. Analyzing and Interpreting Data - Analyze displays of data to identify linear and nonlinear relationships. 8-SEPLS4-3

3A. 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. 8-DCI.LS4.3A

LS4-3. Patterns - Graphs, charts, and images can be used to identify patterns in data. 8-CC.LS4-3

8-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. 8-LS4-4

8-SEPLS4-4. Constructing Explanations and Designing Solutions - Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. 8-SEPLS4-4

4B. Natural Selection - Natural selection leads to the predominance of certain traits in a population, and the suppression of others. 8-DCI.LS4.4B

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. 8-CC.LS4-4

8-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. 8-LS4-5

8-SEPLS4-5. 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. 8-SEPLS4-5

5B. 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. 8-DCI.LS4.5B

LS4-5. Cause and Effect - Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. 8-CC.LS4-5

8-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. 8-LS4-6

8-SEPLS4-6. Using Mathematics and Computational Thinking - Use mathematical representations to support scientific conclusions and design solutions. 8-SEPLS4-6

6C. 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. 8-DCI.LS4.6C

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. 8-CC.LS4-6

Earth and Space Science

8-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. `8-ESS1-4`

8-SEPESS1-4. 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. `8-SEPESS1-4`

4C. 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. `8-DCI.ESS1.4C`

ESS1-4. 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. `8-CC.ESS1-4`

8-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. `8-ESS3-1`

8-SEPESS3-1. 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. `8-SEPESS3-1`

1A. 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. `8-DCI.ESS3.1A`

ESS3-1. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. `8-CC.ESS3-1`

8-ESS3-2. Analyze and interpret data to forecast future catastrophic events to inform the development of technologies to mitigate the effects of natural hazards. `8-ESS3-2`

8-SEPESS3-2. Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings. `8-SEPESS3-2`

1B. 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. `8-DCI.ESS3.1B`

ESS3-2. Patterns - Graphs, charts, and images can be used to identify patterns in data. `8-CC.ESS3-2`

8-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. 8-ESS3-3

8-SEPESS3-3. Constructing Explanations and Designing Solutions - Apply scientific principles to design an object, tool, process or system. 8-SEPESS3-3

1C. 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. 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. 8-DCI.ESS3.1C

ESS3-3. Cause and Effect - Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. 8-CC.ESS3-3

8-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. 8-ESS3-4

8-SEPESS3-4. 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. 8-SEPESS3-4

3C. Human Impacts on Earth Systems - 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. 8-DCI.ESS3.3C

ESS3-4. Cause and Effect - Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. 8-CC.ESS3-4

8-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. 8-ESS3-5

8-SEPESS3-5. Asking Questions and Defining Problems - Ask questions to identify and clarify evidence of an argument. 8-SEPESS3-5

3D. 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. 8-DCI.ESS3.3D

ESS3-5. Stability and Change - Stability might be disturbed either by sudden events or gradual changes that accumulate over time. 8-CC.ESS3-5

6-8 Engineering Design

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.** MS-ETS1-1

MS-SEPETS1-1. **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-SEPETS1-1

1A. **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-DCI.ETS1.1A

MS-ETS1-2. **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** MS-ETS1-2

MS-SEPETS1-2. **Engaging in Argument from Evidence - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.** MS-SEPETS1-2

1-2B. **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-DCI.ETS1.1-2B

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.** MS-ETS1-3

MS-SEPETS1-3. **Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings.** MS-SEPETS1-3

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.** MS-DCI.ETS1.B

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-DCI.ETS1.C

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.** MS-ETS1-4

MS-SEPETS1-4. **Developing and Using Models - Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.** MS-SEPETS1-4

1B. **Developing Possible Solutions - A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Models of all kinds are important for testing solutions.** MS-DCI.ETS1.1B

1C. **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-DCI.ETS1.1C