WISCONSIN STATE ESSENTIAL ELEMENTS
LINKAGE LEVEL DESCRIPTORS FOR

Science

STUDENT BASELINE AND POST-INSTRUCTION CHECKLISTS

Wisconsin Department of Public Instruction

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Teaching and Learning Team
Wisconsin Department of Public Instruction

Special Education Team
Wisconsin Department of Public Instruction

Office of Student Assessment Team
Wisconsin Department of Public Instruction

Wisconsin Department of Public Instruction
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Introduction

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All Students, including a student with a most significant cognitive disability, deserve and have a right to a quality educational experience, including engagement in science. This right includes, to the maximum extent possible, the opportunity to be involved in and meet the same challenging expectations that have been established for all students.

The baseline and post-instruction checklists provide resources aligned to the *Wisconsin State Science Essential Elements* and include baselines of current knowledge expected for each level of proficiency, also known as linkage levels. The checklists can be used as a guide to proficiency levels and inform next steps for instruction. In addition, resource links and suggested instructional science lessons are provided for many of the essential elements.

The Wisconsin State Science Essential Elements and Linkage Level Descriptors, Student Baseline and Post-Instruction Checklists were developed by a workgroup of educators from across Wisconsin. The workgroup included general education Science teachers, special education teachers, instructional support coaches, and those in leadership positions throughout the state. The workgroup also included a family engagement representative and WI DPI consultants.

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Acknowledgements

The Wisconsin Department of Public Instruction (DPI) wishes to acknowledge the ongoing work, personal and professional commitment and contributions of the Wisconsin State Science Essential Elements, and Linkage Level Descriptors, Baseline Checklists Workgroup. Their time, expertise, and valuable input resulted in a document that provides guidance towards science instruction aligned to alternate standards.

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Dynamic Learning Maps Citation Information

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Vision Statement

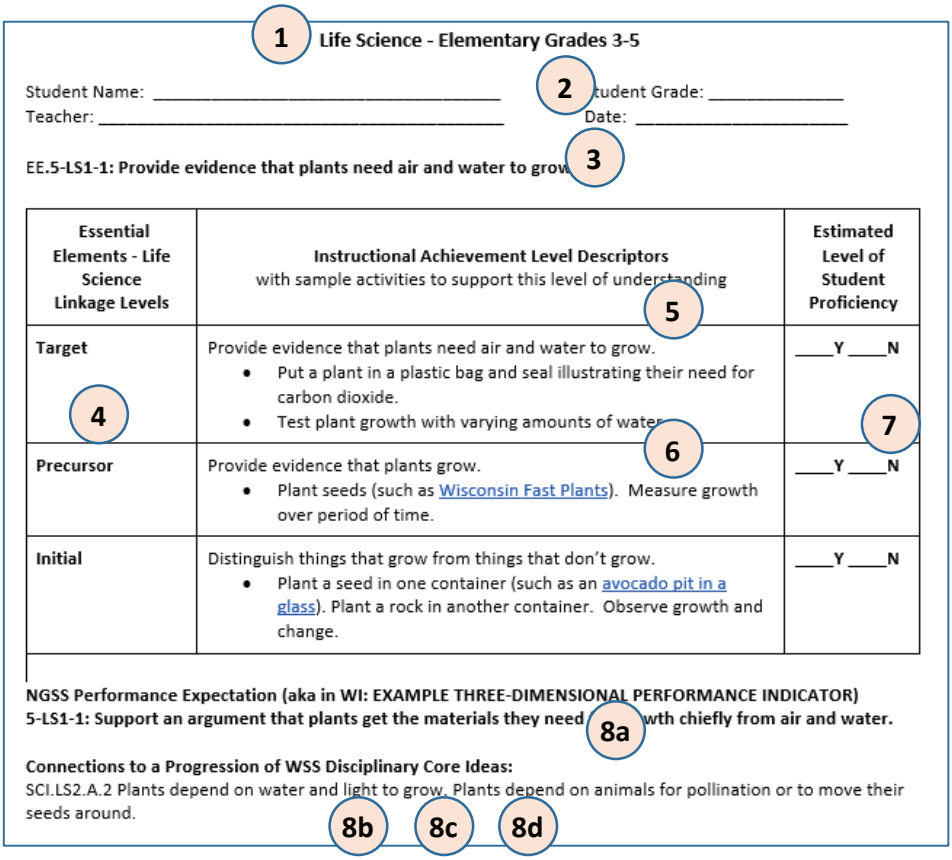
Our state and our communities require scientifically literate citizens who can make informed decisions, help manage our abundant resources, and move our economy forward. In a world of continual innovation and discovery, students across Wisconsin need the ability to apply scientific thinking, skills, and understanding of real-world phenomena and problems. Therefore, student learning must include experiences requiring that type of work.

The National Research Council issued *A Framework for K-12 Science Education* (2012), laying out an expectation for high school graduates that provides a succinct vision for science education supported by Wisconsin educators: "[By] the end of 12th grade, all students have some appreciation of the beauty and wonder of science; possess sufficient knowledge of science and engineering to engage in public discussions on related issues; are careful consumers of scientific and technological information related to their everyday lives; are able to continue to learn about science outside school; and have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology."

Each and every student, including those with the most significant cognitive disabilities, should engage in science practices through hands-on, thought-provoking experiences. Each and every student is expected to actively participate and grow their abilities to question, communicate, and understand core ideas over time. Each and every student in Wisconsin needs these skills to be able to address current problems in their home, community, and society as well as new challenges that will arise. Reflecting on this statewide vision, educators should work with their colleagues and communities to create visions for student science education based on local contexts, and that connect to all students.

Guidance for Using This Document

To clarify, this document is not a standards document. It is a tool to support the implementation of grade-level science standards with students who have the "Most Significant Cognitive Disability". Educators can use this document to see possible progressions of learning toward the essential element standards, with sample science activities included that could support this learning. It is a "baseline" checklist resource, as it can be used to record the baseline of where students are starting in their understanding and where they end up post-instruction. The following image from the document is numbered, with descriptions provided for each number, to further explain the parts of the document and how it might be used.



1 **Life Science - Elementary Grades 3-5**

Student Name: _____ 2 tudent Grade: _____
Teacher: _____ Date: _____

EE.5-LS1-1: Provide evidence that plants need air and water to grow 3

Essential Elements - Life Science Linkage Levels	Instructional Achievement Level Descriptors with sample activities to support this level of understanding 5	Estimated Level of Student Proficiency
Target 4	Provide evidence that plants need air and water to grow. • Put a plant in a plastic bag and seal illustrating their need for carbon dioxide. • Test plant growth with varying amounts of water 6	____Y ____N 7
Precursor	Provide evidence that plants grow. • Plant seeds (such as Wisconsin Fast Plants). Measure growth over period of time.	____Y ____N
Initial	Distinguish things that grow from things that don't grow. • Plant a seed in one container (such as an avocado pit in a glass). Plant a rock in another container. Observe growth and change.	____Y ____N

NGSS Performance Expectation (aka in WI: EXAMPLE THREE-DIMENSIONAL PERFORMANCE INDICATOR)
5-LS1-1: Support an argument that plants get the materials they need 8a wth chiefly from air and water.

Connections to a Progression of WSS Disciplinary Core Ideas:
SCI.LS2.A.2 Plants depend on water and light to grow. Plants depend on animals for pollination or to move their seeds around.

8b 8c 8d

1. The title shows the subject area of the section and the grade band of instruction that would support these standards and the summative Dynamic Learning Maps (DLM) assessment.

2. When a teacher reviews students' learning, they can fill in this top section for reference.

3. This top statement gives the overarching essential elements standard for this page: EE means essential elements, the next number (5) is the grade level, the letters are the subject area (LS – life science, PS – physical science, ESS – earth and space science, and the final number simply states which standard in a sequence this is (so with a number one this is the first standard). .5-LS1-1 standard, noting what each part means.

4. In the left column, you see target, precursor, and initial noted, showing that each row corresponds to a different linkage level. Teachers should be supporting students in moving toward the "target" level.

5. In the middle section, the top line is the linkage level descriptors for target, precursor, and initial. For target, this will be the same as the overarching essential elements standard.

6. Below each linkage level descriptor are some sample activities that could support students' understanding at this developmental level. They are not required by any means, simply ideas that teachers may use. **Ideally, these are activities students would do, not just observe the teacher do.**

7. Teachers can use this document as a checklist, noting whether or not students have successfully achieved the understanding noted in this row – this linkage level. The sample activities can help teachers determine whether or not a student has met a goal.

8. Below the main table, there are links between the Science Essential Elements and the Wisconsin Standards for Science (WSS).

8a. Sample Performance Indicator – this statement connects the three dimensions of the standards (disciplinary core idea, science practice, and crosscutting concept) into an assessment target. These statements are sample indicators of learning at the end of instruction and are not meant to be used to guide instruction. They were built from the performance expectations of the NGSS.

8b. Disciplinary Core Idea (DCI) – the DCI details the content that students understand. The final number or letter indicates the grade level of the DCI. For example, SCI.LS2.A.2 would be for second grade. To support teachers in understanding and building on students' progression of learning, DCIs from previous grades and the target grade are listed.

8c. Science Practices – the science practices detail the skills of scientists in doing their work.

8d. Crosscutting Concepts (CCC) – the CCC is a lens that a scientist/student would use when exploring a phenomenon. They can be developed into questions to guide learning. For example, "What caused that to happen?" is a question based on the crosscutting concept of *cause and effect*.

Life Science Checklist and Sample Activities

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Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Life Science - Elementary Grades 3-5

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.5-LS1-1: Provide evidence that plants need air and water to grow.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Provide evidence that plants need air and water to grow: • Put a plant in a plastic bag and seal illustrating their need for carbon dioxide. • Test plant growth with varying amounts of water.	**____Y ____N**
Precursor	Provide evidence that plants grow: • Plant seeds (such as Wisconsin Fast Plants). Measure growth over a period of time.	**____Y ____N**
Initial	Distinguish things that grow from things that don't grow: • Plant a seed in one container (such as an avocado pit in a glass). Plant a rock in another container. Observe growth and change in each.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS2.A.2 Plants depend on water and light to grow. Plants depend on animals for pollination or to move their seeds around.

SCI.LS1.A.4 Plants and animals have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction.

SCI.LS1.C.5 Plants acquire material for growth chiefly from air, water, and process matter, and obtain energy from sunlight, which is used to maintain conditions necessary for survival. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence

SCI.SEP7.A.K-2 Students compare ideas and representations about the natural and designed world. This includes the following:

- Analyze why some evidence is relevant to a scientific question, and some are not.
- Distinguish between opinions and evidence in one's own explanations.
- Construct an argument with evidence to support a claim.

SCI.SEP7.A.3-5 Students critique the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world. This includes the following:

- Construct or support an argument with evidence, data, or a model.

Connections to a progression of Crosscutting Concepts - Energy and Matter

SCI.CC5.K-2 Students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.

SCI.CC5.3-5 Students understand matter is made of particles and energy can be transferred in various ways and between objects.

EE.5-LS2-1: Create a model that shows the movement of matter (e.g., plant growth, eating, composting) through living things.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Create a model that shows the movement of matter (e.g., plant growth, eating, composting) through living things: • Three Famous Experiments Activity. • Have a school compost barrel. Throw food and plant matter in and watch how it breaks down into its simpler parts.	**____Y ____N**
Precursor	Identify a model that shows the movement of matter from plants to animals (e.g., food chain/food web): • Create a food chain/web of plants and animals from a given list. • "We're all in this Together" Activity.	**____Y ____N**
Initial	Identify common human foods: • Choose from visuals those that are food and which are not (e.g., pencil and apple). Which one gives you energy?	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.C.K Animals obtain the food they need from plants or other animals. Plants need water and light.

SCI.LS1.C.5 Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion. Plants acquire material for growth chiefly from air, water, and process matter, and obtain energy from sunlight, which is used to maintain conditions necessary for survival.

SCI.LS2.A.5 The food of almost any 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, while decomposers restore some materials back to the soil. **(Target)**

SCI.LS2.B.5 Matter cycles between the air and soil and among organisms as they live and die. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.K-2 Students use and develop models (i.e., diagrams drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent concrete events or design solutions. This includes the following:

- Distinguish between a model and the actual object, process, or events the model represents.
- Develop or use a model to represent amounts, relationships, relative scales (bigger, smaller), or patterns in the natural and designed world(s).

SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Collaboratively develop or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop or use models to describe or predict phenomena.

Connections to a progression of Crosscutting Concepts - Systems and System Models

SCI.CC4.K-2 Students understand objects and organisms can be described in terms of their parts and that systems in the natural and designed world have parts that work together.

SCI.CC4.3-5 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. They also describe a system in terms of its components and their interactions.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Life Science - Middle Grades 6-8

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.MS-LS1-3: Make a claim about how a structure (e.g., organs and organ systems) and its related function supports the survival of animals (circulatory, digestive, and respiratory systems).

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample, activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Make a claim about how a structure (e.g., organs and organ systems) and its related function supports the survival of animals (circulatory, digestive, and respiratory systems): • Circulatory: Lesson Ideas for Circulatory System. • Circulatory Model Idea. • Digestive- Discussion of why a person needs to eat. Need for energy to maintain other body systems. • Respiratory: Model a lung with a balloon.	**____Y ____N**
Precursor	Use a model to demonstrate how organs are connected in major organ systems: • Student activities for understanding the functions of body organs. • Body Outline Organ Identification Activity. This activity can be modified with pre-drawn bodies, put the body on wall and have students place organs on the body, noting how they create a system.	**____Y ____N**
Initial	Recognize the major organs of animals: • Basic identification using pictures or models of different organs (for example: heart, lungs stomach, etc., and recognize where they are in their body).	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-LS1-3: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.A.4 Plants and animals have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction.

SCI.LS1.A.m All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence
SCI.SEP7.A.3-5 Students critique the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world. This includes the following:

- Compare and refine arguments based on an evaluation of the evidence presented.
- Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.

SCI.SEP7.A.m Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. This includes the following:

- Construct, use, or present 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.
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

Connections to a progression of Crosscutting Concepts - Systems and System Models
SCI.CC4.3-5 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. They also describe a system in terms of its components and their interactions.

SCI.CC4.m Students understand that systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.

EE.MS-LS1-5: Interpret data to show that environmental resources (e.g., food, light, space, water) influence growth of organisms (e.g., drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, fish growing larger in large ponds than small ponds).

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Interpret data to show that environmental resources (e.g., food, light, space, water) influence growth of organisms (e.g., drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, fish growing larger in large ponds than small ponds): • Submit simple house plants (e.g., geraniums) to various conditions like light and dark, lack of water versus abundant water, less fertilizer versus more, etc. and note results.	**____Y ____N**
Precursor	Identify factors that influence the growth of organisms: • Pair basic needs to organisms. • Identify environmental conditions that can affect organism growth.	**____Y ____N**
Initial	Match organisms to their habitats: • Matching bird to tree/prairie, fish to pond, etc.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS4.C.3 Particular organisms can only survive in particular environments.

SCI.LS1.C.5 Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion. Plants acquire material for growth chiefly from air, water, and process matter, and obtain energy from sunlight, which is used to maintain conditions necessary for survival.

SCI.LS1.B.m Animals engage in behaviors that increase the odds of reproduction. An organism's growth is affected by both genetic and environmental factors. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.A.3-5 Students use evidence to construct explanations that specify variables that describe and predict phenomena. This includes the following:

- Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation.
- Identify the evidence that supports particular points in an explanation.

SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments, and built on 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.
- Apply scientific ideas, principles, or evidence to construct, revise, or use an explanation for real-world phenomena, examples, or events.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.3-5 Students routinely identify and test causal relationships and use these relationships to explain the change. They understand events that occur together with regularity may or may not signify a cause and effect relationship.

SCI.CC2.m Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

EE.MS-LS2-2: Use models of food chains/webs to identify producers and consumers in aquatic and terrestrial ecosystems.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use models of food chains/webs to identify producers and consumers in aquatic and terrestrial ecosystems: • Given a simple food chain or web, label the producers and consumers.	**____Y ____N**
Precursor	Classify animals based on what they eat (e.g., herbivore, omnivore, or carnivore): • Complete a card sort of animals in the categories above.	**____Y ____N**
Initial	Identify the food that animals eat: • Match images of food (e.g., plants, other animals) with images of animals that eat that food.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.C.K Animals obtain the food they need from plants or other animals. Plants need water and light.

SCI.LS2.A.5 The food of almost any 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, while decomposers restore some materials back to the soil.

SCI.LS2.B.m Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions
SCI.SEP6.A.3-5 Students use evidence to construct explanations that specify variables that describe and predict phenomena. This includes the following:

- Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation.

- Identify the evidence that supports particular points in an explanation.

SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Construct an explanation using models or representations.

Connections to a progression of Crosscutting Concepts - Patterns

SCI.CC1.3-5 Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and use these patterns to make predictions.

SCI.CC1.m Students use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

EE.MS-LS3-2: Make a claim supported by evidence that offspring inherit traits from their parents.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Make a claim supported by evidence that offspring inherit traits from their parents: • Given a set of mixed up pictures of organisms and offspring, have the students match up the parent or offspring pairs and explain why they paired them the way they did.	**____Y ____N**
Precursor	Identify similarities and differences between plant and animal parents and their offspring (e.g., eye color, hair or fur color, height, leaf shape, or markings). • Analyze family pictures of parents and children that students bring into class. • If possible, have a dog breeder bring in a litter of puppies and parents.	**____Y ____N**
Initial	Recognize that organisms differ within the same species (e.g., dogs, chickens, oaks that differ in color and size): • Given a set of dog pictures, sort them into groups. • Compare traits of classmates (eye color, hair color, etc.).	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-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.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS3.A.1 Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.

SCI.LS3.B.1 Individuals of the same kind of plant or animal are recognizable as similar, but can also vary in many ways.

SCI.LS3.A.3 Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment. Many characteristics involve both inheritance and environment.

SCI.LS3.B.3 Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.

SCI.LS3.B.m In sexual reproduction, each parent contributes half of the genes acquired by the offspring resulting in variation between parent and offspring. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Collaboratively develop or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop or use models to describe or predict phenomena.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Develop or use a model to predict or describe phenomena.

Connections to a progression of Crosscutting Concepts - Cause and Effect
SCI.CC2.3-5 Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity may or may not signify a cause and effect relationship.

SCI.CC2.m They use cause and effect relationships to predict phenomena in natural or designed systems.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Life Science – High School Grades 9-12

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.HS-LS1-2: Use a model to illustrate the organization and interaction of major organs into systems (e.g., circulatory, respiratory, digestive, sensory) in the body to provide specific functions.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use a model to illustrate the organization and interaction of major organs into systems (e.g., circulatory, respiratory, digestive, sensory) in the body to provide specific functions: • Use a tube or other objects as a model of digestive system organs, showing the input of food, nutrient absorption, and output of waste. • Create or use a lung model to illustrate how the lungs and the respiratory system function.	**____Y ____N**
Precursor	Identify which organs work for a specific function: • Given the picture cards from below and some additional, like the senses, match the organ to the function (i.e., heart - pump blood)	**____Y ____N**
Initial	Recognize that different organs have different functions: • Given pictures of various common external and internal structures of humans (hands, feet, face, heart, lungs, stomach) discuss the function of each.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.A.4 Plants and animals have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction.

SCI.LS1.D.4 Different sense receptors are specialized for particular kinds of information; animals use their perceptions and memories to guide their actions.

SCI.LS1.A.m All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions.

SCI.LS1.A.h Systems of specialized cells within organisms help perform essential functions of life. Any one system in an organism is made up of numerous parts. Feedback mechanisms maintain an organism's internal conditions within certain limits and mediate behaviors. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use or develop a model of simple systems with uncertain and less predictable factors.
- Develop or use a model to predict or describe phenomena.

SCI.SEP2.A.h Students use, synthesize, and develop models to predict and show relationships among variables between systems and their components in the natural and designed world. This includes the following:

- Develop, revise, or use a model based on evidence to illustrate or predict the relationships between systems or between components of a system.
- Develop or use multiple types of models to provide mechanistic accounts or predict phenomena, and move flexibly between model types based on merits and limitations.

Connections to a progression of Crosscutting Concepts - Systems and System Models
SCI.CC4.m Students understand that systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.

SCI.CC4.h Students investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They use models (e.g., physical, mathematical, computer models) to simulate the flow of energy, matter, and interactions within and between systems at different scales. They also use models and simulations to predict the behavior of a system and recognize that these predictions have limited precision and reliability due to the assumptions and approximations inherent in the models. They also design systems to do specific tasks.

EE.HS-LS1-4: Use a model to illustrate how growth occurs when cells multiply.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Use a model to illustrate how growth occurs when cells multiply: • Video that can help teachers understand the process of mitosis. • Students can use clay to create a model of the different phases of mitosis.	**____Y ____N**
Precursor	Use a model to relate the number of cells to the size of a body: • Use blocks to build buildings of different sizes. Compare the number of blocks needed for small buildings versus the number needed for larger buildings. • Teacher background info to understand how cell number and size are related. How many cells are there?	**____Y ____N**
Initial	Recognize that organisms are composed of cells: • Use blocks to build larger buildings. Equate the blocks to cells and that all living things are made up of different cells. • This is a link to a website the details how to use a microscope to look at simple human and plant cells. Animal and Plant Cell Activity Link	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.A.m All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions.

SCI.LS1.B.h Growth and division of cells in organisms occurs by mitosis and differentiation for specific cell types. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use or develop a model of simple systems with uncertain and less predictable factors.
- Develop or use a model to predict or describe phenomena.

SCI.SEP2.A.h Students use, synthesize, and develop models to predict and show relationships among variables between systems and their components in the natural and designed world. This includes the following:

- Develop or use multiple types of models to provide mechanistic accounts or predict phenomena, and move flexibly between model types based on merits and limitations.

Connections to a progression of Crosscutting Concepts - Systems and System Models

SCI.CC4.m Students understand that systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study.

SCI.CC4.h Students investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They use models (e.g., physical, mathematical, computer models) to simulate the flow of energy, matter, and interactions within and between systems at different scales. They also use models and simulations to predict the behavior of a system and recognize that these predictions have limited precision and reliability due to the assumptions and approximations inherent in the models. They also design systems to do specific tasks.

EE.HS-LS2-2: Use a graphical representation to explain the dependence of an animal population on other organisms for food and their environment for shelter.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Use a graphical representation to explain the dependence of an animal population on other organisms for food and their environment for shelter: • Kaibob Population Activity & Graphing • Use basic algebraic understanding of slope to see whether populations are changing quickly or slowly in relation to other environmental factors (like food availability or habitat destruction).	**____Y ____N**
Precursor	Recognize the relationship between population size and available resources for food and shelter from a graphical representation. • Students recognize the pattern of predator and prey population cycles - prey population goes up, and the predator population goes up, then the prey population goes down, and the predator population goes down.	**____Y ____N**
Initial	Identify food and shelter needs for familiar wildlife. • Visit a local zoo or wildlife center and observe and discuss the needs of wildlife.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS2.A.5 The food of almost any 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, while decomposers restore some materials back to the soil.

SCI.LS2.A.m Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems, but the patterns are shared.

SCI.LS2.A.h Ecosystems have carrying capacities resulting from biotic and abiotic factors. The fundamental tension between resource availability and organism populations affects the abundance of

species in any given ecosystem. The combination of the factors that affect an organism's success can be measured as a multidimensional niche. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Using Mathematics and Computational Thinking

SCI.SEP5.A.m Students identify patterns in large data sets and use mathematical concepts to support explanations and arguments. This includes the following:

- Use mathematical representations to describe or support scientific conclusions and design solutions.

SCI.SEP5.A.h Students use algebraic thinking and analysis, a range of linear and nonlinear functions (including trigonometric functions, exponentials, and logarithms), and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. This includes the following:

- Use mathematical, computational, or algorithmic representations of phenomena or design solutions to describe or support claims or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Connections to a progression of Crosscutting Concepts - Scale, Proportion, and Quantity

SCI.CCS3.m They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale.

SCI.CCS3.h Students understand the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. They use orders of magnitude to understand how a model at one scale relates to a model at another scale.

EE.HS-LS3-2: Defend why reproduction may or may not result in offspring with different traits.

Essential Elements - Life Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Defend why reproduction may or may not result in offspring with different traits: • Look at data of when common mutations came about in human history - blue eyes, digesting lactose, and red hair - to show that these traits suddenly appeared instead of slowly evolving. • Use a tangible model to show combinations of recessive genes can produce new traits.	**____Y ____N**
Precursor	Make a claim supported by evidence that parents and offspring may have different traits: • Collect data from students in the class, compare student or parent combinations with the same traits and those with different traits to provide evidence that some offspring look different than parents. • Look at the evidence from livestock or pets that parents and offspring may have different traits (litter of kittens).	**____Y ____N**
Initial	Compare the traits of parents and offspring. • Observe pictures of students, siblings, parents, and grandparents as possible and compare and contrast what traits they see -- hair color, eye color, nose shape, height, etc.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, or (3) mutations caused by environmental factors.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS3.A.1 Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.

SCI.LS3.A.3 Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment. Many characteristics involve both inheritance and environment.

SCI.LS3.B.3 Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.

SCI.LS3.B.m In sexual reproduction, each parent contributes half of the genes acquired by the offspring resulting in variation between parent and offspring. Genetic information can be altered because of mutations, which may result in beneficial, negative, or no change to proteins in or traits of an organism.

SCI.LS3.B.h The variation and distribution of traits in a population depend on genetic and environmental factors. Genetic variation can result from mutations caused by environmental factors or errors in DNA replication, or from chromosomes swapping sections during meiosis. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence

SCI.SEP7.A.m Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. This includes the following:

- Construct, use, or present 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.

SCI.SEP7.A.h Students use appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world. Arguments may also come from current scientific or historical episodes in science. This includes the following:

- Evaluate the claims, evidence, or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Construct, use, or present an oral and written argument or counter-arguments based on data and evidence.
- Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Connections to Crosscutting Concepts - Cause and Effect

SCI.CC2.m They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

SCI.CC2.h They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.

EE.HS-LS4-2: Explain how the traits of particular species allow them to survive in their specific environments

Essential Elements - Life Science Linkage Levels	Linkage Level Descriptors with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Explain how the traits of particular species allow them to survive in their specific environments: • Show through a sequence of picture selecting (or verbally reporting) what would happen to species in an environment they don't typically belong.	**____Y ____N**
Precursor	Identify factors in an environment that require special traits to survive: • Describe factors in the Antarctic, desert, or Wisconsin environments and unique traits of animals in those environments (e.g., penguins need certain traits in order to survive in the extreme cold; have fur to touch)	**____Y ____N**
Initial	Match particular species to their various environments: • Providing pictures, match: deer to woods, fish to pond, bird to tree.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS4.D.2 There are many different kinds of living things in any area, and they exist in different places on land and in water.

SCI.LS4.C.3 Particular organisms can only survive in particular environments.

SCI.LS4.D.3 Populations of organisms live in a variety of habitats. Change in those habitats affects the organisms living there.

SCI.LS4.B.m Both natural and artificial selection result from certain traits giving some individuals an advantage in surviving and reproducing, leading to predominance of certain traits in a population.

SCI.LS4.C.m Species can change over time in response to changes in environmental conditions through adaptation by natural selection acting over generations. Traits that support successful survival and reproduction in the new environment become more common.

SCI.LS4.C.h Evolution results primarily from genetic variation of individuals in a species, competition for resources, and proliferation of organisms better able to survive and reproduce. Adaptation means that the distribution of traits in a population, as well as species expansion, emergence, or extinction, can change when conditions change. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence

SCI.SEP7.A.m Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. This includes the following:

- Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence or interpretations of facts.
- Construct, use, or present 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.

SCI.SEP7.A.h Students use appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world. Arguments may also come from current scientific or historical episodes in science. This includes the following:

- Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.
- Respectfully provide or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions.
- Construct, use, or present an oral and written argument or counter-arguments based on data and evidence.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.m They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

SCI.CC2.h They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.

6

Physical Science Checklist and Sample Activities

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Physical Science – Elementary Grades 3-5

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.5-PS1-2: Measure and compare weights of substances before and after heating, cooling, or mixing substances to show that weight of matter is conserved.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Measure and compare weights of substances before and after heating, cooling, or mixing substances to show that weight of matter is conserved: • Weigh a volume of water before freezing. Once frozen, compare the weight of the ice cube to the weight of the water found previously. • Caramel Corn Assessment Activity	**____Y ____N**
Precursor	Compare the weight of an object before and after it changes from a liquid to a solid and from a solid to a liquid: • Compare the weight of an ice cube to the weight of the melted ice cube. Use a balance scale and a Ziploc bag for ice/water. • Make pudding and compare weights before and after solidifying.	**____Y ____N**
Initial	Recognize the change in state from liquid to solid or from solid to liquid of the same material: • Present ice cubes and have student feel the cubes. Show a picture of an ice cube labeled "solid". Watch an ice cube as it melts. Have student feel the water. Show a picture of water labeled "liquid". • Present a solid ice cube and a melted ice cube. Have student match the picture of solid ice cube to the actual ice cube and the picture of the melted ice cube (liquid) to the actual melted ice cube.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
5-PS1-2: 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.

SCI.PS1.A.2 Matter exists as different substances that have different observable properties. Different properties are suited to different purposes.

SCI.PS1.B.2 Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

SCI.PS1.A.5 Matter exists as particles that are too small to see. Matter is always conserved, even if it seems to disappear. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Using Mathematics and Computational Thinking
SCI.SEP5.A,B.K-2 Students recognize that mathematics can be used to describe the natural and designed world. This includes the following:

- Describe, measure, or compare quantitative attributes of different objects and display the data using simple graphs.

SCI.SEP5.A,B.3-5 Students extend quantitative measurements to a variety of physical properties, using computation and mathematics to analyze data and compare alternative design solutions. This includes the following:

- Organize simple data sets to reveal patterns that suggest relationships.
- Describe, measure, estimate, or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.

Connections to a progression of Crosscutting Concepts - Scale, Proportion, and Quantity
SCI.CCS3.K-2 Students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects.

SCI.CCS3.3-5 Students use standard units to measure and describe physical quantities such as mass, time, temperature, and volume.

EE.5-PS1-3: Make observations and measurements to identify materials based on their properties (e.g., weight, shape, texture, buoyancy, color, or magnetism).

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Make observations and measurements to identify materials based on their properties (e.g., weight, shape, texture, buoyancy, color, or magnetism): • Given a group of objects, identify properties, based on observations (i.e., non-magnetic vs. magnetic, soft vs. hard) and measurements (i.e., heavier vs. lighter). • Present round and square items (some that float and some that do not). Observe and chart shape. Place each item in a tank of water and chart whether or not it floated. Use the chart to classify into groups—round items that float, etc.	**____Y ____N**
Precursor	Classify materials by physical properties. (e.g., weight, shape, texture, buoyancy, color, or magnetism): • Sort a group of objects using a selected property. • Present a chart with columns labeled round or square. Present a pile of items that are round and square. Have the student place each item in the correct column.	**____Y ____N**
Initial	Match materials with similar physical properties: • Put two objects of the same color together. • Present three items (e.g., feather, tissue, chair) and ask, "Which is light like the feather?"	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-PS1-3: Make observations and measurement to identify materials based on their properties

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS1.A.2 Matter exists as different substances that have different observable properties. Different properties are suited to different purposes.

SCI.PS1.A.5 Measurements of a variety of observable properties can be used to identify particular materials. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Planning and Conducting Investigations

SCI.SEP3.A.K-2 Students plan and carry out simple investigations, based on fair tests, which provide data to support explanations or design solutions. This includes the following:

- Evaluate different ways of observing or measuring a phenomenon to determine which way can answer the question being studied.
- Make observations (firsthand or from media) or measurements to collect data that can be used to make comparisons.

SCI.SEP3.A.3-5 Students plan and carry out investigations that control variables and provide evidence to support explanations or design solutions. This includes the following:

- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Connections to a progression of Crosscutting Concepts - Scale, Proportion, and Quantity

SCI.CCS3.K-2 Students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.

SCI.CCS3.3-5 Students recognize natural objects, and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as mass, time, temperature, and volume.

EE.5-PS2-1: Demonstrate that the gravitational force exerted by Earth on objects is directed down.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Demonstrate that the gravitational force exerted by Earth on objects is directed down: • When requested, drop an object to demonstrated understanding of the term "gravity".	**____Y ____N**
Precursor	Predict the direction an object will go when dropped: • Indicate which direction the object <u>will go</u> (up or down) before dropped (use UP and DOWN cards).	**____Y ____N**
Initial	Recognize the direction an object will go when dropped. • Look at objects (feather, paper, book) as they are dropped. • After dropped, ask the student to point to an arrow pointing up or an arrow pointing down to identify direction.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS2.B.5 The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. **(Initial, Precursor, Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence
SCI.SEP7.A.3-5 Students critique the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world. This includes the following:

- Construct or support an argument with evidence, data, or a model.
- Use data to evaluate claims about cause and effect.

Connections to a progression of Crosscutting Concepts - Cause and Effect
SCI.CC2.K-2 Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.

SCI.CC2.3-5 Students routinely identify and test causal relationships and use these relationships to explain the change. They understand events that occur together with regularity may or may not signify a cause and effect relationship.

EE.5-PS3-1: Create a model to describe that energy in animals' food was once energy from the Sun.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Create a model to describe that energy in animals' food was once energy from the Sun: • Demonstrate in pictorial form that animals eat different types of plants. • Present an unfinished model (missing sun) of how energy in plants was once energy from the sun. Provide various pictures (including one picture of the sun) and have the student select the picture of the sun to complete the model.	**____Y ____N**
Precursor	Use models to describe that plants capture energy from sunlight: • Compare the growth and health of a plant that has had sun vs. a plant that has been in the dark.	**____Y ____N**
Initial	Identify simple models that show that plants need sunlight to grow: • Place a plant in the dark and make observations to show the plant does not survive without sunlight.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-PS3-1: Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the Sun.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.LS1.C.K Animals obtain the food they need from plants or other animals. Plants need water and light.

SCI.LS2.A.2 Plants depend on water and light to grow.

SCI.PS3.D.4, 5 Plants capture energy from sunlight which can be used as fuel or food. Stored energy in food or fuel can be converted to usable energy.

SCI.LS1.C.5 Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion. Plants acquire material for growth chiefly from air, water, and process matter, and obtain energy from sunlight, which is used to maintain conditions necessary for survival. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models

SCI.SEP2.A.K-2 Students use and develop models (i.e., diagrams drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent concrete events or design solutions. This includes the following:

- Distinguish between a model and the actual object, process, or events the model represents.

SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Develop or use models to describe or predict phenomena.

Connections to a progression of Crosscutting Concepts - Energy and Matter

SCI.CC5.3-5 Students understand energy can be transferred in various ways and between objects.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Physical Science – Middle School Grades 6-8

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.MS-PS1-2: Interpret and analyze data on the properties (e.g., color, texture, odor, and state of matter) of substances before and after chemical changes have occurred (e.g., burning sugar or burning steel wool, rust, effervescent tablets).

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Interpret and analyze data on the properties (e.g., color, texture, odor, and state of matter) of substances before and after chemical changes have occurred (e.g., burning sugar or burning steel wool, rust, effervescent tablets): • Given pictures of various substances before and after chemical changes (e.g., sugar, steel wool, effervescent tablets) match the "before" pictures to the "after" pictures of each substance. • Make a table showing each substance before and after the chemical change and have students indicate that a new substance was formed.	**____Y ____N**
Precursor	Gather data on the properties (e.g., color, texture, odor, and state of matter) of substances before and after chemical changes have occurred (e.g., burning sugar or burning steel wool, rust, effervescent tablets): • Describe the change in substances before and after chemical changes (change on a match after burning, see bubbles in effervescent tablets, smell the odor from wood splint). • Take pictures of each substance before and after the chemical change.	**____Y ____N**
Initial	Observe and identify examples of change (e.g., state of matter, color, temperature, and odor): • Melt ice, boil water. • Burn paper to show color change. • Place effervescent tablets in water.	**____Y ____N**

	• Present a nail. Present a rusted nail and a non-rusted nail. Ask student to identify the nail that "changed."	

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-PS1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS1.A.2 Matter exists as different substances that have different observable properties.

SCI.PS1.B.2 Heating or cooling a substance may cause changes that can be observed.

SCI.PS1.A.5 Measurements of a variety of observable properties can be used to identify particular materials.

SCI.PS1.B.5 Chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties.

SCI.PS1.B.m Reacting substances rearrange to form different molecules [with different properties]. (**Target)**

Connections to a progression of Science Practices and related sub-skills - Analyzing and Interpreting Data
SCI.SEP4.A.3-5 Students begin to use quantitative approaches to collect data and conduct multiple trials of qualitative observations. (When possible, digital tools should be used.) This includes the following:

- Represent data in tables or various graphical displays (bar graphs, pictographs, or pie charts) to reveal patterns that indicate relationships.
- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, or computation.

SCI.SEP4.A.m Students extend quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. This includes the following:

- Analyze and interpret data to determine similarities and differences in findings.

Connections to a progression of Crosscutting Concepts - Patterns
SCI.CC1.3-5 Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and use these patterns to make predictions.

SCI.CC1.m Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

EE.MS-PS2-2: Investigate and predict the change in motion of objects based on the forces acting on those objects.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Investigate and predict the change in motion of objects based on the forces acting on those objects: • Given two toy cars and two different ramps (different heights, materials, lengths), make predictions about which car will go faster or farther. • Using a fan with a small object in front of the fan, have student predict the change in motion if the fan is turned to different speeds.	**____Y ____N**
Precursor	Investigate and identify ways to change the motion of an object (e.g., change an incline's slope to make an object go slower, faster, farther): • Use toy cars on different heights and slopes of tracks or boards to make connections. • Place a light-weight object in front of a fan. Measure and chart how far object moves in five seconds when the fan is turned off when it is turned on low, when it is turned on medium, and when it is turned on high speed. Discuss how the motion of the object was changed.	**____Y ____N**
Initial	Identify ways to change the movement of an object (e.g., faster, slower, stop): • Use small toys with wheels to demonstrate ways to make the cars go “faster,” “slower,” and “stop” using verbal or visual instructions. • Given two moving objects, identify which is slower, faster, stopping, etc.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS2.A.K Pushes and pulls can have different strengths and directions, and can change the speed or direction of an object’s motion, or start or stop it. A bigger push or pull makes things speed up or slow down more quickly.

SCI.PS2.A.3 Qualities of motion and changes in motion require a description of both size and direction. The effect of unbalanced forces on an object results in a change of motion. Patterns of motion can be used to predict future motion.

SCI.PS2.A.m Motion and changes in motion can be qualitatively described using concepts of speed, velocity, and acceleration (including speeding up, slowing down, or changing direction). **(Target)**

Connections to a progression of Science Practices and related sub-skills - Planning and Conducting Investigations

SCI.SEP3.A.3-5 Students plan and carry out investigations that control variables and provide evidence to support explanations or design solutions. This includes the following:

- 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 considered.
- Make predictions about what would happen if a variable changes.

SCI.SEP3.A.m Students plan and carry out investigations that use multiple variables and provide evidence to support explanations or solutions. This includes the following:

- Conduct an investigation.
- Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation.
- Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions.

Connections to a progression of Crosscutting Concepts - Stability and Change

SCI.CC7.3-5 Students measure the change in terms of differences over time and observe that change may occur at different rates.

SCI.CC7.m Students explain stability and change in natural or designed systems by examining changes over time and considering forces at different scales. They understand changes in one part of a system might cause large changes in another part.

EE.MS-PS3-3: Test and refine a device (e.g., foam cup, insulated box, or thermos) to either minimize or maximize thermal energy transfer (e.g., keeping liquids hot or cold, preventing liquids from freezing, keeping hands warm in cold temperatures).

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Test and refine a device (e.g., foam cup, insulated box, or thermos) to either minimize or maximize thermal energy transfer (e.g., keeping liquids hot or cold, preventing liquids from freezing, keeping hands warm in cold temperatures): • Choose a device to test (determined by the student) to hold an ice cube and keep it from melting. • Use four cups: one plastic, three Styrofoam of similar size. Nest two of the Styrofoam cups together. Add hot water to each (plastic, single styro, and nested styro). Measure the temperature every minute and chart for 15 minutes. Make a claim about what minimized the thermal energy transfer.	**____Y ____N**
Precursor	Investigate objects/materials, and predict their ability to maximize or minimize thermal energy transfer: • Place an ice cube in an insulated thermos and make predictions about if it will melt or stay frozen. • Use two cups (same size). One made of thin plastic and one made of foam. Place the same amount of hot water in each cup. Measure and chart the temperature of the water. Measure the temperature of the water in each cup and chart the temperature every minute. Compare the temperatures and have student answer, "If I want to keep my hot cocoa warm, which cup would be my best choice?"	**____Y ____N**
Initial	Identify objects/materials used to minimize or maximize thermal energy transfer (e.g., gloves, vacuum flask (thermos), insulated hot pad holder or foam cup): • Hold an ice cube in a foam cup. • Hold an ice cube in a warm cup. • Show a wool cap, and a baseball cap and have the student identify which one would keep them warm. Show a cotton shirt and a winter coat and ask which one would keep them warmer.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS3.B.4 Energy can be moved from place to place by moving objects, or through sound, light, heat or electrical currents.

SCI.PS3.B.m Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions
SCI.SEP6.B.3-5 Students use evidence in designing multiple solutions to design problems. This includes the following:

- Apply scientific ideas to solve design problems.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

SCI.SEP6.B.m Students design solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas or principles to design, construct, or test a design of an object, tool, process, or system.

Connections to a progression of Crosscutting Concepts - Energy and Matter
SCI.CC5.3-5 Students understand energy can be transferred in various ways and between objects.

SCI.CC5.m Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.

EE.MS-PS4-2: Use a model to show how light waves (e.g., light through a water glass, light on colored objects) or sound waves are reflected, absorbed, or transmitted through various materials (e.g., water, air, table).

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use a model to show how light waves (e.g., light through a water glass, light on colored objects) or sound waves are reflected, absorbed, or transmitted through various materials (e.g., water, air, table): • Listen to sounds through various materials placed over the ears like a Ziploc bag, Ziploc bag with water, various types, and thicknesses of fabrics. • Look at a light bulb through various colored filters after seeing the light from a prism. Explain why filters are only one color? • Shining a flashlight on a mirror and seeing the reflection on the wall. (Ray diagram the reflection).	**____Y ____N**
Precursor	Investigate changes in vibrations and sources of sound in everyday life: • Look at various kinds of vibrating objects that make a sound (tuning forks, speakers, create "clucking ducks" from string and cups).	**____Y ____N**
Initial	Use a model to recognize that sound waves are transmitted by vibrations: • Using a press and seal wrap, put over a speaker and have small, lightweight items like pepper flakes, salt, etc. "dance" on the speaker.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS4.A.1 Sound can make matter vibrate, and vibrating matter can make a sound.

SCI.PS4.B.1 Objects can be seen only when light is available to illuminate them.

SCI.PS4.B.4 Objects can be seen when light reflected from their surface enters our eyes.

SCI.PS4.B.m The construct of a wave is used to model how light interacts with objects. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Use models to describe or predict phenomena.

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use a model to predict or describe phenomena.

Connections to a progression of Crosscutting Concepts - Structure and Function
SCI.CC6.3-5 Students understand different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.

SCI.CC6.m Students model systems and visualize how their function depends on the shapes, composition, and relationships among their parts.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Physical Science – High School Grades 9-12

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.HS-PS1-2: Make a claim supported by evidence to explain patterns of chemical properties that occur in a substance during a common chemical reaction (e.g., baking soda and vinegar).

<table>
<tr><th>Essential Elements - Physical Science Linkage Levels</th><th>Linkage Level Descriptors
with sample activities to support this level of understanding</th><th>Estimated Level of Student Proficiency</th></tr>
<tr><td>Target</td><td>Make a claim supported by evidence to explain patterns of chemical properties that occur in a substance during a common chemical reaction (e.g., baking soda and vinegar):
• Using two cups, add baking soda to the water in one cup and baking soda to vinegar in the other cup. Have student identify the chemical reaction and describe what happened.</td><td>____Y ____N</td></tr>
<tr><td>Precursor</td><td>Identify the changes that have occurred during a chemical reaction (e.g., metal-rust, paper-burn):
• Identify that products to make slime change from a liquid to a solid when mixed.
• Use table to give evidence that a chemical change happened:
<table>
<tr><td>Items</td><td>Before</td><td>After</td></tr>
<tr><td>Vinegar and
Baking soda</td><td>Clear liquid
White powder</td><td>Bubbles</td></tr>
</table></td><td>____Y ____N</td></tr>
<tr><td>Initial</td><td>Recognize that a change has occurred during a chemical reaction.
• Watch products (glue, borax, contact solution) change when mixed together to make slime.
• Show a nail. Show a rusted nail and a non-rusted nail. Ask the student to identify the nail that changed.
• Show paper. Show burned paper and paper. Ask the student to identify the paper that changed.</td><td>____Y ____N</td></tr>
</table>

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS1.A.2 Matter exists as different substances that have different observable properties.

SCI.PS1.B.2 Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

SCI.PS1.B.5 Chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties.

SCI.PS1.B.m Some reactions release energy, and others absorb energy.

SCI.PS1.A.h Repeating patterns of the periodic table reflect patterns of outer electrons. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions
SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas, principles, or evidence to construct, revise, or use an explanation for real-world phenomena, examples, or events.

SCI.SEP6.A.h Students create explanations that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review), 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.

Connections to a progression of Crosscutting Concepts - Patterns
SCI.CC1.m Students use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

SCI.CC1.h Students observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena.

EE.HS-PS2-3: Evaluate the effectiveness of safety devices and design a solution that could minimize the force of a collision.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Evaluate the effectiveness of safety devices and design a solution that could minimize the force of a collision: • Have students design "protection" for eggs and conduct an egg drop experiment.	**____Y ____N**
Precursor	Use data to compare the effectiveness of safety devices to determine which best minimizes the force of a collision: • Provide a chart for the results of an egg drop experiment where one egg was wrapped in numerous layers of bubble wrap, while the other egg was not wrapped.	**____Y ____N**
Initial	Identify safety equipment devices that minimize the force of a collision (e.g., floor mats, helmets, or steel-toed boots): • Show a helmet and a wool cap. Ask, "Which one will protect your head when you skateboard?" • Show shin guards and socks. Ask, "Which one will protect your legs when you play soccer?"	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-PS2-3: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS2.B.K When objects touch or collide, they push on one another and can result in a change of motion.

SCI.PS2.A.m For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).

SCI.PS2.A.h If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.B.m Students design solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas or principles to design, construct, or test a design of an object, tool, process, or system.
- Undertake a design project, engaging in the design cycle, to construct or implement a solution that meets specific design criteria and constraints.
- Optimize the performance of a design by prioritizing criteria, making trade-offs, testing, revising, and retesting.

SCI.SEP6.A.h Students create explanations that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas, principles, or evidence to provide an explanation of phenomena taking into account possible, unanticipated effects.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.m They use cause and effect relationships to predict phenomena in natural or designed systems.

SCI.CC2.h They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems.

EE.HS-PS3-4: Investigate and predict the temperatures of two liquids before and after combining to show uniform energy distribution.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Investigate and predict the temperatures of two liquids before and after combining to show uniform energy distribution: • Present two glasses of water. Measure the temperature of each and record on a chart. One should be hot (but not hot enough to burn) and the other should be cold. Predict the temperature of the water when the two glasses are combined. Combine the two cups of water and measure the temperature. Compare it to the predictions.	**____Y ____N**
Precursor	Compare the temperatures of two liquids of different temperatures before and after combining: • Present two glasses of water. Measure the temperature of each and record on a chart--one should be hot (but not hot enough to burn) and the other should be cold. Combine the two cups of water and measure the temperature.	**____Y ____N**
Initial	Compare the relative difference in temperature (warmth, coldness) of two liquids: • Present 2 glasses of water, one with ice and one without ice (lukewarm). Ask the student to identify the water that is cooler and the one that is warmer.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS3.B.4 Energy can be moved from place to place by moving objects, or through sound, light, or electrical currents. Energy can be converted from one form to another form.

SCI.PS3.B.m Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter.

SCI.PS3.A.h Systems move towards more stable states. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Planning and Conducting Investigations

SCI.SEP3.A.m Students plan and carry out investigations that use multiple variables and provide evidence to support explanations or solutions. This includes the following:

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

SCI.SEP3.A.h Students plan and carry out investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models: This includes the following:

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.

Connections to a progression of Crosscutting Concepts - Systems and System Models

SCI.CC4.m Students use models to represent systems and their interactions.

SCI.CC4.h Students investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs.

EE.HS-PS4-5: Make a claim supported by evidence that shows how some devices use light and sound waves to transmit and capture information.

Essential Elements - Physical Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Make a claim supported by evidence that shows how some devices use light and sound waves to transmit and capture information: • Have kids record themselves using a microphone and recording device. Use recording and speaker movement as evidence for the claim. • Demonstrate using a video recorder projected on a screen that remote controls, when used, will flash in a specific pattern. • Test cup phones, noting vibrations in cups and string. Test different set-ups for evidence.	**____Y ____N**
Precursor	Identify common devices which use light or sound waves to transmit information: • Be able to do a card sort of objects that use light and sound and those that don't.	**____Y ____N**
Initial	Identify how common technological devices are used for different purposes: • Look at the things that are human-made around the room. All of these can be considered technology; discuss their uses.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-PS4-5: Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.PS4.C.1 People use devices to send and receive information.

SCI.PS4.C.4 Patterns can encode, send, receive, and decode information.

SCI.PS4.C.m Waves can be used to transmit digital information.

SCI.PS4.A.h Waves can be used to transmit information and energy. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Obtaining, Evaluating, and Communicating Information

SCI.SEP8.A.m Students evaluate the merit and validity of ideas and methods. This includes the following:

- Clarify claims and findings by integrating text-based qualitative and quantitative scientific information with information contained in media and visual displays.
- Describe how they are supported or not supported by evidence and evaluate the methods used.

SCI.SEP8.A.h Students evaluate the validity and reliability of claims, methods, and designs. This includes the following:

- Communicate scientific or technical information or ideas.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.m They use cause and effect relationships to predict phenomena in natural or designed systems.

SCI.CC2.h They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems.

7 Earth and Space Science Checklist and Sample Activities

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Earth and Space Science – Elementary School Grades 3-5

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.5-ESS1-2: Represent and interpret data on a picture, line, or bar graph to show seasonal patterns in the length of daylight hours.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Represent and interpret data on a picture, line, or bar graph to show seasonal patterns in the length of daylight hours: • Noon solar angle animation. • Create a chart of sunrise sunset in different places of the country and world.	**____Y ____N**
Precursor	Recognize patterns about the length of daylight hours over time (e.g., week to week, month to month): • Chart local sunrise and sunset daily and monthly.	**____Y ____N**
Initial	Order events in daily routine including sunrise and sunset: • Chart am and pm indicating during sunrise and during sunset activities with words or pictures.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-ESS1-2: 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.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS1.A.1 Patterns of movement of the sun, moon, and stars, as seen from Earth, can be observed, described, and predicted.

SCI.ESS1.B.1 Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

SCI.ESS1.B.5 The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observable patterns. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Analyzing and Interpreting Data

SCI.SEP4.A.K-2 Students collect, record, and share observations. This includes the following:

- Record information (observations, thoughts, and ideas).
- Use and share pictures, drawings, or writings of observations.
- Use observations (firsthand or from media) to describe patterns or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems. Compare predictions (based on prior experiences) to what occurred (observable events).

SCI.SEP4.A.3-5 Students begin to use quantitative approaches to collect data and conduct multiple trials of qualitative observations. (When possible, digital tools should be used.) This includes the following:

- Represent data in tables or various graphical displays (bar graphs, pictographs, or pie charts) to reveal patterns that indicate relationships.

Connections to a progression of Crosscutting Concepts - Patterns

SCI.CC1.K-2 Students recognize that patterns in the natural and human-designed world can be observed, used to describe phenomena, and used as evidence.

SCI.CC1.3-5 Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and use these patterns to make predictions.

EE.5-ESS2-1: Develop a model showing how water (hydrosphere) affects the living things (biosphere) found in a region.

Essential Elements - Earth Science Linkage Levels	Linkage Level Descriptors with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Develop a model showing how water (hydrosphere) affects the living things (biosphere) found in a region: • Explain the water cycle. • Grow a hydroponic plant.	**____Y ____N**
Precursor	Recognize how water (hydrosphere) affects people in a region (e.g., floods, droughts, mudslide, tourism, and recreation): • Identify natural disasters involving water. • Identify the impact of water in specific climates (i.e., desert, rainforest, prairie).	**____Y ____N**
Initial	Anticipate routines (e.g., clothes to wear, activities to do) to follow when it is raining: • Identify appropriate clothing and equipment for the weather.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, or atmosphere interact.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.D.K Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time. People record weather patterns over time.

SCI.ESS2.A.2 Wind and water change the shape of the land.

SCI.ESS2.A.4,5 Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.K-2 Students use and develop models (i.e., diagrams drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent concrete events or design solutions. This includes the following:

- Distinguish between a model and the actual object, process, or events the model represents.

- Develop or use a model to represent amounts, relationships, relative scales (bigger, smaller), or patterns in the natural and designed world(s).

SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Collaboratively develop or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop or use models to describe or predict phenomena.

Connections to a progression of Crosscutting Concepts - Systems and System Models

SCI.CC4.K-2 Students understand objects and organisms can be described in terms of their parts and that systems in the natural and designed world have parts that work together.

SCI.CC4.3-5 Students understand a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They also describe a system in terms of its components and their interactions.

EE.5-ESS3-1: Use information to describe how people can help protect the Earth's resources and how that affects the environment.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Use information to describe how people can help protect the Earth's resources and how that affects the environment: • Explain why we should recycle. • Provide an example of how to protect Earth's resources. • Using a video or other evidence, explain how people's actions affect the environment.	**____Y ____N**
Precursor	Compare two methods people can use to help protect the Earth's resources: • Identify one way to protect the earth's resources. • Identify Earth's resources.	**____Y ____N**
Initial	Identify one way to protect a resource of Earth (e.g., put the paper in the recycling bin): • Identify where to place different pieces of refuse (garbage or recycling).	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.C.K Things people do can affect the environment, but they can make choices to reduce their impacts.

SCI.ESS3.C.5 Societal activities have had major effects on the land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Obtaining, Evaluating, and Communicating Information
SCI.SEP8.A.K-2 Students use observations and texts to communicate new information. This includes the following:

- Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.

- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question or supporting a scientific claim.
- Communicate information or design ideas or solutions with others in oral or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, or design ideas.

SCI.SEP8.A.3-5 Students evaluate the merit and accuracy of ideas and methods. This includes the following:

- Read and comprehend grade-appropriate complex texts or other reliable media to summarize and obtain scientific and technical ideas, and describe how they are supported by evidence.
- Obtain and combine information from books or other reliable media to explain phenomena or solutions to a design problem.

Connections to a progression of Crosscutting Concepts - Systems and System Models

SCI.CC4.K-2 Students understand objects and organisms can be described in terms of their parts and that systems in the natural and designed world have parts that work together.

SCI.CC4.3-5 Students understand a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They also describe a system in terms of its components and their interactions.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Earth and Space Science – Middle School Grades 6-8

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.MS-ESS1-1: Use an Earth-Sun-Moon model to show that Earth's orbit around the Sun corresponds to a calendar year and the orbit of the Moon around Earth corresponds to a month.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use an Earth-Sun-Moon model to show that Earth's orbit around the Sun corresponds to a calendar year and the orbit of the Moon around Earth corresponds to a month: • Given a model, explain if the model is of a year or a month.	**____Y ____N**
Precursor	Use a model to show that Earth's Moon moves around Earth, and Earth and its Moon move around the Sun: • Given three different sized spherical objects, demonstrate the revolution of the moon around the earth and the earth around the sun with objects of correct relative size.	**____Y ____N**
Initial	Recognize models of the Earth, Moon, and Sun system: • Identify the Earth, Moon, or Sun within a model.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-ESS1-1: Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS1.A.1 Patterns of movement of the sun, moon, and stars, as seen from Earth, can be observed, described, and predicted.

SCI.ESS1.B.5 The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observable patterns.

SCI.ESS1.B.m The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Develop or use models to describe or predict phenomena.

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Develop or use a model to predict or describe phenomena.
- Develop a model to describe unobservable mechanisms.

Connections to a progression of Crosscutting Concepts - Patterns
SCI.CC1.3-5 Students identify patterns related to time, including simple rates of change and cycles, and use these patterns to make predictions.

SCI.CC1.m Students use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

EE.MS-ESS2-1: Use a model to describe the change within the rock cycle between the igneous, metamorphic, and sedimentary rock.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Use a model to describe the change within the rock cycle between igneous, metamorphic, and sedimentary rock: • Given easily identifiable rocks, identify what type they are relative to a rock cycle diagram. • Connect an "edible rock cycle model" to the parts of the rock cycle.	**____Y ____N**
Precursor	Use a model to describe the change from igneous to sedimentary rock: • Compare and contrast the properties of an igneous and sedimentary rock. • Identify a model that shows the change from an igneous to sedimentary rock versus one that does not.	**____Y ____N**
Initial	Identify the process that forms igneous rock (e.g., volcanoes): • Match images of earth processes to the type of rock formed (e.g., volcanoes and pumice). • Given a group of objects, identify a rock.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.A.4,5 Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around.

SCI.ESS2.A.m Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Develop or use models to describe or predict phenomena.

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Develop or use a model to predict or describe phenomena.
- Develop a model to describe unobservable mechanisms.

Connections to a progression of Crosscutting Concepts - Stability and Change

SCI.CC7.3-5 Students measure the change in terms of differences over time and observe that change may occur at different rates.

SCI.CC7.m Students explain stability and change in natural or designed systems by examining changes over time.

EE.MS-ESS2-2: Explain how geoscience processes that occur daily (e.g., wind, rain, runoff) slowly change the surface of Earth, while catastrophic events (e.g., earthquakes, tornadoes, floods) can quickly change the surface of Earth.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample, activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Explain how geoscience processes that occur daily (e.g., wind, rain, runoff) slowly change the surface of Earth, while catastrophic events (e.g., earthquakes, tornadoes, floods) can quickly change the surface of Earth: • Use a model like a stream table to recreate geoscience processes and show that they can be slow or catastrophic. • Identify a catastrophic event and explain the effect on the earth's surface. • Identify weathering and explain the effect on the earth's surface. Find examples in the school yard.	**____Y ____N**
Precursor	Identify geoscience processes (e.g., wind, rain, runoff) that have an impact on landforms (e.g., landslides, erosion such as gullies): • Cause an event (using a large fan and sand or water and soil) that changes the earth's surface in the school yard. • Identify when a change in the earth's surface has occurred and identify events that cause those changes.	**____Y ____N**
Initial	Identify differences in weather conditions from day to day: • Identify a picture of a weather condition matching that day's weather. Compare it to previous days.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.D.K Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time. People record weather patterns over time.

SCI.ESS2.A.2 Wind and water change the shape of the land.

SCI.ESS2.A.4,5 Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around.

SCI.ESS2.C.m Water movement causes weathering and erosion, changing landscape features. (**Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.A.3-5 Students use evidence to construct explanations that specify variables which describe and predict phenomena. This includes the following:

- Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation.
- Identify the evidence that supports particular points in an explanation.

SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas, principles, or evidence to construct, revise, or use an explanation for real-world phenomena, examples, or events.
- Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.

Connections to a progression of Crosscutting Concepts - Scale, Proportion, and Quantity

SCI.CCS3.3-5 Students recognize natural objects, and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as mass, time, temperature, and volume.

SCI.CCS3.m Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small.

EE.MS-ESS2-6: Interpret basic weather information (e.g., radar, map) to make predictions about future conditions (e.g., precipitation, temperature, wind).

Essential Elements - Earth Science Linkage Levels	Linkage Level Descriptors with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Interpret basic weather information (e.g., radar, map) to make predictions about future conditions (e.g., precipitation, temperature, wind): • Provide students a National Weather Service map and ask them to use it to make predictions about upcoming Wisconsin weather.	**____Y ____N**
Precursor	Interpret basic weather information (e.g., radar, map) to compare weather conditions (either over several days at the same location or different locations on the same day): • Watch a brief weather forecast video showing a local, regional, or national map, and then ask students to provide evidence for their comparisons of weather conditions across the area.	**____Y ____N**
Initial	Interpret basic weather information (e.g., radar, map) to identify weather conditions: • Take students outside to observe weather and then connect their observations to what they see on a radar-based weather map.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.D.K Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time. People record weather patterns over time.

SCI.ESS2.D.3 Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed.

SCI.ESS2.D.m Complex interactions determine local weather patterns and influence climate, including the role of the ocean. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP2.A.3-5 Students build and revise simple models and use models to represent events and design solutions. This includes the following:

- Develop or use models to describe or predict phenomena.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use and develop a model of simple systems with uncertain and less predictable factors.
- Develop and use a model to predict and describe phenomena.

Connections to a progression of Crosscutting Concepts - Patterns

SCI.CCS1.3-5 Students identify patterns related to time, including simple rates of change and cycles, and use these patterns to make predictions.

SCI.CCS3.m Students identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.

EE.MS-ESS3-1: Interpret, based on evidence, how the geoscience processes (e.g., weathering, erosion) create resources.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Interpret, based on evidence, how the geoscience processes (e.g., weathering, erosion) create resources: • Use a model for evidence to explain the production of coal or natural gas. • Rub sandstone together and use that evidence to explain how weathering creates frack sand.	**____Y ____N**
Precursor	Identify the geoscience process that produces a natural resource (e.g., solar energy creating wind energy, rock cycle with ores and minerals): • Connect renewable energy sources to the processes that create them (geothermal – heat in the earth, hydroelectric – rivers, wind turbines – wind, solar panels – sun). • Identify the connection between the rock cycle and useful rocks and gems; connect the cause of wind (uneven heating of atmosphere) to wind energy production.	**____Y ____N**
Initial	Identify a natural resource (e.g., water, sand, wind): • Identify a picture of water, sand, or wind. Contrast that to a resource that is not natural (e.g., plastic).	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-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.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.A.K Humans use natural resources for everything they do.

SCI.ESS3.A.4 Energy and fuels humans use are derived from natural sources, and their use affects the environment. Some resources are renewable over time; others are not.

SCI.ESS3.A.m Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.A.3-5 Students use evidence to construct explanations that specify variables that describe and predict phenomena. This includes the following:

- Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation.
- Identify the evidence that supports particular points in an explanation.

SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments, and built on 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.
- Apply scientific ideas, principles, or evidence to construct, revise, or use an explanation for real-world phenomena, examples, or events.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.3-5 Students routinely identify and test causal relationships and use these relationships to explain the change. They understand events that occur together with regularity may or may not signify a cause and effect relationship.

SCI.CC2.m Students use cause and effect relationships to predict phenomena in natural or designed systems.

EE.MS-ESS3-3: Develop a plan to monitor and minimize a human impact on the local environment (e.g., water, land, pollution).

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Develop a plan to monitor and minimize a human impact on the local environment (e.g., water, land, pollution): • Keep a "trash inventory" for a day and week and discuss how much is thrown away. • Develop a plan to minimize trash created.	**____Y ____N**
Precursor	Recognize ways in which humans impact the environment (e.g., agriculture, pollution, recycling, city growth): • Identify a way in which humans are interacting with their environment, noting positive or negative impacts.	**____Y ____N**
Initial	Recognize resources (e.g., food, water, shelter, air) in the local environment that are important for human life: • Identify a picture of a familiar resource (food, water, shelter, etc.) important for life.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.A.K Humans use natural resources for everything they do

SCI.ESS3.C.K Things people do can affect the environment, but they can make choices to reduce their impacts.

SCI.ESS3.A.4 Energy and fuels humans use are derived from natural sources, and their use affects the environment. Some resources are renewable over time; others are not.

SCI.ESS3.C.5 Societal activities have had major effects on the land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments.

SCI.ESS3.C.m Human activities have altered the hydrosphere, atmosphere, and lithosphere, which in turn has altered the biosphere. Changes to the biosphere can have different impacts on different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.B.3-5 Students use evidence in designing multiple solutions to design problems. This includes the following:

- Apply scientific ideas to solve design problems.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

SCI.SEP6.B.m Students design solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas or principles to design, construct, or test a design of an object, tool, process, or system.
- Undertake a design project, engaging in the design cycle, to construct or implement a solution that meets specific design criteria and constraints.
- Optimize the performance of a design by prioritizing criteria, making trade-offs, testing, revising, and retesting.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.3-5 Students routinely identify and test causal relationships and use these relationships to explain the change. They understand events that occur together with regularity may or may not signify a cause and effect relationship.

SCI.CC2.m Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

Wisconsin State Science Essential Elements and Linkage Level Descriptors
Student Baseline and Post-Instruction Checklist
with Sample Leveled Activities

Earth and Space Science – High School Grades 9-12

Student Name: _____ Student Grade: _____
Teacher: _____ Date: _____

EE.HS-ESS1-4: Use a model of Earth and the Sun to show how Earth's tilt and orbit around the Sun cause changes in seasons.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use a model of Earth and the Sun to show how Earth's tilt and orbit around the Sun cause changes in seasons: • Translate a physical model of the seasons to a conceptual/pictorial model. • Exploratorium modeling seasons activity. • Solar Animation.	**____Y ____N**
Precursor	Use a model of Earth and sun to show how Earth's positions in its orbit around the Sun correspond with the four seasons: • Using a model such as a bare lamp and ball on a stick, identify that the earth is tilted and how this tilt results in different seasons. • Using thermometer strips on a ball outside, show that it's warmer in direct vs. indirect sunlight.	**____Y ____N**
Initial	Identify characteristics of the seasons: • Relate images of seasons to activities and clothes worn in each.	**____Y ____N**

Connections to the Wisconsin Standards for Science (WSS)

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS1.B.1 Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

SCI.ESS1.B.5 The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observable patterns.

SCI.ESS1.B.m The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.

SCI.ESS1.B.h Kepler's laws describe common features of the motions of orbiting objects. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Using Mathematical and Computational Thinking
SCI.SEP5.A.h Use mathematical, computational, and algorithmic representations of phenomena or design solutions to describe and support claims and explanations.

Connections to a progression of Crosscutting Concepts - Scale, Proportion, and Quantity
SCI.CCS3.m Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small.

SCI.CCS3.h Students understand the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. They recognize patterns observable at one scale may not be observable or exist at other scales, and some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. They use orders of magnitude to understand how a model at one scale relates to a model at another scale. They use algebraic thinking to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

EE.HS-ESS2-1: Use a model to show how constructive forces (e.g., volcanoes) and destructive mechanisms (e.g., weathering, coastal erosions) change Earth's surface.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	**Estimated Level of Student Proficiency**
Target	Use a model to show how constructive forces (e.g., volcanoes) and destructive mechanisms (e.g., weathering, coastal erosions) change Earth's surface: • While showing an online animation of mountain building at the boundaries of earth plates, model this with two sheets of playdough on waxed paper and move the sheet together to model how the crust (playdough) goes upward when colliding. • Model erosion and weathering with a simple stream table or on school grounds.	**____Y ____N**
Precursor	Recognize if processes that change Earth's surface are constructive or destructive: • Given a picture or model of a process, identify whether it is constructive or destructive.	**____Y ____N**
Initial	Recognize changes (e.g., mountain formation, erosion, and glacial changes) that occurred on Earth's surface: • View videos or animations of earth processes, or observe similar processes in the school yard, and identify that change occurred. Discuss and model how they occurred.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS2-1: Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.E.K Plants and animals can change their local environment.

SCI.ESS2.A.2 Wind and water change the shape of the land.

SCI.ESS2.A.4,5 Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around.

SCI.ESS2.C.m Water movement causes weathering and erosion, changing landscape features.

SCI.ESS2.A.h Feedback effects exist within and among Earth's systems. **(Target)**

SCI.ESS2.C.h The planet's dynamics are greatly influenced by water's unique chemical and physical properties. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use or develop a model of simple systems with uncertain and less predictable factors.

SCI.SEP2.A.h Students use, synthesize, and develop models to predict and show relationships among variables between systems and their components in the natural and designed world. This includes the following:

- Develop, revise, or use a model based on evidence to illustrate or predict the relationships between systems or between components of a system.

Connections to a progression of Crosscutting Concepts - Stability and Change
SCI.CC7.m Students explain stability and change in natural or designed systems by examining changes over time and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.

SCI.CC7.h Students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.

EE.HS-ESS2-4: Using a model, recognize how the effects of changes in climate can impact human lives.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Using a model, recognize how the effects of changes in climate can impact human lives: • Create a diagram or picture that demonstrates changes that can be caused by climate changes. • Identify news articles and broadcasts related to natural disasters and note human impacts.	**____Y ____N**
Precursor	Recognize climate changes have occurred (e.g., a change in average temperature, precipitation patterns, glacial ice volumes, sea levels): • Create a simple graph (line, bar, etc.) that shows a change in average temperature for a region, sea levels, duration of lake freeze, or amount of glacial ice to recognize changing patterns over time.	**____Y ____N**
Initial	Recognize the differences between geographical climates (e.g., Minnesota versus Florida, desert versus rainforest): • Identify pictures representing the geographical climate of Wisconsin and contrast it with other climates.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS2.D.3 Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed.

SCI.ESS2.D.m Complex interactions determine local weather patterns and influence climate, including the role of the ocean.

SCI.ESS2.D.h The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Developing and Using Models
SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following:

- Use or develop a model of simple systems with uncertain and less predictable factors.
- Use a model to predict or describe phenomena.

SCI.SEP2.A.h Students use, synthesize, and develop models to predict and show relationships among variables between systems and their components in the natural and designed world. This includes the following:

- Design a test of a model to ascertain its reliability.
- Develop, revise, or use a model based on evidence to illustrate or predict the relationships between systems or between components of a system.
- Develop a complex model that allows for manipulation and testing of a proposed process or system.

Connections to a progression of Crosscutting Concepts - Cause and Effect
SCI.CC2.m Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

SCI.CC2.h Students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects.

EE.HS-ESS3-1: Construct an explanation based on evidence for how natural hazards have influenced human activity.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Construct an explanation based on evidence for how natural hazards have influenced human activity: • Evaluate examples of people preparing for Natural Hazards (e.g., tornado drills, alert systems). • Use videos, articles, and other evidence of the aftermath of natural disasters to explain how they impact humans.	**____Y ____N**
Precursor	Recognize how natural hazards (e.g., floods, earthquakes, tornadoes) influence human activity: • Recognize how natural hazards displace people from home at least temporarily. • Match images of natural disasters to images of their impacts (e.g., tornado and torn off the roof; blizzard or flood and cars stuck in the road).	**____Y ____N**
Initial	Recognize the characteristics of natural hazards (e.g., floods, earthquakes, tornadoes): • Identify a picture of a natural hazard (flood, earthquake, tornado, etc.). Compare the causes of these hazards.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS3-1: Construct an explanation based on evidence on how the availability of natural resources, hazards, and climate have influenced human activity.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.B.K In a region, some kinds of severe weather are more likely than others. Forecasts allow communities to prepare for severe weather.

SCI.ESS3.B.3,4 A variety of hazards result from natural processes; humans cannot eliminate hazards but can reduce their impacts

SCI.ESS3.B.m Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces.

SCI.ESS3.B.h Natural hazards and other geological events have shaped the course of human history at local, regional, and global scales. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Constructing Explanations and Designing Solutions

SCI.SEP6.B.m Students design solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Apply scientific ideas or principles to design, construct, or test a design of an object, tool, process, or system.

SCI.SEP6.A.h Students create explanations that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. This includes the following:

- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review), 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.

Connections to a progression of Crosscutting Concepts - Cause and Effect

SCI.CC2.m Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be explained using probability.

SCI.CC2.h Students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.

EE.HS-ESS3-2: Construct an argument for a strategy to conserve, recycle, or reuse resources.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Construct an argument for a strategy to conserve, recycle, or reuse resources: • Discuss various strategies for collecting and recycling containers, paper, etc. in your school. Argue a best method for improving recycling or conservation or argue a way to improve an existing method. Present to building administration and implement in the building.	**____Y ____N**
Precursor	Describe the factors that would favor one strategy to conserve, recycle, or reuse resources over another: • Evaluate various ways of disposing, recycling, or reusing a grocery bag. Discuss the pros and cons of each method. • Look at data on costs of recycling, reusing, or conserving resources such as plastic. Use that data to support a strategy.	**____Y ____N**
Initial	Recognize strategies to manage objects (e.g., dispose, repurpose, or recycle): • Identify a pair or series of before and after pictures as a disposal of an object, reuse of an object (for the same purpose), repurpose of an object or recycle of the object.	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.C.K Things people do can affect the environment, but they can make choices to reduce their impacts.

SCI.ESS3.C.5 Societal activities have had major effects on the land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments.

SCI.ESS3.C.m Human activities have altered the hydrosphere, atmosphere, and lithosphere, which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.

SCI.ESS3.C.h Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Engaging in Argument from Evidence

SCI.SEP7.A.m Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. This includes the following:

- Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence or interpretations of facts.
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

SCI.SEP7.A.h Students use appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world. Arguments may also come from current scientific or historical episodes in science. This includes the following:

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, or logical arguments regarding relevant factors (e.g., economic, societal, environmental, ethical considerations).

Connections to Nature of Science

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions.
- Many decisions are not made using science alone but rely on social and cultural contexts to resolve issues.

EE.HS-ESS3-3: Analyze data to determine the effects of a conservation strategy on the level of a natural resource.

Essential Elements - Earth Science Linkage Levels	**Linkage Level Descriptors** with sample activities to support this level of understanding	Estimated Level of Student Proficiency
Target	Analyze data to determine the effects of a conservation strategy on the level of a natural resource: • Interpret a simple graph to show how conservation efforts such as recycling paper or fuel-efficient cars relates to use of a specific natural resource (e.g., forests, aluminum, oil, etc.).	**____Y ____N**
Precursor	Organize data on the effects of conservation strategies (e.g., using less energy, using rechargeable batteries, recycling, or repurposing materials): • Analyze a simple chart of before and after energy use for a building level initiative like installing motion detectors on lights or solar panels.	**____Y ____N**
Initial	Gather data on the effects of a local (e.g., class or school-wide) conservation strategy: • Chart effectiveness of conservation strategy (like recycling) with number, words, or pictures (e.g., how much did we recycle over time).	**____Y ____N**

<u>Connections to the Wisconsin Standards for Science (WSS)</u>

Sample Three-Dimensional Performance Indicator from the WSS (or NGSS Performance Expectation)
HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Connections to a progression of WSS Disciplinary Core Ideas (building toward the grade-level Target expectation)
SCI.ESS3.C.K Things people do can affect the environment, but they can make choices to reduce their impacts.

SCI.ESS3.C.5 Societal activities have had major effects on the land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments.

SCI.ESS3.C.m Human activities have altered the hydrosphere, atmosphere, and lithosphere, which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.

SCI.ESS3.A.h Resource availability has guided the development of human society, and the use of natural resources has associated costs, risks, and benefits. **(Target)**

Connections to a progression of Science Practices and related sub-skills - Using Mathematics and Computational Thinking

SCI.SEP5.A.m Students identify patterns in large data sets and use mathematical concepts to support explanations and arguments. This includes the following:

- Use mathematical representations to describe or support scientific conclusions and design solutions.

SCI.SEP5.A.h Students use algebraic thinking and analysis, a range of linear and nonlinear functions (including trigonometric functions, exponentials, and logarithms), and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. This includes the following:

- Create or revise a computational model or simulation of a phenomenon, designed device, process, or system.

Connections to a progression of Crosscutting Concepts - Stability and Change

SCI.CC7.m Students explain stability and change in natural or designed systems by examining changes over time.

SCI.CC7.h Students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.

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