Grade 5
Science
Item Specifications

Missouri
DEPARTMENT OF ELEMENTARY & SECONDARY
EDUCATION

Table of Contents

Introduction

In 2014 Missouri legislators passed House Bill 1490, mandating the development of the Missouri Learning Expectations. In April of 2016, these Missouri Learning Expectations were adopted by the State Board of Education. Groups of Missouri educators from across the state collaborated to create the documents necessary to support the implementation of these expectations.

One of the documents developed is the item specification document, which includes all Missouri grade level/course expectations arranged by domains/strands. It defines what could be measured on a variety of assessments. The document serves as the foundation of the assessment development process.

Although teachers may use this document to provide clarity to the expectations, these specifications are intended for summative, benchmark, and large-scale assessment purposes.

Components of the item specifications include:

Expectation Unwrapped breaks down a list of clearly delineated content and skills the students are expected to know and be able to do upon mastery of the Expectation.

Depth of Knowledge (DOK) Ceiling indicates the highest level of cognitive complexity that would typically be assessed on a large scale assessment. The DOK ceiling is not intended to limit the complexity one might reach in classroom instruction.

Item Format indicates the types of test questions used in large scale assessment. For each expectation, the item format specifies the type best suited for that particular expectation.

Content Limits/Assessment Boundaries are parameters that item writers should consider when developing a large scale assessment. For example, some expectations should not be assessed on a large scale assessment but are better suited for local assessment.

Sample stems are examples that address the specific elements of each expectation and address varying DOK levels. The sample stems provided in this document are in no way intended to limit the depth and breadth of possible item stems. The expectation should be assessed in a variety of ways.

Possible Evidence indicates observable methods in which a student can show understanding of the expectations.

Stimulus Materials defines types of stimulus materials that can be used in the item stems.

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Physical Sciences</th><th>5.PS1.A.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Matter and Its Interactions
Structure and Properties of Matter
Develop a model to describe that matter is made of particles too small to be seen.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Developing and Using Models
• Using models to describe phenomena

<u>DISCIPLINARY CORE IDEAS</u>
Structure and Properties of Matter
• Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.

<u>CROSSCUTTING CONCEPTS</u>
Scale, Proportion, and Quantity
• Natural objects exist from the very small to the immensely large.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should not include the atomic-scale mechanisms of evaporation and condensation or the defining of the unseen particles.
• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td><u>Sample Stems</u></td></tr>
</table>

Possible Evidence

- Students develop a model to describe a phenomenon (observable event) that includes the idea that matter is made of particles too small to be seen. In the model, students identify the relevant components for the phenomenon, including the following
  - Bulk matter (macroscopic observable matter [e.g., sugar, air, water])
  - Particles of matter that are too small to be seen
- In the model, students identify and describe relevant relationships between components, including the relationships between
  - bulk matter and tiny particles that cannot be seen (e.g., tiny particles of matter that cannot be seen make up bulk matter).
  - the behavior of a collection of many tiny particles of matter and observable phenomena involving bulk matter (e.g., an expanding balloon, evaporating liquids, substances that dissolve in solvents, effects of wind).
- Students use the model to describe how matter composed of tiny particles too small to be seen can account for observable phenomena (e.g., air inflating a basketball, ice melting into water).

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Physical Sciences</th><th>5.PS1.A.2</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Matter and Its Interactions
Structure and Properties of Matter
Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Using Mathematics and Computational Thinking
• Measure and graph quantities such as weight to address scientific and engineering questions and problems.

<u>DISCIPLINARY CORE IDEAS</u>
Structure and Properties of Matter
• The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
Chemical Reactions
• No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)

<u>CROSSCUTTING CONCEPTS</u>
Scale, Proportion, and Quantity
• Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should not include distinguishing mass and weight.
• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td><u>Sample Stems</u></td></tr>
</table>

Possible Evidence

- Students measure and graph the given quantities using standard units, including the following:
  - The weight of substances before they are heated, cooled, or mixed.
  - The weight of substances, including any new substances produced by a reaction, after they are heated, cooled, or mixed.
- Students measure and/or calculate the difference between the total weight of the substances (using standard units) before and after they are heated, cooled, and/or mixed.
- Students describe the changes in properties they observe during and/or after heating, cooling, or mixing substances.
- Students use their measurements and calculations to describe that the total weights of the substances did not change, regardless of the reaction or changes in properties that were observed.
- Students use measurements and descriptions of weight, as well as the assumption of consistent patterns in natural systems, to describe evidence to address scientific questions about the conservation of the amount of matter, including the idea that the total weight of matter is conserved after heating, cooling, or mixing substances.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Physical Sciences	5.PS1.B.1
Core Idea	**Matter and Its Interactions**
Component	**Types of Interactions of Matter**
MLS	Plan and conduct investigations to separate the components of a mixture/solution by their physical properties (i.e., sorting, filtration, magnets, and screening).

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using a fair test in which variables are controlled and the number of trials are considered.
- Describe ways to separate the components of a mixture/solution by their properties (i.e., sorting, filtration, magnets, screening).

Constructing Explanations and Designing Solutions

- Apply scientific ideas to solve design problems.

DISCIPLINARY CORE IDEAS

Mixtures and Solutions

- Matter exists as different substances that have observable different properties. Components of mixtures and solutions can be separated using a variety of methods, depending on the properties of the indivdual components.

CROSSINGCUTTING CONCEPTS

Cause and Effect

- Cause and Effect relationships are routinely identified and used to explain change.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks should avoid specific events or steps in a procedure.

Sample Stems

Possible Evidence

- From the given investigation plan, students describe the phenomenon (observable event) under investigation, which includes the separation of two or more substances in a mixture or solution.
- From the given investigation plan, students describe the evidence from data that will be collected, including
  - quantitative (e.g., weight) and qualitative (e.g., state of matter, color, texture, odor) properties of the mixture or solution to be separated.
- Students describe how the collected data can serve as evidence for the separation of mixture or solution into individual components.
- From the given investigation plan, students describe how the data will be collected, including the following:
  - How quantitative and qualitative properties of the mixture or solution to be separated will be determined and measured
  - The method of separation, along with the appropriate tools for separation (i.e., sorting, filtration, magnets, and screening)
  - Number of trials for the investigation
  - How variables will be controlled to ensure a fair test
- According to the investigation plan, students collaboratively collect and record data, including data about the mixture or solution after separating.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Physical Sciences	5.PS1.B.2
Core Idea	**Matter and Its Interactions**
Component	**Types of Interactions of Matter**
MLS	Conduct an investigation to determine whether the combining of two or more substances results in new substances.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

- Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered.

DISCIPLINARY CORE IDEAS

Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed.

CROSSCUTTING CONCEPTS

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Possible Evidence

- From the given investigation plan, students describe the phenomenon (observable event) under investigation, which includes the mixing of two or more substances.
- Students identify the purpose of the investigation, which includes providing evidence for whether new substances are formed by mixing two or more substances, based on the properties of the resulting substance.

Sample Stems

- From the given investigation plan, students describe the evidence from data that will be collected, including the following:
  - Quantitative (e.g., weight) and qualitative properties (e.g., state of matter, color, texture, odor) of the substances to be mixed
  - Quantitative and qualitative properties of the resulting substances
- Students describe how the collected data can serve as evidence for whether the mixing of the two or more tested substances results in one or more new substances.
- From the given investigation plan, students describe how the data will be collected, including the following:
  - How quantitative and qualitative properties of the two or more substances to be mixed will be determined and measured
  - How quantitative and qualitative properties of the substances that resulted from the mixture of the two or more substances will be determined and measured
  - The number of trials for the investigation
  - How variables will be controlled to ensure a fair test (e.g., the temperature at which the substances are mixed, the number of substances mixed together in each trial)
- According to the investigation plan, students collaboratively collect and record data, including data about the substances before and after mixing.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Physical Sciences	5.PS2.B.1
Core Idea	**Motion and Stability: Forces and Interactions**
Component	**Types of Interaction**
MLS	Support an argument that the gravitational force exerted by Earth on objects is directed toward the planet's center.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Engaging in Argument from Evidence

- Support an argument with evidence, data, or a model.

DISCIPLINARY CORE IDEAS

Types of Interactions

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

CROSSCUTTING CONCEPTS

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks should not include mathematical representation (e.g., formulas, numbers, units) of gravitational force.
- Tasks should include a minimum of two dimensions.
- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Sample Stems

Possible Evidence

- Students identify a given claim about a phenomenon to be supported. The claim includes the idea that the gravitational force exerted by Earth on objects is directed toward the center of Earth.
- Students identify and describe the given evidence, data, and/or models that support the claim, including the following:
  - Multiple lines of evidence that indicate that Earth's shape is spherical (e.g., observation of ships sailing beyond the horizon, the shape of Earth's shadow on the moon during an eclipse, the changing height of the North Star above the horizon as people travel north and south)
  - That objects dropped appear to fall straight down
  - That people live all around the spherical Earth, and they all observe that objects appear to fall straight down
- Students evaluate the evidence to determine whether it is sufficient and relevant to supporting the claim.
- Students describe whether any additional evidence is needed to support the claim.
- Students use reasoning to connect the relevant and appropriate evidence to support the claim with argumentation. Students describe a chain of reasoning that includes the following:
  - If Earth is spherical, and all observers see objects near them falling directly "down" to the Earth's surface, then all observers would agree that objects fall toward Earth's center.
  - Since an object that is initially stationary when held moves downward when it is released, there must be force (gravity) acting on the object that pulls the object toward the center of Earth.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Physical Sciences	5.PS3.D.1
Core Idea	**Energy**
Component	**Energy in Chemical Process and Everyday**
MLS	Use models to describe that energy stored in food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

- Use models to describe phenomena.

DISCIPLINARY CORE IDEAS

Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Organization for Matter and Energy

- Food provides animals with the materials they need for body repair and growth, the energy they need to maintain body warmth, and for motion.

CROSSCUTTING CONCEPTS

Energy and Matter

- Energy can be transferred in various ways and between objects.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- A minimum of two dimensions should be assessed.
- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Sample Stems

Grades 3-5 SCIENCE

Possible Evidence

- Students use models to describe a phenomenon (observable event) that includes the idea that energy in animals' food was once energy from the sun. Students identify and describe the components of the model that are relevant for describing the phenomenon, including
  - energy.
  - the sun.
  - animals, including their bodily functions (e.g., body repair, growth, motion, body warmth maintenance).
  - plants.
- Students identify and describe the relevant relationships between components, including the following:
  - The relationship between plants and the energy they get from sunlight to produce food
  - The relationship between food and the energy and materials that animals require for bodily functions (e.g., body repair, growth, motion, body warmth maintenance)
  - The relationship between animals and the food they eat, which is either other animals or plants (or both), to obtain energy for bodily functions and materials for growth and repair
- Students use the models to describe causal accounts of the relationships between energy from the sun and animals' needs for energy, including that
  - since all food can eventually be traced back to plants, all of the energy that animals use for body repair, growth, motion, and body warmth maintenance is energy that once came from the sun.
  - energy from the sun is transferred to animals through a chain of events that begins with plants producing food then being eaten by animals.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Physical Sciences</th><th>5.PS4.A.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Waves and Their Applications in technologies for Information Transfer
Wave Properties
Develop a model to describe that objects can be seen only when light is reflected off them or when they produce their own light.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Developing and Using Models
• Develop and/or use models to describe and/or predict phenomena.

<u>DISCIPLINARY CORE IDEAS</u>
Electromagnetic Radiation
• Objects can be seen when light reflected from their surfaces enters our eyes.

<u>CROSSCUTTING CONCEPTS</u>
Cause and Effect
• Events that occur together with regularity might or might not be a cause and effect relationship.
Systems and System Model
• A system can be described in terms of its components and their interactions.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.
• Tasks should not include evaluation of the limitations of models.</td><td><u>Sample Stems</u></td></tr>
</table>

Possible Evidence

- Students develop a model to describe a phenomenon (observable event) that includes the idea that objects can be seen only when light is reflected off them or when they produce their own light. In the model, students identify the relevant components for the phenomenon, including the following:
  - A light source
  - An object that can be seen
- In the model, students identify and describe the relevant relationship between components, including the relationship between the light source and an object to be seen.
- Students use the model to describe observable phenomena (e.g., light reflection, light production, or where a light source may not be present.)

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Life Sciences</th><th>5.LS1.A.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">From Molecules to Organisms: Structure and Processes
Structure and Function
Compare and contrast the major organs/organ systems (e.g., support, reproductive, digestive, transport/circulatory, excretory, response) that perform similar functions for animals belonging to different vertebrate classes.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Constructing Explanations and Designing Solutions
• Identify the evidence that supports particular points and in explanation.
Engaging in Argument from Evidence
• Construct and/or support an argument with evidence, data, and/or a model.

<u>DISCIPLINARY CORE IDEAS</u>
Structure and Function
• Organisms have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction with organs that are specialized for particular body functions.

<u>CROSSCUTTING CONCEPTS</u>
Systems and System Model
• Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. Students can also describe a system in terms of its components and their interactions.
Energy and Matter
• Energy can be transferred in various ways and between objects.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should be limited to macroscopic structures within animal systems.</td><td><u>Sample Stems</u></td></tr>
</table>

Grades 3-5 SCIENCE

Possible Evidence

- Students compare and contrast the major organs/organ systems that perform similar functions for animals belonging to different vertebrate classes.
- Organs/Organ Systems
  - support—skeletal and muscular
  - reproductive
  - digestive
  - circulatory/transport
  - excretory
  - response—nervous
  - respiratory
- Vertebrate Classes
  - birds
  - fish
  - amphibians
  - reptiles
  - mammals

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Life Sciences</th><th>5.LS1.C.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">From Molecules to Organisms: Structure and Processes
Organization for Matter and Energy Flow in Organisms
Support an argument that plants get the materials (i.e., carbon dioxide, water, and sunlight) they need for growth chiefly from air and water.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Engaging in Argument from Evidence
• Support an argument with evidence, data, or a model.

<u>DISCIPLINARY CORE IDEAS</u>
Organization for Matter and Energy Flow in Organisms
• Plants acquire their material for growth chiefly from air and water.

<u>CROSSCUTTING CONCEPTS</u>
Energy and Matter
• Matter is transported into, out of, and within systems.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should not include knowing the formula for photsynthesis. Students should not be required to know reactants or products.
• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td rowspan="2"><u>Sample Stems</u></td></tr>
<tr><td colspan="2"><u>Possible Evidence</u>

• Students identify a given claim to be supported about a given phenomenon (observable event). The claim includes the idea that plants acquire the materials they need for growth chiefly from air and water.</td></tr>
</table>

- Students describe the given evidence, data, and/or models that support the claim, including evidence of the following:
  - Plant growth over time
  - Changes in the weight of soil and water within a closed system with a plant, indicating that soil does not provide most of the material for plant growth (e.g., changes in weight of soil and a plant in a pot over time, hydroponic growth of plants)
  - Plants' inability to grow without water
  - Plants' inability to grow without air
- Students determine whether the evidence supports the claim, including the following:
  - Whether a particular material (e.g., air, soil) is required for growth of plants
  - Whether a particular material (e.g., air, soil) may provide sufficient matter to account for an observed increase in weight of a plant during growth
- Students use reasoning to connect the evidence to support the claim with argumentation. Students describe a chain of reasoning that includes the following:
  - During plant growth in soil, the weight of the soil changes very little over time, whereas the weight of the plant changes a lot. Additionally, some plants can be grown without soil at all.
  - Because some plants don't need soil to grow and others show increases in plant matter (as measured by weight) but not accompanying decreases in soil matter, the material from soil must not enter the plant in sufficient quantities to be the chief contributor to plant growth.
  - Therefore, plants do not acquire most of the material for growth from soil.
  - A plant cannot grow without water or air. Because both air and water are matter and are transported into the plant system, they can provide the materials plants need for growth.
  - Since soil cannot account for the change in weight as a plant grows and since plants take in water and air, both of which could contribute to the increase in weight during plant growth, plant growth must come chiefly from water and air.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Life Sciences	5.LS2.B.1
Core Idea	**Ecosystems: Interactions, Energy, and Dynamics**
Component	**Cycles of matter and Energy Transfer in Ecosystems**
MLS	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Expectation Unwrapped

[Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and Earth.]

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

- Develop a model to describe phenomena.

DISCIPLINARY CORE IDEAS

Interdependent Relationships in Ecosystems

- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as decomposers. Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

Cycles of Matter and Energy Transfer in Ecosystems

- Matter cycles between the air and soil and between plants, animals, and microbes as these organisms live and die. Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

CROSSCUTTING CONCEPTS

Systems and System Models

- A system can be described in terms of its components and their interactions.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Grades 3-5 SCIENCE

Content Limits/Assessment Boundaries

- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Possible Evidence

- Students develop a model to describe a phenomenon (observable event) that includes the movement of matter within an ecosystem. In the model, students identify the relevant components, including
  - matter.
  - plants.
  - animals.
  - decomposers, such as fungi and bacteria.
  - environment.
- Students describe the relationships among components that are relevant for describing the phenomenon, including
  - the relationships in the system between organisms that consume other organisms, such as
    - animals that consume other animals.
    - animals that consume plants.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Sample Stems

Grades 3-5 SCIENCE

Earth and Space Sciences	5.ESS1.A.1
Core Idea	**Earth's Place in the Universe**
Component	**The Universe and its Stars**
MLS	Support an argument that relative distances from Earth affect the apparent brightness of the sun compared to other stars.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Engaging in Argument from Evidence

- Support an argument with evidence, data, or a model.

DISCIPLINARY CORE IDEAS

The Universe and Its Stars

- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

CROSSCUTTING CONCEPTS

Scale, Proportion, and Quanity

- Natural objects exist, from the very small to the immensely large.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks are limited to relative distances, not sizes, of stars.
- Tasks should not include other factors that affect apparent brightness (e.g., stellar masses, age, life-cycle stage).
- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.
- Data sets should be given in order to provide students with evidence needed to support their arguments.

Possible Evidence

- Students identify a given claim that is about a phenomenon to be supported. The claim includes the idea that the apparent brightness of the sun and stars is due to their relative distances from Earth.

Sample Stems

- Students describe the evidence, data, and/or models that support the claim, such as
  - the sun and other stars are natural bodies in the sky that give off their own light.
  - the apparent brightness of a variety of stars, including the sun.
  - a luminous object close to a person appears much brighter and larger than a similar object that is very far away from a person (e.g., nearby streetlights appear bigger and brighter than distant streetlights).
  - the relative distance of the sun and stars from Earth (e.g., although the sun and other stars are all far from Earth, the stars are very much farther away; the sun is much closer to Earth than other stars).
- Students evaluate the evidence to determine whether it is relevant to supporting the claim and sufficient to describe the relationship between apparent size and apparent brightness of the sun and other stars and their relative distances from Earth.
- Students determine whether additional evidence is needed to support the claim.
- Students use reasoning to connect the relevant and appropriate evidence to the claim with argumentation. Students describe a chain of reasoning that includes points such as the following:
  - Because stars are defined as natural bodies that give off their own light, the sun is a star.
  - The sun is many times larger than Earth but appears small because it is very far away.
  - Even though the sun is very far from Earth, it is much closer to Earth than other stars.
  - Because the sun is closer to Earth than any other star, it appears much larger and brighter than any other star in the sky.
  - Because objects appear smaller and dimmer the farther they are from the viewer, other stars, although immensely large compared to the Earth, seem much smaller and dimmer because they are so far away.
  - Although stars are immensely large compared to Earth, they appear small and dim because they are so far away.
  - Similar stars vary in apparent brightness, indicating that they vary in distance from Earth.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Earth and Space Sciences	5.ESS1.B.1
Core Idea	**Earth's Place in the Universe**
Component	**Earth and the Solar System**
MLS	Make observations during different seasons to relate the amount of daylight to the time of year.

Expectation Unwrapped

[Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Solving Problems

- Ask questions that can be investigated and predict resonable outcomes based on patterns such as cause and effect relationships.

Analyzing and Interpreting Data

- Represent data in tables and/or verious graphical displays, bar graphs, pictographs, and/or pie charts to reveal patterns that indicate relationships.

Using Mathematics and Computational Thinking

- Organize simple data sets to reveal patterns that suggest relationships.

DISCIPLINARY CORE IDEAS

Seasons

- Patterns of seasons can be observed, described, and predicted.

CROSSCUTTING CONCEPTS

Patterns

- Patterns of change can be used to make predictions.

Cause and Effect

- Events that occur together with regularity might or might not be a cause and efffect relationship.

Scale, Proportion, and Quanitity

- Natural objects and/or observable phenomina exist, from the very smal to the immesnely large or from very short to very long time periods.

Stability and Change

- Change is measured in terms of differences over time and may occur at different rates.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Grades 3-5 SCIENCE

Content Limits/Assessment Boundaries

- Tasks should only reflect the seasonal patterns of Missouri.
- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Possible Evidence

- From the given investigation plan, students identify the phenomenon under investigation, which includes the following idea: there is a relationship between the time of year and the amount of daylight.
- From the given investigation plan, students identify the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon.
- From the given investigation plan, students describe the data to be collected that will serve as the basis for evidence.
- From the given investigation plan, students describe the evidence needed, based on observations made during the investigation, including
  - the amount of daylight.
  - the time of year.
- Students describe how the data to be collected will serve as evidence of the relationship between the amount of daylight and the time of year.
- From the given investigation plan, students describe how the data will be collected, including
  - the amount of daylight.
  - the time of year.
- Students make and record observations according to the given investigation plan to provide evidence for the relationship between the amount of daylight and the time of year.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Sample Stems

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Earth and Space Sciences</th><th>5.ESS1.B.2</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Earth’s Place in the Universe
Earth and the Solar System
Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Analyzing and Interpreting Data
• Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.

<u>DISCIPLINARY CORE IDEAS</u>
Earth and the Solar System
• The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South Poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

<u>CROSSCUTTING CONCEPTS</u>
Patterns
• Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should not include the causes of the seasons.
• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td><u>Sample Stems</u></td></tr>
</table>

Grades 3-5 SCIENCE

Possible Evidence

- Using graphical displays (e.g., bar graphs, pictographs) students organize data pertaining to daily and seasonal changes caused by the Earth's rotation and orbit around the sun. Students organize data that includes
  - the length and direction of shadows observed several times during one day.
  - the duration of daylight throughout the year, as determined by sunrise and sunset times.
  - presence or absence of selected stars and/or groups of stars that are visible in the night sky at different times of the year.
- Students use the organized data to find and describe relationships within the datasets, including
  - the apparent motion of the sun from east to west results in patterns of changes in length and direction of shadows throughout a day as Earth rotates on its axis.
  - the length of the day gradually changes throughout the year as Earth orbits the sun, with more daylight hours in the summer and fewer daylight hours in the winter.
  - some stars and/or groups of stars (i.e., constellations) can be seen in the sky all year, while others appear only at certain times of the year.
- Students use the organized data to find and describe relationships between the datasets, including
  - similarities and differences in the timing of observable changes in shadows, daylight, and the appearance of stars show that events occur at different rates (e.g., Earth rotates on its axis once a day, while its orbit around the sun takes a full year).

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Earth and Space Sciences</th><th>5.ESS2.A.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Earth’s Systems
Earth Materials and Systems
Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Developing and Using Models
• Develop a model using an example to describe a scientific principle.

<u>DISCIPLINARY CORE IDEAS</u>
Earth Materials and Systems
• Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

<u>CROSSCUTTING CONCEPTS</u>
Systems and System Models
• A system can be described in terms of its components and their interactions.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Tasks should be limited to the interactions of two systems at time.
• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td><u>Sample Stems</u></td></tr>
</table>

Grades 3-5 SCIENCE

Possible Evidence

- Students develop a model, using a specific given example of a phenomenon (observable event), to describe ways that the geosphere, biosphere, hydrosphere, and/or atmosphere interact. In their model, students identify the relevant components of their example, including features of two of the following systems that are relevant for the given example:
  - Geosphere (i.e., solid and molten rock, soil, sediment, continents, and mountains)
  - Hydrosphere (i.e., water and ice in the form of rivers, lakes, and glaciers)
  - Atmosphere (i.e., wind and oxygen)
  - Biosphere (i.e., plants and animals [including humans])
- Students identify and describe relationships (interactions) within and between the parts of the Earth systems identified in the model that are relevant to the example (e.g., the atmosphere and the hydrosphere interact by exchanging water through evaporation and precipitation; the hydrosphere and atmosphere interact through air temperature changes, which lead to the formation or melting of ice).
- Students use the model to describe a variety of ways in which the parts of two major Earth systems in the specific given example interact to affect Earth's surface materials and processes in that context.
- Students use the model to describe how parts of an individual Earth system
  - work together to affect the functioning of that Earth system.
  - contribute to the functioning of the other relevant Earth system.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

Earth and Space Sciences	5.ESS2.C.1
Core Idea	**Earth's Systems**
Component	**The Role of Water in Earth's Surface Processes**
MLS	Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Using Mathematics and Computational Thinking

- Describe and graph quantities such as area and volume to address scientific questions.

DISCIPLINARY CORE IDEAS

The Roles of Water in Earth's Surface Processes

- Nearly all of Earth's available water is in the oceans. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

CROSSCUTTING CONCEPTS

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight and volume.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks should be limited to oceans, lakes, rivers, glaciers, groundwater, and polar ice caps and do not include the atmosphere.
- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Sample Stems

Possible Evidence

- Students graph the given data (using standard units) about the amount of salt water and the amount of fresh water in each of the following reservoirs, as well as in all the reservoirs combined, to address a scientific question:
  - oceans.
  - lakes.
  - rivers.
  - glaciers.
  - ground water.
  - polar ice caps.
- Students use the graphs of the relative amounts of total salt water and total fresh water in each of the reservoirs to describe that
  - the majority of water on Earth is found in the oceans.
  - most of the Earth's fresh water is stored in glaciers or underground.
  - a small fraction of fresh water is found in lakes, rivers, wetlands, and the atmosphere.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Earth and Space Sciences</th><th>5.ESS3.C.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">Earth and Human Activity
Human Impacts on Earth's Systems
Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Obtaining, Evaluating, and Communicating Information
• Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

<u>DISCIPLINARY CORE IDEAS</u>
Human Impacts on Earth Systems
• Human activiites in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments.

<u>CROSSCUTTING CONCEPTS</u>
Systems and System Models
• A system can be described in terms of its components and their interactions.</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

• Students’ descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.</td><td><u>Sample Stems</u></td></tr>
</table>

Grades 3-5 SCIENCE

Possible Evidence	

• Students obtain information from books and other reliable media about
  ○ how a given human activity (e.g., in agriculture, industry, everyday life) affects the Earth's resources and environments.
  ○ how a given community uses scientific ideas to protect a given natural resource and the environment in which the resource is found.
• Students combine information from two or more sources to provide and describe evidence about
  ○ the positive and negative effects on the environment as a result of human activities.
  ○ how individual communities can use scientific ideas and a scientific understanding of interactions between components of environmental systems to protect a natural resource and the environment in which the resource is found.	

Stimulus Materials Graphic organizers, diagrams, graphs, data tables, drawings	

Grades 3-5 SCIENCE

Engineering, Technology, and Application of Science	5.ETS1.A.1
Core Idea	**Engineering Design**
Component	**Defining and Delimiting Engineering Problems**
MLS	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Defining Problems

- Define a simple design problem that can be solved through the development of and object, tool, processes, system and includes several criteria for success and constraints on materials, time, or cost.

DISCIPLINARY CORE IDEAS

Defining and Deliminating Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for cusses or how well each takes the constraints into account.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Possible Evidence

- Students use given scientific information and information about a situation or phenomenon to define a simple design problem that includes responding to a need or want.
- The problem students define is one that can be solved with the development of a new or improved object, tool, process, or system.
- Students describe that people's needs and wants change over time.
- Students define the limits within which the problem will be addressed, which include addressing something people want and need at the current time.
- Based on the situation people want to change, students specify criteria (required features) of a successful solution.

Sample Stems

• Students describe the constraints or limitations on their design, which may include the following: o Cost o Materials o Time	
Stimulus Materials Graphic organizers, diagrams, graphs, data tables, drawings	

Grades 3-5 SCIENCE

Engineering, Technology, and Application of Science	5.ETS1.B.1
Core Idea	**Engineering Design**
Component	**Developing Possible Solutions**
MLS	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and contraints of the design problem.

DISCIPLINARY CORE IDEAS

Developing Possible Soultions

- Research on a problem should be carreid out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.

Possible Evidence

- Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information.
- Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem.
- Students specify how each design solution solves the problem.
- Students share ideas and findings with others about design solutions to generate a variety of possible solutions.

Sample Stems

• Students describe the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design. The emphasis is on what is necessary for designing solutions not on a step-wise process.
• Students describe
  ○ the given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate.
  ○ how the criteria and constraints will be used to generate and test the design solutions.
• Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem.
• Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem.	

Stimulus Materials Graphic organizers, diagrams, graphs, data tables, drawings	

Grades 3-5 SCIENCE

Engineering, Technology, and Application of Science	5.ETS1.C.1
Core Idea	**Engineering Design**
Component	**Optimizing the Solution Process**
MLS	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Expectation Unwrapped

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

- Planning and carrying out investigations to answer questions or test solutions to problems in grades 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered.

DISCIPLINARY CORE IDEAS

Developing Possible Solutions

- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- N/A

Possible Evidence

- Students describe the purpose of the investigation, which includes finding possible failure points or difficulties to identify aspects of a model or prototype that can be improved.
- Students describe the evidence to be collected, including
  - how well the model/prototype performs against the given criteria and constraints.
  - specific aspects of the prototype or model that do not meet one or more of the criteria or constraints (i.e., failure points or difficulties).
  - aspects of the model/prototype that can be improved to better meet the criteria and constraints.
- Students describe how the evidence is relevant to the purpose of the investigation.

Sample Stems

• Students create a plan for the investigation that describes different tests for each aspect of the criteria and constraints. For each aspect, students describe
  ○ the specific criterion or constraint to be used.
  ○ what is to be changed in each trial (the independent variable).
  ○ the outcome (dependent variable) that will be measured to determine success.
  ○ what tools and methods are to be used for collecting data.
  ○ what is to be kept the same from trial to trial to ensure a fair test.
• Students carry out the investigation, collecting and recording data according to the developed plan.	

Stimulus Materials Graphic organizers, diagrams, graphs, data tables, drawings	