Windham School District

Grades K-8

Science Curriculum

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WINDHAM SCHOOL DISTRICT

Science Grades K-8

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Mission Statement

The Windham School Science & Technology curriculum is designed to develop curious graduates willing to take on the challenge of solving problems. The program is designed to inspire all students to experience wonder and appreciation for the natural and designed world and to prepare them for success as students, scientists and citizens. Each course is in alignment with the expectations of the Next Generation Science Standards (NGSS) and is designed to offer students a hands-on experience of content-rich investigations that will ensure students are able to grow in their ability to think creatively, ponder problems, and propose solutions based on evidence and reason. Science investigations allow students to develop their inquiry skills so that they may learn to confidently initiate and investigate their own questions. The teachers who deliver the curriculum are committed to helping students grow their scientific perspective, improve their skill level with technology so they will thrive in their future academic studies and careers, have the ability to solve the problems they encounter and a greater appreciation of the physical universe throughout their lives.

Throughout our program we engage students in the eight Science and Engineering Practices identified in the NGSS Standards:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

Title of Curriculum: Kindergarten: Forces and Interactions

Unit Name	What (Standards)	How (SEP)	Why (Cross Cutting)
Pushes and Pulls	● Compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. ● Design a solution to change the speed or direction of an object with a push or pull.	● Plan and conduct an investigation ● Analyze data	● Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Title of Curriculum: Kindergarten: Interdependent Relationships in Ecosystems

Unit Name	What (Standards)	How (SEP)	Why (Cross Cutting)
Animals, Plants, and Their Environment	● Describe patterns of what plants and animals (including humans)need to survive.	● Use observation	● Patterns in the natural and human designed world can be observed and used as evidence. ● Events have causes that generate observable patterns. ● Systems in the natural and designed world have parts that work together.

Title of Curriculum: Kindergarten: Weather and Climate

Unit Name	What (Standards)	How (SEP)	Why (Cross Cutting)
Weather and Climate	● Determine the effect of sunlight on Earth's surface. ● Design and build a structure that will reduce the warming effect of sunlight on an area. ● Describe patterns of local weather conditions over time. ● Obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	● Make observations ● Use tools and materials ● Use and share observations ● Ask questions	● Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. ● Events have causes that generate observable patterns. ● People encounter questions about the natural world every day. ● People depend on various technologies in their lives; human life would be very different without technology.

Windham School District Curriculum
Forces and Interactions/Pushes and Pulls - Kindergarten

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to and apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution.

Content Standards:

Transfer

Students will be able to

- Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- Analyze data to determine if a design solution works as intended to change the speed or direction of an object.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

ESSENTIAL QUESTIONS

- What are the effects of different strengths of forces on the motion of an object?
- How does this knowledge impact engineering and designs of tomorrow?

Acquisition

Students will know…

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull makes things speed up or slow down more quickly.
- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions.

Students will be skilled at…

- With guidance, plan and conduct an investigation in collaboration with peers
- Analyze data from tests of an object or tool to determine if it works as intended

● K-PS2-1 Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. ● K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*		
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-PS2-2) ● W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS2-1) ● SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-PS2-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (K-PS2-1) ● K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-PS2-1) ● K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. (K-PS2-1)		*Scientists use different ways to study the world.* ● Critical Thinkers ● Communication ● Information Literacy ● Technology Literacy

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will: ● Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object, ie. measure the distance of object ● Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.
	OTHER EVIDENCE: ● Teacher observation of student participation. ● Use kindergarten science rubric.

Windham School District Curriculum
Interdependent Relationships in Ecosystems/Animals, Plants, and Their Environment - Kindergarten

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to an understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live.

Content Standards:

- K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
- K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
- K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*

Transfer

Students will be able to

- Use observations to describe patterns of what plants and animals (including humans) need to survive.
- Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs
- Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
- Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

Meeting

ENDURING UNDERSTANDINGS
Students will understand that…

- Patterns in the natural and human designed world can be observed and used as evidence.
- Events have causes that generate observable patterns.
- Systems in the natural and designed world have parts that work together.

ESSENTIAL QUESTIONS

- How do plants and animals (including humans) depend upon each other?
- What is the relationship between the needs of living things and where they live?
- How do the choices of humans impact our Earth?

Acquisition

Students will know…

- All animals need food to live and grow.
- Animals obtain their food from plants or from other animals.
- All plants need water and light to live and grow.
- Plants and animals can change their environment.
- Living things need water, air, resources from the land, and they live in places that have the things they need.
- Humans use natural resources.

Students will be skilled at…

- developing models (diagrams, drawings, dioramas , or storyboards) that represent concrete events or design solutions.
- Students will use observation to describe patterns found in the natural world in order to answer scientific questions.
- Students will construct an argument with evidence to support a claim.
- Students will communicate solutions with others in oral or written forms using models

	● Humans can make choices that reduce their impact on land, water, air, and other living things. ● Sketches, drawings, or physical models can communicate ideas for problem solving.	and or drawings that provide details about scientific ideas.
Used in Content Area Standards		***21st Century Skills***
● RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-ESS2-2) ● W.K.1 Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book. (K-ESS2-2) ● W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic. (K-ESS2-2),(K-ESS3-3) ● W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-LS1-1) ● SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail. (K-ESS3-1) ● Mathematics – ● MP.2 Reason abstractly and quantitatively. (K-ESS3-1) ● MP.4 Model with mathematics. (K-ESS3-1) ● K.CC Counting and Cardinality (K-ESS3-1) ● K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference. (K-LS1-1)		Our Earth and life is dependent upon solutions to reduce negative impacts on our environment and natural resources. Critical Thinking ● Collaboration ● Communication ● Information Literacy ● Initiative ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will: ● Develop models (diagrams, drawings, dioramas , or storyboards) that represent concrete events or design solutions. ● Use observation to describe patterns found in the natural world in order to answer scientific questions. ● Construct an argument with evidence to support a claim. ● Communicate solutions with others in oral or written forms using models and or drawings that provide details about scientific ideas.
	OTHER EVIDENCE: ● Teacher observation of student participation. ● Use kindergarten science rubric.

Windham School District Curriculum
Weather and Climate - Kindergarten

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will begin to develop understanding of patterns and variations in local weather and the purpose of weather forecasting to prepare for, and respond to, severe weather.

Content Standards:

- K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.
- K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.*
- K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.
- K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.*

Transfer

Students will be able to

- Make observations to determine the effect of sunlight on Earth's surface.
- Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.
- Use and share observations of local weather conditions to describe patterns over time.
- Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.
- Cause and Effect; events have causes that generate observable patterns.
- People encounter questions about the natural world every day.

ESSENTIAL QUESTIONS

- How would the absence of the sun affect life on earth?
- How do patterns and variations in local weather affect our daily lives?
- How does weather forecasting help people prepare for, and respond to severe weather?

Acquisition

Students will know…

- Sunlight warms Earth's Surface.
- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
- Some kinds of severe weather are more likely than others in a given region.

Students will be skilled at…

- Asking questions based on observation to gain more information.
- Making observations to collect data that can be used to make comparisons.
- Using observations, students will describe patterns to answer specific questions.

	Severe weather forecasts can prepare communications to respond to these events. ● Asking questions, making observations, and gathering information are helpful in thinking about problems.	● Building and designing a device that will solve specific problems. ● Reading grade appropriate texts or other media to obtain scientific information to describe patterns in our natural world.
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-ESS3-2) ● W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS3-1),(K-PS3-2),(K-ESS2- 1) ● SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-ESS3-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (K-ESS2-1) ● MP.4 Model with mathematics. (K-ESS2-1),(K-ESS3-2) ● K.CC Counting and Cardinality (K-ESS3-2) ● K.CC.A Know number names and the count sequence. (K-ESS2-1) ● K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-ESS2-1) ● K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. (K-PS3-1),(K PS3-2) ● K.MD.B.3 Classify objects into given categories; count the number of objects in each category and sort the categories by count. (K-ESS2-1)		People depend on various technologies in their lives; human life would be very different without technology. ● Critical Thinking ● Communication ● Collaboration ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will: ● Recognize: effects of sun's light, weather changes frequently, weather patterns change over the seasons ● Describe and compare weather by observing and documenting weather over a period of time
	OTHER EVIDENCE: ● Teacher observation of student participation. ● Use kindergarten science rubric.

Title of Curriculum: Grade 1 Science: Waves - Light and Sound

Unit Name	What	How	Why
Light and Sound	● Provide evidence that vibrating materials can make sound and that sound can make materials vibrate. ● Construct an evidence-based account that objects can be seen only when illuminated ● Determine the effect of placing objects made with different materials in the path of a beam of light ● Design and build a device that uses light or sound to solve the problem of communicating over a distance.	● Plan and Conduct Investigations ● Make Observations ● Use Tools and Materials	● Students will be able to determine that simple tests can be designed to gather evidence to support or refute student ideas. ● People depend on various technologies in their lives; human life would be very different without technology.

Title of Curriculum: Grade 1 Science: Space Systems - Patterns and Cycles

Unit Name	What	How	Why
Sun, Moon, Stars	● Describe patterns that can be predicted. ● Relate the amount of daylight to the time of year.	● Make observations of the sun, moon, and stars	● Students will be able to determine that patterns in the natural world can be observed, used to describe phenomena, and used as evidence. ● Science assumes natural events happen today as they happened in the past. ● Many events are repeated.

Title of Curriculum: Grade 1 Science: Structure, Function, and Information Processing

Unit Name	What	How	Why
Adaptation	● Design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. ● Determine patterns in behavior of parents and offspring that help offspring survive. ● Construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	● Use materials to design a solution. ● Read texts and use media. ● Make observations.	● Students will be able to determine that patterns in the natural world can be observed, used to describe phenomena, and used as evidence. ● Students will be able to determine that the shape and stability of structures of natural and designed objects are related to their function(s). ● Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world.

Title of Curriculum: Grade 1 Science: Engineering Design

Unit Name	What	How	Why
Engineering Design	● Define a simple problem that can be solved through the development of a new or improved object or tool. ● Illustrate how the shape of an object helps it function as needed to solve a given problem. ● Compare the strengths and weaknesses of two objects designed to solve the same problem.	● Ask questions, make observations, and gather information about a situation people want to change. ● Develop a simple sketch, drawing, or physical model. ● Analyze data from tests of two objects designed to solve the same problem.	● Students will be able to determine that the shape and stability of structures of natural and designed objects are related to their functions.

Windham School District Curriculum
Waves - Light and Sound - Grade 1

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to the processes of light and sound. Students will develop understanding of the relationship between sound and vibrating materials, as well as between the availability of light and ability to see objects.

Content Standards:

- 1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4-2 Make observations to construct an evidence-based account that objects can be seen only when illuminated.
- 1-PS4-3 Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
- 1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
- K-2ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Transfer

Students will be able to:

- Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- Make observations to construct an evidence-based account that objects can be seen only when illuminated.
- Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
- Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- There is a relationship between sound and vibrating materials as well as between the availability of light and ability to see objects.
- Light travels from place to place as determined by placing objects made with different materials in the path of a beam of light.

ESSENTIAL QUESTIONS

- What happens when materials vibrate?
- What happens when there is no light?

Acquisition

Students will know…

- Sound can make matter vibrate, and vibrating matter can make sound
- Objects can be seen if light is available to illuminate them or if they give off their own light.
- Some materials allow light to pass through them, others allow only some light through and others block all light and create a dark shadow on any surface beyond them, where the light cannot reach.

Students will be skilled at…

- Planning and conducting investigations collaboratively to produce data to serve as the basis for evidence to answer a question.
- Making observations (firsthand or from media) to construct an evidence-based account for natural phenomena

	● People use a variety of devices to communicate (send and receive information) over long distances.	● Using tools and materials provided to design a device that solves a specific problem.
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure. (1-PS4-2) ● W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-PS4- 1),(1-PS4-2),(1-PS4-3),(1-PS4-4) W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-PS4-1),(1-PS4-2),(1- PS4-3) ● SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups. (1-PS4-1),(1-PS4-2),(1- PS4-3) Mathematics ● 1.MP.5 Use appropriate tools strategically. (1-PS4-4) ● 1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object. (1-PS4-4) ● 1.MD.A.2 Express the length of an object as a whole number of length units, by layering multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. (1-PS4-4)		● Collaboration and teamwork ● Creativity and imagination ● Critical thinking ● Problem solving

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. ● Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. ● Define a simple design problem. ● Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. ● Make meaningful observations and/or measurements to construct an evidence-based account that objects can be seen only when illuminated. ● Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment ● Grade 1 Science Rubric

Windham School District Curriculum
Space Systems - Patterns and Cycles - Grade 1

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to the processes of patterns and cycles. Students are able to observe, describe, and predict some patterns of the movement of objects in the sky.

Content Standards:

- 1-ESS1-1 Use observations of the sun, moon, and stars to describe patterns that can be predicted
- 1-ESS1-2 Make observations at different times of year to relate the amount of daylight to the time of year.
- K-2ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Transfer

Students will be able to:

- Use observations of the sun, moon and stars to describe patterns that can be predicted.
- Make observations at different times of year to relate the amount of daylight to the time of year.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Movement of objects in the sky can be observed, described, and predicted as patterns.

ESSENTIAL QUESTIONS

- What objects are in the sky and how do they seem to move?

Acquisition

Students will know…

- Patterns of the motion of the sun, moon and stars in the sky can be observed, described, and predicted.
- Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

Students will be skilled at…

- Making observations (firsthand or from media) to collect data that can be used to make comparisons.
- Using observations (firsthand or from media) to describe patterns in the natural world in order to answer specific questions.

Used in Content Area Standards

ELA/Literacy

- W.1.7 Participate in shared research and writing projects (e.g., explore a number of “how-to” books on a given topic and use them to write a sequence of instructions). (1- ESS1-1),(1-ESS1-2)
- W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-ESS1-1),(1-ESS1-2)

Mathematics

- MP.2 Reason abstractly and quantitatively. (1-ESS1-2)
- MP.4 Model with mathematics. (1-ESS1-2)
- MP.5 Use appropriate tools strategically. (1-ESS1-2)

21st Century Skills

- Collaboration and teamwork
- Creativity and imagination
- Critical thinking
- Problem solving

● 1.OA.A.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations to represent the problem. (1-ESS1-2) ● 1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. (1-ESS1-2)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Plan and conduct an investigation. ● Define a simple design problem. ● Use observations of the sun, moon, and stars to describe patterns that can be predicted. ● Make observations at different times of year to relate the amount of daylight to the time of year. ● Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment ● Grade 1 Science Rubric

Windham School District Curriculum
Structure, Function and Information Processing - Grade 1

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to the process of how plants and animals use their external parts to help them survive, grow, and meet their needs as well as how behaviors of parents and offspring help the offspring survive.

Content Standards:

- 1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- 1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.
- 1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
- K-2ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2ETS1-3 Analyze data from tests of two objects designed to solve the same

Transfer

Students will be able to:

- Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.
- Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Plants and animals use their external parts to help them survive, grow and meet their needs.
- Behaviors of parents and offspring help the offspring survive.
- Young plants and animals are like, but not exactly the same as, their parents.

ESSENTIAL QUESTIONS

- What are some ways plants and animals meet their needs so that they can survive and grow?

Acquisition

Students will know…

- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.
- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring survive.
- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with

Students will be skilled at…

- Making observations (firsthand or from media) to construct an evidence-based account for natural phenomena
- Using materials to design a device that solves a specific problem or a solution to a specific problem.
- Reading grade-appropriate texts and using media to obtain scientific information to determine patterns in the natural world.

problem to compare the strengths and weaknesses of how each performs.	behaviors that help them survive. Plants also respond to some external inputs. ● Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents. ● Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.	
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.1.1 Ask and answer questions about key details in a text. (1-LS1-2),(1-LS3-1) ● RI.1.2 Identify the main topic and retell key details of a text. (1-LS1-2) ● RI.1.10 With prompting and support, read informational texts appropriately complex for grade. (1-LS1-2) W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-LS1- 1),(1-LS3-1) ● W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-LS3-1) Mathematics ● MP.2 Reason abstractly and quantitatively. (1-LS3-1) ● MP.5 Use appropriate tools strategically. (1-LS3-1) ● 1.NBT.B.3 Compare two two-digit numbers based on the meanings of the tens and one digits, recording the results of comparisons with the symbols , , and . (1-LS1-2) ● 1.NBT.C.4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning uses. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. (1-LS1-2) ● 1.NBT.C.5 Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. (1-LS1-2) ● 1.NBT.C.6 Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. (1-LS1-2) ● 1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object. (1-LS3-1)		● Collaboration and teamwork ● Creativity and imagination ● Critical thinking ● Problem solving

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Plan and conduct an investigation. ● Define a simple design problem. ● Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. ● Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. ● Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
	OTHER EVIDENCE: ● Teacher ● Classroom Discussion ● End of Topic Assessment ● Grade 1 Science Rubric

Windham School District Curriculum
Engineering Design - Grade 1

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will demonstrate grade appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

Content Standards:

- K-2 ETS1-1-Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2 ETS1-2- Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Transfer

Students will be able to:

- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- the engineering design process shows that shape and stability of natural structures and designed objects are related to their functions

ESSENTIAL QUESTIONS

- Why do engineers and designers strive to improve products used in our daily life?
- Why do we use the engineering design process to solve design challenges?
- How can the engineering design process benefit us in solving problems in our daily life?

Acquisition

Students will know…

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Asking questions, making observations and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.
- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solution to other people.
- Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Students will be skilled at…

- Asking questions based on observations to find more information about the natural and/or designed world.
- Defining a simple problem that can be solved through the development of a new or improved object or tool.
- Developing a simple model based on evidence to represent a proposed object or tool.
- Analyzing data from tests of an object or tool to determine if it works as intended.

Used in Content Area Standards	*21st Century Skills*
not applicable	● Collaboration and teamwork ● Creativity and imagination ● Critical thinking ● Problem solving

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment ● Grade 1 Science Rubric
	OTHER EVIDENCE: ● Plan and conduct an investigation. ● Make meaningful observations and/or measurements. ● Ask questions. ● Define a simple design problem

Title of Curriculum: Grade 2 Science: Earth's Systems-Processes that Shape the Earth

Unit Name	What	How	Why
Erosion	● Provide evidence that Earth events can occur quickly or slowly ● Determine how to slow or prevent wind or water from changing the shape of the land ● Represent the shapes and kinds of land and bodies of water in an area ● Identify where water is found on Earth and that it can be solid or liquid	● Use information from several sources ● Compare multiple solutions ● Develop a model ● Obtain information	● Students will be able to develop and use technologies to show impact on the natural world

Title of Curriculum: Grade 2 Science: Structures and Properties of Matter

Unit Name	What	How	Why
Matter	● Describe and classify different kinds of materials by their observable properties ● Determine which materials have the properties that are best suited for an intended purpose ● Construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object ● Use evidence to identify that some changes caused by heating or cooling can be reversed and some cannot	● Plan and conduct an investigation ● Analyze data obtained from testing different materials ● Make observations ● Construct an argument	● Students will be able to determine that human made products are designed by applying knowledge of the natural world and is built using material derived from the natural world

Title of Curriculum: Grade 2 Science: Interdependent Relationships in Ecosystems

Unit Name	What	How	Why
Plants	● Determine if plants need sunlight and water to grow ● Mimic the function of an animal in dispersing seeds or pollinating plants ● Compare the diversity of life in different habitats	● Plan and conduct an investigation ● Develop a simple model ● Make observations of plants and animals	● Students will be able to identify that events have causes that generate observable patterns ● Students will be able to determine that the shape of a natural structure is related to its function

Title of Curriculum: Grade 2 Science: Engineering Design

Unit Name	What	How	Why
Engineering	● Define a simple problem that can be solved through the development of a new or improved object or tool ● Illustrate how the shape of an object helps it function as needed to solve a given problem. ● Solve the same problem to compare the strengths and weaknesses of how each performs.	● Ask questions, make observations, and gather information about a situation people want to change ● Develop a simple sketch, drawing, or physical model ● Analyze data from tests of two objects designed	● Students will be able to demonstrate the engineering design process to show that shape and stability of natural structures and designed objects are related to their functions

Windham School District Curriculum
Earth's Systems: Processes that Shape the Earth - Grade 2

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will apply their understanding of the idea that wind and water can change the shape of the land and compare design solutions to slow or prevent such change. Students are able to use information and models to identify and represent the shapes and kinds of land and bodies of water in an area.

Content Standards:

- 2-ESS1-1- Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
- 2-ESS2-1- Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
- 2-ESS2-2-Develop a model to represent the shapes and kinds of land and bodies of water in an area.
- 2-ESS2-3- Obtain information to identify where water is found on Earth and that it can be solid or liquid.
- 2 ETS1-1-Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2 ETS1-2- Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.K-2-ETS1-3- Analyze data from tests of two objects designed to solve the same problem to

Transfer

Students will be able to:

- Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
- Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
- Develop a model to represent the shapes and kinds of land and bodies of water in an area.
- Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Scientists study the natural and material world. They develop and use technologies to show impact on the natural world.

ESSENTIAL QUESTIONS

- How does land change and what are some things that cause it to change?
- What are the different kinds of land and bodies of water?
- How do the properties of earth materials differ?

Acquisition

Students will know how to…

- list that some events happen very quickly and others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1)
- demonstrate that wind and water can change the shape of the land. (2- ESS2-1)
- illustrate that maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2- 2)
- reference that water is found in the ocean, rivers, lakes, and ponds. Water

Students will be skilled at…

- developing a model to represent patterns in the natural world. (2-ESS2-2)
- making observations from several sources to construct an evidence-based account for natural phenomena. (2-ESS1-1)
- comparing multiple solutions to a problem. (2-ESS2-1)
- obtaining information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be

compare the strengths and weaknesses of how each performs.	exists as solid ice and in liquid form. (2-ESS2-3) ● conclude that because there is always more than one possible solution to a problem, it is useful to compare and test designs.	useful in answering a scientific question. (2-ESS2-3)

Used in Content Area Standards	***21st Century Skills***
This content may offer opportunities to cross reference the following Common Core Standards: ELA/Literacy ● RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-ESS1-1) ● RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS1-1),(2-ESS2-1) ● RI.2.9 Compare and contrast the most important points presented by two texts on the same topic. (2-ESS2-1) ● W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS1-1),(2-ESS2-3) ● W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-ESS1-1) ● W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-ESS1-1),(2-ESS2-3) ● SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. (2-ESS1-1) ● SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-ESS2-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (2-ESS2-1),(2-ESS2-1),(2-ESS2-2) ● MP.4 Model with mathematics. (2-ESS1-1),(2-ESS2-1),(2-ESS2-2) ● MP.5 Use appropriate tools strategically. (2-ESS2-1) ● 2.NBT.A Understand place value. (2-ESS1-1) ● 2.NBT.A.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (2-ESS2-2) ● 2.MD.B.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. (2-ESS2-1)	*Students will use:* ● collaboration and teamwork, creativity and imagination, critical thinking, as well as problem solving to become better decision makers about scientific and technical issues and apply science to their daily lives.

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Use information from several sources to provide evidence that Earth events can occur quickly or slowly. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Develop a model to represent the shapes and kinds of land and bodies of water in an area. Obtain information to identify where water is found on Earth and that it can be solid or liquid.
	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment

Windham School District Curriculum
Structures and Properties of Matter - Grade 2

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will show an understanding of observable properties of materials, through analysis and classification of different materials.

Content Standards:

- 2-PS1-1- Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2- Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-3-Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- 2-PS1-4-Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- K-2- ETS1-1- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2-Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Transfer

Students will be able to:

- Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- human made products are designed by applying knowledge of the natural world and are built using material derived from the natural world

ESSENTIAL QUESTIONS

- How are materials similar and different from one another?
- How do the properties of materials relate to their use?
- How are solids and liquids represented in our daily lives?

Acquisition

Students will know how to…

- identify that different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- demonstrate that different properties are suited to different purposes. (2-PS1-2),(2-PS1-3)
- construct a plan to show a great variety of objects can be built up from a small set of pieces. (2-PS1-3)

Students will be skilled at…

- planning and conducting an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1)
- analyzing data from tests of an object or tool to determine if it works as intended. (2-PS1-2)
- making observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3)
- constructing an argument with evidence to support a claim. (2- PS1-4)

	● describe that heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	
Used in Content Area Standards		***21st Century Skills***
This content may offer opportunities to cross reference the following Common Core Standards: ELA/Literacy ● RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4) ● RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4) ● RI.2.8 Describe how reasons support specific points the author makes in a text. (2-PS1-2),(2-PS1-4) W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4) ● W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1- 2),(2-PS1-3) ● W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3) Mathematics ● MP.2 Reason abstractly and quantitatively. (2-PS1-2) ● MP.4 Model with mathematics. (2-PS1-1),(2-PS1-2) ● MP.5 Use appropriate tools strategically. (2-PS1-2) ● 2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-PS1-1),(2-PS1-2)		*Students will use:* ● collaboration and teamwork, creativity and imagination, critical thinking, as well as problem solving to become better decision makers about scientific and technical issues and apply science to their daily lives.

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Describe and classify different kinds of materials by their observable properties ● Determine which materials have the properties that are best suited for an intended purpose ● Construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object ● Use evidence to identify that some changes caused by heating or cooling can be reversed and some cannot.
	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment

Windham School District Curriculum
Interdependent Relationships in Ecosystems - Grade 2

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students are also expected to compare the diversity of life in different habitats.

Content Standards:

- 2-LS2-1- Plan and conduct an investigation to determine if plants need sunlight and water to grow.
- 2-LS2-2- Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
- 2-LS4-1 - Make observations of plants and animals to compare the diversity of life in different habitats.
- K-2-ETS1-1-Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2-Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3-Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Transfer

Students will be able to:

- Plan and conduct an investigation to determine if plants need sunlight and water to grow.
- Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
- Make observations of plants and animals to compare the diversity of life in different habitats

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- events have causes that generate observable pattern
- the shape of a natural structure is related to its function

ESSENTIAL QUESTIONS

- What do plants need to grow?
- How many types of living things live in a place?
- How can you describe the effects of light and water on seed germination and plant growth?
- How are plants connected with other living things?

Acquisition

Students will know how to…

- state that plants depend on water and light to grow. (2-LS2-1)
- explain that plants depend on animals for pollination or to move their seeds around. (2-LS2-2)
- recognize that there are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)
- create designs that can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Students will be skilled at…

- developing a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)
- planning and conducting an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1) ▪ making observations (firsthand or from media) to collect data which can be used to make comparisons. (2-LS4-1)

Used in Content Area Standards	***21st Century Skills***
This content may offer opportunities to cross reference the following Common Core Standards: ELA/Literacy ● W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1),(2-LS4-1) ● W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(2-LS4-1) ● SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-LS2-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (2-LS2-1),(2-LS4-1) ● MP.4 Model with mathematics. (2-LS2-1),(2-LS2-2),(2-LS4-1) ● MP.5 Use appropriate tools strategically. (2-LS2-1) ● 2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems. (2-LS2-2),(2-LS4-1)	*Students will use:* ● collaboration and teamwork, creativity and imagination, critical thinking, as well as problem solving to become better decision makers about scientific and technical issues and apply science to their daily lives.

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Determine if plants need sunlight and water to grow ● Mimic the function of an animal in dispersing seeds or pollinating plants ● Compare the diversity of life in different habitats
	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● End of Topic Assessment

Windham School District Curriculum
Engineering Design - Grade 2

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">ESTABLISHED GOALS:
Students will demonstrate grade appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

Content Standards:
● K-2-ETS1-1-Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
● K-2-ETS1-2-Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
● K-2-ETS1-3-Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to observe the crosscutting concepts of patterns; cause and effect; energy and matter; structure and function; and stability and change. Students will be able to understand the influence of engineering, technology, and science on society and the natural world.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand that…
● the engineering design process shows that shape and stability of natural structures and designed objects are related to their functions</td><td>ESSENTIAL QUESTIONS
● Why do engineers and designers strive to improve products used in our daily life?
● Why do we use the engineering design process to solve design challenges?
● How can the engineering design process benefit us in solving problems in our daily life?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know how to…
● define situations that people want to change or create can be approached as a problem to be solved through engineering. (K-2- ETS1-1)
● ask questions, make observations, and gather information are helpful in thinking about problems. (K-2-ETS1-1)
● state, before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)
● construct designs that can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)
● conclude that because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)</td><td>Students will be skilled at…
● asking questions based on observations to find more information about the natural and/or designed world. (K-2- ETS1-1)
● defining a simple problem that can be solved through the development of a new or improved object or tool. (K-2- ETS1-1)
● developing a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)
● analyzing data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)</td></tr>
</table>

Used in Content Area Standards	***21st Century Skills***
This content may offer opportunities to cross reference the following Common Core Standards: ELA/Literacy ● RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (K-2-ETS1-1) ● W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1),(K-2-ETS1-3) ● W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1),(K-2-ETS1-3) ● SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (K-2-ETS1-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (K-2-ETS1-1),(K-2-ETS1-3) ● MP.4 Model with mathematics. (K-2-ETS1-1),(K-2-ETS1-3) ● MP.5 Use appropriate tools strategically. (K-2-ETS1-1),(K-2-ETS1-3) ● 2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (K-2-ETS1-1),(K-2-ETS1-3)	*Students will use:* ● collaboration and teamwork, creativity and imagination, critical thinking, as well as problem solving to become better decision makers about scientific and technical issues and apply science to their daily lives.

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Grade 2 Science Rubric ● Launch Log/Science Notebook
	OTHER EVIDENCE: Students who understand the concepts can: ● Observe and classify patterns of different kinds of materials ● Plan and conduct investigations collaboratively ● Collect, analyze and interpret data ● Construct explanations and engage in discussion with evidence to support a claim ● Integrate technology

Title of Curriculum: Grade 3 Forces and Interaction

Unit Name	What	How	Why
Forces and Interactions	● The effects of balanced and unbalanced forces on the motion of an object. ● A pattern can be used to predict future motion. ● Determine if there is a cause and effect relationship of electric or magnetic interactions between two objects not in contact with each other. ● Scientific ideas about magnets.	● Students will plan and conduct an investigation. ● Students will make observations and/or measurements of an object's motion. ● Students will ask scientific and non scientific questions. ● Students will define a simple design problem that can be solved with magnets.	● Patterns of change can be used to make predictions. ● Cause and effect relationships are routinely identified, tested, and used to explain change. ● Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

Title of Curriculum: Grade 3 Interdependent Relationship in Ecosystems

Unit Name	What	How	Why
Interdependent Relationships in Ecosystems	● Some animals form groups that help members survive. ● Fossils provide evidence of the organisms and the environments in which they lived long ago. ● In a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. ● When the environment changes and the types of plants and animals that live there may change.	● Students will construct an argument in verbal or written form ● Students will analyze and interpret data through inquiries ● Students will construct an argument with evidence from inquiries ● Students will make a claim in verbal or written form	● Cause and effect relationships are routinely identified and used to explain change. ● Observable phenomena exist from very short to very long time periods. ● A system can be described in terms of its components and their interactions. ● Knowledge of relevant scientific concepts and research findings is important in engineering. ● Science assumes consistent patterns in natural systems.

Title of Curriculum: Grade 3 Inheritance and Variation of Traits: Life Cycles and Traits

Unit Name	What?	How?	Why ?
Inheritance and Variation of Traits: Life Cycles and Traits	● Organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death. ● Plants and animals have traits inherited from parents that variation of these traits exists in a group of similar organisms. ● Traits can be influenced by the environment. ● Variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	● Students will develop models using different materials. ● Students will analyze and interpret data to provide evidence. ● Students will use evidence to support an explanation in verbal or written form.	● Similarities and differences in patterns can be used to sort and classify natural phenomena. ● Patterns of change can be used to make predictions. ● Cause and effect relationships are routinely identified and used to explain change.

Title of Curriculum: Grade 3 Weather and Climate

Unit Name	What?	How?	Why ?
Weather and Climate	● Typical weather conditions expected during a particular season ● Climates in different regions of the world ● Reducing the impacts of a weather-related hazards	● Students will represent data in tables and graphical displays. ● Students will obtain and combine information to describe the given topic. ● Students will make a claim about the merit of a design solution in verbal or written form.	● Patterns of change can be used to make predictions. ● Cause and effect relationships are routinely identified, tested, and used to explain ● Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. ● Science affects everyday life.

Windham School District Curriculum
Forces and Interactions: Grade 3

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be introduced to the effect of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. They are then able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

Content Standards:

- 3-PS2-1 - Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2 - Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- 3-PS2-3 - Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- 3-PS2-4 - Define a simple design problem that can be solved by applying scientific ideas about magnets.
- 3-5ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Transfer

Students will be able to

- Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- Define a simple design problem that can be solved by applying scientific ideas about magnets.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Patterns of change can be used to make predictions.
- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

ESSENTIAL QUESTIONS

- How do balanced and unbalanced forces on an object affect the object?
- How can magnets be used?

Acquisition

Students will know…

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
- The patterns of an object's motion in various situations can be observed and measured;

Students will be skilled at…

- Asking questions that can be investigated based on patterns such as cause and effect relationships.
- Defining a simple problem that can be solved through the development of a new or improved object or tool.
- Planning and conducting an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in

● 3-5ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	when that past motion exhibits a regular pattern, future motion can be predicted from it. ● Objects in contact exert forces on each other. ● Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	which variables are controlled and the number of trials considered. ● Making observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Recognizing patterns using a variety of methods, tools, and techniques.
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1),(3-PS2-3) ● RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3) ● RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3) ● W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2) ● W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1),(3-PS2-2) ● SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3) Mathematics ● MP.2 Reason abstractly and quantitatively. (3-PS2-1) ● MP.5 Use appropriate tools strategically. (3-PS2-1) ● 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-PS2-1)		● Critical Thinkers ● Communication ● Information Literacy ● Technology Literacy ● Productivity

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Plan and conduct an investigation of forces on the motion of an object. ● Make meaningful observations and/or measurements on patterns to predict future motions. ● Ask scientific and non scientific questions about the relationship of magnetic interactions. ● Define a simple design problem that can be solved by use of magnets.
	OTHER EVIDENCE: ● Teacher Observations ● Classroom Discussion ● Unit Assessment

Windham School District Curriculum
Interdependent Relationships in Ecosystems: Grade 3

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will develop an understanding of types of organisms that lived long ago and also about the nature of their environments. Third graders will also develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.

Content Standards:

- 3-LS2-1 - Construct an argument that some animals form groups that help members survive.
- 3-LS4-1 - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-3 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 3-LS4-4 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Transfer

Students will be able to

- Construct an argument that some animals form groups that help members survive.
- Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
- Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

- Cause and effect relationships are routinely identified and used to explain change.
- Observable phenomena exist from very short to very long time periods.
- A system can be described in terms of its components and their interactions.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Science assumes consistent patterns in natural systems.

ESSENTIAL QUESTIONS

- How do animals work together to survive in their ecosystem?
- How are plants, animals, and environments of the past similar or different from current plants, animals, and environments?
- What happens to organisms when their environment changes?

Acquisition

Students will know…

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.
- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

Students will be skilled at…

- Analyzing and interpreting data to make sense of phenomena using logical reasoning
- Constructing an argument with evidence, data, and/or a model.
- Making a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

	● Some kinds of plants and animals that once lived on Earth are no longer found anywhere. ● Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. ● For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. ● Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	
Used in Content Area Standards		**21st Century Skills**
ELA/Literacy ● RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4) ● RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-1),(3-LS4-3),(3LS4-4) ● RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4) ● W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4) ● W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-1),(3-LS4-3),(3-LS4-4) ● W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-LS4-1) ● SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-3),(3-LS4-4) Mathematics ● MP.2 Reason abstractly and quantitatively. (3-LS4-1),(3-LS4-3),(3-LS4-4) ● MP.4 Model with mathematics. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4) ● MP.5 Use appropriate tools strategically. (3-LS4-1) ● 3.NBT Number and Operations in Base Ten (3-LS2-1) ● 3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. (3-LS4-3) ● 3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS4-1)		● Critical Thinking ● Collaboration ● Communication ● Information Literacy ● Initiative ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	**Assessment Evidence**
	ASSESSMENT: ● Construct an argument that some animals form groups that help members survive. ● Analyze and interpret data about fossils and the organism's environment long ago. ● Make a claim about environment changes and the types of plants and animals that may change as well.
	OTHER EVIDENCE: ● Unit Assessment ● Teacher Observations ● Classroom Discussion

Windham School District Curriculum
Inheritance and Variation of Traits: Life Cycles and Traits: Grade 3

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will develop an understanding of the similarities and differences of organisms' life cycles. An understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops, is acquired by students at this level. In addition, students are able to construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

Content Standards:

- 3-LS1-1 - Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- 3-LS3-1 - Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- 3-LS3-2 - Use evidence to support the explanation that traits can be influenced by the environment.
- 3-LS4-2 - Use evidence to construct an explanation for how the variations in characteristics among individuals of the

Transfer

Students will be able to

- Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- Use evidence to support the explanation that traits can be influenced by the environment.
- Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

Meaning

ENDURING UNDERSTANDINGS

- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Patterns of change can be used to make predictions.
- Cause and effect relationships are routinely identified and used to explain change.

ESSENTIAL QUESTIONS

- How do organisms vary in their traits?
- How are life cycles of plants and animals similar? How are they different?
- How can the environment affect the traits of organisms?
- How do animals adapt to survive changes in their ecosystem?

Acquisition

Students will know…

- Reproduction is essential to the continued existence of every kind of organism.
- Plants and animals have unique and diverse life cycles.
- Many characteristics of organisms are inherited from their parents.
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning.

Students will be skilled at…

- Developing models to describe phenomena.
- Analyzing and interpreting data to make sense of phenomena using logical reasoning.
- Using evidence (e.g., observations, patterns) to support an explanation.

same species may provide advantages in surviving, finding mates, and reproducing.	● Many characteristics involve both inheritance and environment. ● 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. ● Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	● Using evidence (e.g., observations, patterns) to construct an explanation. ● Recognizing patterns.
Used in Content Area Standards		**21st Century Skills**
ELA/Literacy ● RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1) ● W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● SL.3.5 Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1) Mathematics ● MP.2 Reason abstractly and quantitatively. (3-LS3-1),(3-LS3-2),(3-LS4-2) ● MP.4 Model with mathematics. (3-LS1-1),(3-LS3-1),(3-LS3-2),(3-LS4-2) ● 3.NBT Number and Operations in Base Ten (3-LS1-1) ● 3.NF Number and Operations—Fractions (3-LS1-1) ● 3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. (3-LS4-2)		● Creativity ● Critical Thinking ● Collaboration ● Communication ● Media Literacy ● Productivity ● Technology Literacy

● 3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop models to describe life cycles. ● Analyze and interpret data about inherited traits. ● Use evidence to support the explanation that traits can be influenced by the environment. ● Use evidence to construct an explanation on variation among individuals of the same species.
	OTHER EVIDENCE: ● Unit Assessment ● Teacher Observations ● Classroom Discussion

Windham School District Curriculum
Weather and Climate: Grade 3

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be able to organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards.
Sample Questions:
"What is typical weather in different parts of the world and during different times of the
year? How can the impact of weather-related hazards be reduced?"

Content Standards:

- 3-ESS2-1 - Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2 - Obtain and combine information to describe climates in different regions of the world.
- 3-ESS3-1 - Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
- 3-5ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are

Transfer

Students will be able to

- Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- Obtain and combine information to describe climates in different regions of the world.
- Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

Meaning

ENDURING UNDERSTANDINGS

- Patterns of change can be used to make predictions.
- Cause and effect relationships are routinely identified, tested, and used to explain
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Science affects everyday life.

ESSENTIAL QUESTIONS

- What is typical weather in different parts of the world and during different times of the year?
- How can the impact of weather-related hazards be reduced?

Acquisition

Students will know…

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.
- A variety of natural hazards result from natural processes.
- Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

Students will be skilled at…

- Representing data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.
- Making a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

considered to identify aspects of a model or prototype that can be improved.		● Obtaining and combining information from books and other reliable media to explain phenomena.
Used in Content Area Standards		**21st Century Skills**
LA/Literacy ● RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2) ● RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2) ● W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESS3-1) ● W.3.7 Conduct short research projects that build knowledge about a topic. (3-ESS3-1) ● W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-ESS2-2) Mathematics ● MP.2 Reason abstractly and quantitatively. (3-ESS2-1),(3-ESS2-2),(3-ESS3-1) ● MP.4 Model with mathematics. (3-ESS2-1),(3-ESS2-2), (3-ESS3-1) ● MP.5 Use appropriate tools strategically. (3-ESS2-1) ● 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1) ● 3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in bar graphs. (3-ESS2-1)		● Critical Thinking ● Communication ● Collaboration ● Information Literacy ● Productivity ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Represent data in tables and graphical displays to describe typical weather conditions. ● Obtain and combine information to describe climates of the world. ● Make a claim to reduce the impact of hazardous weather.
	OTHER EVIDENCE: ● Unit Assessments ● Teacher Observations ● Classroom Discussion

Title of Curriculum: Grade 4 Science: Energy

Unit Name	What	Why	How
Energy	● The faster a given object is moving, the more energy it possesses. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. ● Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. ● Light also transfers energy from place to place. ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. ● When objects collide, the contact forces transfer energy so as to change the objects' motions. ● The expression "produce energy" typically refers to the conversion of	● Cause and effect relationships are routinely identified and used to explain change. ● Energy can be transferred in various ways and between objects. ● Knowledge of relevant scientific concepts and research findings is important in engineering ● Over time, people's needs and wants change, as do their demands for new and improved technologies. ● Engineers improve existing technologies or develop new ones. ● Most scientists and engineers work in teams. ● Science affects everyday life. ● The faster a given object is moving, the more energy it possesses. ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents	● Students will ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. ● Students will make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Students will use evidence (e.g., measurements, observations, patterns) to construct an explanation. ● Students will apply scientific ideas to solve design problems. ● Students will obtain and combine information from books and other reliable media to explain phenomena.

	stored energy into a desired form for practical use. ● Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.		

Title of Curriculum: Grade 4 Science: Waves and Information

Unit Name	What	Why	How
Waves and Information	● Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. ● Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). ● Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. ● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	● Similarities and differences in patterns can be used to sort and classify natural phenomena. ● Similarities and differences in patterns can be used to sort and classify designed products. ● Knowledge of relevant scientific concepts and research findings is important in engineering.	● Students will develop a model using an analogy, example, or abstract representation to describe a scientific principle. ● Students will generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. ● Students will understand that science findings are based on recognizing patterns.

Title of Curriculum: Grade 4 Science: Structure, Function, and Information Processing

Unit Name	What	Why	How
Structure, Function, and Information Processing	● An object can be seen when light reflected from its surface enters the eyes. ● Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ● Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.	● Cause and effect relationships are routinely identified. ● A system can be described in terms of its components and their interactions.	● Develop a model to describe phenomena. ● Use a model to test interactions concerning the functioning of a natural system. ● Construct an argument with evidence, data, and/or a model.

Title of Curriculum: Grade 4 Science: Earth's Systems: Processes that Shape the Earth

Unit Name	What	Why	How
Earth's Systems: Processes that Shape the Earth	● Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. ● Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ● The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. ● Living things affect the physical characteristics of their regions. ● A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. ● Testing a solution involves investigating how well it performs under a range of likely conditions.	● Patterns can be used as evidence to support an explanation. ● Cause and effect relationships are routinely identified, tested, and used to explain change. ● Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. ● Science assumes consistent patterns in natural systems.	● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. ● Analyze and interpret data to make sense of phenomena using logical reasoning. ● Identify the evidence that supports particular points in an explanation. ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Windham School District Curriculum
Energy - Grade 4

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will be able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students will develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They will apply their understanding of energy to design, test, and refine a device that converts energy from one form to another.

Competencies (Standards):

- Physical Science

Content Standards

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by

Transfer

Students will be able to

- Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)

Energy and Matter

- Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1)

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

- Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1)
- Engineers improve existing technologies or develop new ones. (4-PS3-4)

Science is a Human Endeavor

- Most scientists and engineers work in teams. (4-PS3-4)
- Science affects everyday life. (4-PS3-4)

ESSENTIAL QUESTIONS

- What is energy and how is it related to motion?
- How is energy transferred?
- How can energy be used to solve a problem?

Acquisition

Students will know…

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4- PS3-1)

Students will be skilled at…

- Ask questions that can be investigated and predict

sound, light, heat, and electric currents. ● 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide. ● 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* ● 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.	● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3) **PS3.B: Conservation of Energy and Energy Transfer** ● Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2),(4-PS3-3) ● Light also transfers energy from place to place. (4-PS3-2) ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4- PS3-4) **PS3.C: Relationship Between Energy and Forces** ● When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4) ESS3.A: Natural Resources ● Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1) **ETS1.A: Defining Engineering Problems** ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)	reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2) ● Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) ● Apply scientific ideas to solve design problems. (4-PS3-4) ● Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy ● RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1) ● RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1) ● RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1) ● W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)		● Critical Thinking ● Communication ● Collaboration ● Information Literacy ● Productivity ● Social Skills

● W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1) ● W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1) ● W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1),(4-ESS3-1) Mathematics ● MP.2 Reason abstractly and quantitatively. (4-ESS3-1) ● MP.4 Model with mathematics. (4-ESS3-1) 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1) 4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Use evidence to construct an explanation relating the speed of an object to its energy. ● Make observations to provide evidence that energy can be transferred by sound, light, heat, and electric currents. ● Ask questions and predict outcomes about the changes in energy when objects collide. ● Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. ● Obtain and combine information to describe that energy and fuels are derived from natural resources and affect the environment.
	OTHER EVIDENCE: ● Inquiry ● Unit Assessments ● Teacher Observations ● Classroom Discussions

Windham School District Curriculum
Waves and Information - Grade 4

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move.

Content Standards:

- 4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
- 4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Transfer

Students will be able to

- Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
- Generate and compare multiple solutions that use patterns to transfer information.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

Patterns

- Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1)
- Similarities and differences in patterns can be used to sort and classify designed products. (4- PS4-3)

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)

ESSENTIAL QUESTIONS

- What are waves and what are some things they can do?

Acquisition

Students will know…

PS4.A: Wave Properties

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the

Students will be skilled at…

- Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4- 1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)

	water meets a beach. (Note: This grade band endpoint was moved from K–2). (4-PS4-1) ● Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) **PS4.C: Information Technologies and Instrumentation** ● Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3) **ETS1.C: Optimizing The Design Solution** ● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4-PS4-3)	● Science findings are based on recognizing patterns. (4- PS4-1)
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy ● RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS4-3) ● RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3) ● SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1) Mathematics ● MP.4 Model with mathematics. (4-PS4-1) ● 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1)		● Critical Thinking ● Communication ● Collaboration ● Information Literacy ● Productivity ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a sound waves model. ● Use Morse Code to generate information transfer.
	OTHER EVIDENCE: ● Inquiry ● Unit Assessments ● Teacher Observations ● Classroom Discussions ● Develop a model of waves to describe patterns in amplitude and wavelength and that waves can cause objects to move ● Generate and compare multiple solutions that use patterns to transfer information (such as Morse Code)

Windham School District Curriculum
Structure, Function, and Information Processing - Grade 4

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they will describe that an object can be seen when light reflected from its surface enters the eye.

Content Standards:

- 4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Transfer

Students will be able to

- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

Cause and Effect

- Cause and effect relationships are routinely identified. (4-PS4-2)

Systems and System Models

- A system can be described in terms of its components and their interactions. (4- LS1-1), (LS1-2)

ESSENTIAL QUESTIONS

- How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?

Acquisition

Students will know…

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) LS1.D:

Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

Students will be skilled at…

- Develop a model to describe phenomena. (4-PS4-2)
- Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)
- Construct an argument with evidence, data, and/or a model. (4-LS1-1)

Used in Content Area Standards	*21st Century Skills*
Common Core State Standards Connections: ELA/Literacy ● W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1) ● SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-2),(4-LS1-2) Mathematics ● MP.4 Model with mathematics. (4-PS4-2) ● 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-2) ● 4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line symmetric figures and draw lines of symmetry. (4-LS1-1)	● Critical Thinking ● Communication ● Collaboration ● Information Literacy ● Productivity ● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to describe that light reflecting from objects, enters the eye and can be seen. ● Construct an argument that plants and animals have internal and external structures that support survival, growth, behavior, and reproduction. ● Use a model to describe that animals process information through their senses, process, and respond.
	OTHER EVIDENCE: ● Inquiry ● Unit Assessments ● Teacher Observations ● Classroom Discussions

Windham School District Curriculum
Earth's Systems: Processes that Shape the Earth - Grade 4

Stage 1 Desired Results

ESTABLISHED GOALS:

Students will develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They will apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth's features, students will analyze and interpret data from maps.

Content Standards:

- 4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how

Transfer

Students will be able to

- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Analyze and interpret data from maps to describe patterns of Earth's features.
- Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

Patterns

- Patterns can be used as evidence to support an explanation. (4-ESS1-1),(4- ESS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1),(4-ESS3-2)

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

- Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (4-ESS1-1)

ESSENTIAL QUESTIONS

- What patterns of Earth's features can be determined with the use of maps?

Acquisition

Students will know…

ESS1.C: The History of Planet Earth

Students will be skilled at…

well each is likely to meet the criteria and constraints of the problem. ● 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	● Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1) **ESS2.A: Earth Materials and Systems** ● Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** ● The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2) **ESS2.E: Biogeology** ● Living things affect the physical characteristics of their regions. (4- ESS2-1) **ESS3.B: Natural Hazards** ● A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) **ETS1.B: Designing Solutions to Engineering Problems** ● Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)	● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1) ● Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2) ● Identify the evidence that supports particular points in an explanation. (4-ESS1-1) ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy ● RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)		● Critical Thinking ● Communication ● Collaboration ● Information Literacy ● Productivity

● RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4-ESS2-2) ● RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2) W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS1-1),(4-ESS2-1) W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS1-1),(4-ESS2-1) W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1) Mathematics ● MP.2 Reason abstractly and quantitatively. (4-ESS1-1),(4-ESS2-1),(4-ESS3-2) ● MP.4 Model with mathematics. (4-ESS1-1),(4-ESS2-1),(4-ESS3-2) ● MP.5 Use appropriate tools strategically. (4-ESS2-1) 4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. (4-ESS1-1),(4-ESS2-1) 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. (4-ESS2-1),(4-ESS2-2) 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-2)	● Social Skills

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Identify evidence from patterns in rock formations to explain changes in landscapes over time. ● Make observations and/or measurements to provide evidence of weathering and erosion. ● Analyze and interpret data from maps to describe patterns in Earth's features. ● Generate and compare multiple solutions to reduce impacts of earthquakes, floods, tsunamis, and/or volcanic eruptions.
	OTHER EVIDENCE: ● Inquiry ● Unit Assessments ● Teacher Observations ● Classroom Discussions

Title of Curriculum: Grade 5 Science: Structure and Properties of Matter

Unit Name	What	Why	How
Matter	● Matter of any type can be subdivided into particles that are too small to see. ● The weight of matter is conserved when it changes form. ● Identify materials based on their properties. ● When substances are mixed, a new substance with different properties may be formed.	● To identify that objects exist from very small to immensely large. ● To distinguish that standard units are used to measure and describe physical properties. ● To recognize there are consistent patterns in natural systems. ● To identify, test, and explain cause and effect relationships	● Students will develop a model ● Students will measure and graph quantities ● Students will make observations and measurements ● Students will conduct an investigation

Title of Curriculum: Grade 5: Matter and Energy in Organisms and Ecosystems

Unit Name	What	Why	How
Ecosystems	● Energy in animals' food was once energy from the sun. ● Plants get the materials they need for growth chiefly from air and water. ● Matter moves between plants, animals, decomposers, and the environment.	● To understand that energy can be transferred in various ways and between objects ● To argue that matter is transported into, out of, and within systems. ● To describe a system in terms of its components and their interactions.	● Students will use models ● Students will support arguments ● Students will develop models

Title of Curriculum: Grade 5: Earth's Systems

Unit Name	What	Why	How
Earth's Systems	● Describe ways the geosphere, biosphere, geosphere, and/or atmosphere interact. ● Provide evidence about the distribution of water on Earth. ● Human impacts on Earth systems.	● To describe a system in terms of its components and their interactions. ● To measure and describe physical quantities. ● To make a connection that science questions can be answered with evidence.	● Students will develop a model ● Students will describe and graph water distribution ● Students will obtain and combine information

Title of Curriculum: Grade 5: Space Systems: Stars and the Solar System

Unit Name	What	Why	How
Solar System	● Gravitational force exerted by Earth on objects is directed down. ● Apparent brightness of the sun compared to other stars is due to their relative distances from Earth. ● Reveal patterns of daily changes in length and direction of shadows. ● Reveal patterns of day and night ● Reveal patterns of the seasonal appearance of some stars in the sky.	● To identify and explain change using cause and effect relationships. ● To recognize that natural objects exist from the very small to the immensely large. ● To sort, classify, communicate and analyze simple rates of change for natural phenomena using similarities and differences in patterns.	● Students will support an argument ● Students will represent data in graphical displays

Windham School District Curriculum
Structure and Properties of Matter - Grade 5

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="8">ESTABLISHED GOALS:
Students will use the NGSS science and engineering practices to develop and use models, plan and carry out investigations, and use mathematics and computational thinking to demonstrate understanding of the structure and properties of matter.

Content Standards:
● 5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.
● 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.
● 5-PS1-3: Make observations and measurements to identify materials based on their properties.
● 5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
● 3-5ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to:
● Develop a model to describe that matter is made of particles too small to be seen.
● 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.
● Make observations and measurements to identify materials based on their properties.
● Conduct an investigation to determine whether the mixing of two or more substances results in new substances.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand that…
Cause and Effect
● Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)
Scale, Proportion, and Quantity
● Natural objects exist from the very small to the immensely large. (5-PS1-1)
● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2), (5-PS1-3)
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
● Science assumes consistent patterns in natural systems.(5-PS1-2)</td><td>ESSENTIAL QUESTIONS
● What is the structure of matter?
● When matter changes, does its weight change?
● What are the properties of matter?
● Does mixing two or more substances result in a new substance?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
PS1.A: Structure and Properties of Matter
● Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by</td><td>Students will be skilled at…
Developing and Using Models
● Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and</td></tr>
</table>

● 3-5ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. ● 3-5ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. ● Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) **PS1.B: Chemical Reactions:** ● No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) ● When two or more different substances are mixed, a new substance with different properties may be formed.	using models to represent events and design solutions. ● Use models to describe phenomena. (5-PS1-1) **Planning and Carrying Out Investigations** ● Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in • one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.which variables are controlled and the number of trials considered. (5-PS1-4) ● Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3) **Using Mathematics and Computational Thinking** ● Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ● Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1) ● W.5.7 - Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2)		*Students will use:* ● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

● W.5.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2) ● W.5.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2) Mathematics ● MP.2 - Reason abstractly and quantitatively. (5-PS1-2) ● MP.4 - Model with mathematics. (5-PS1-2) ● MP.5 - Use appropriate tools strategically. (5-PS1-2) ● 5.NBT.A.1 - Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1) ● 5.NF.B.7 - Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1) ● 5.MD.A.1 - Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. (5-PS1-2) ● 5.MD.C.3 - Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1) ● 5.MD.C.4 - Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to explain matter is made of particles ● Measure and graph quantities to show matter is conserved ● Make observations and measurements to identify materials ● Conduct an investigation to observe the mixing of substances
	OTHER EVIDENCE: ● SAS ● Unit Assessment(s) ● Inquiry Activities ● Teacher observations ● Classroom discussions ● Small group work/projects

Windham School District Curriculum
Matter and Energy in Organisms and Ecosystems - Grade 5

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will use the NGSS science and engineering practices to develop and use models and engage in argument from evidence to demonstrate understanding of matter and energy in organisms and ecosystems.

Content Standards:

- 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.
- 5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.
- 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Transfer

Students will be able to:

- 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.
- Support an argument that plants get the materials they need for growth chiefly from air and water.
- Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Meaning

ENDURING UNDERSTANDINGS
Students will understand that…

Systems and System Models

- A system can be described in terms of its components and their interactions. (5-LS2-1)

Energy and Matter

- Matter is transported into, out of, and within systems. (5-LS1-1)
- Energy can be transferred in various ways and between objects. (5-PS3-1)

ESSENTIAL QUESTIONS

- How does matter cycle through ecosystems?
- Where does energy and food come from and what is it used for?

Acquisition

Students will know…

PS3.D: Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)

LS1.C: Organization for Matter and Energy Flow in Organisms

- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)

Students will be skilled at…

Developing and Using Models

- Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Use models to describe phenomena. (5-PS3-1)
- Develop a model to describe phenomena. (5-LS2-1)

Engaging in Argument from Evidence

- Engaging in argument from evidence in 3–5 builds on K– 2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers

	● Plants acquire their material for growth chiefly from air and water. (5-LS1-1) **LS2.A: Interdependent Relationships in Ecosystems** ● The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** ● Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	by citing relevant evidence about the natural and designed world(s). ● Support an argument with evidence, data, or a model. (5-LS1-1)
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1) ● RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1) ● RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1) ● W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)		*Students will use:* ● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

● SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1) Mathematics ● MP.2 Reason abstractly and quantitatively. (5-LS1-1) ● MP.4 Model with mathematics. (5-LS1-1) ● MP.5 Use appropriate tools strategically. (5-LS1-1) ● 5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Use models to represent the flow of energy ● Support an argument on plant needs ● Develop a model to describe the movement of matter
	OTHER EVIDENCE: ● Teacher observations ● Classroom discussions ● Small group work/projects ● SAS ● Unit Assessment(s) ● Inquiry Activities

Windham School District Curriculum
Earth's Systems - Grade 5

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">ESTABLISHED GOALS:
Students will use the NGSS science and engineering practices to develop and use models, use mathematics and computational thinking, and obtain, evaluate, and communicate information to demonstrate understanding of earth's systems.

Content Standards:
● 5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
● 5-ESS2-2 Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
● 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
● 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
● 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to:
● Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
● Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
● Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand that…
Scale, Proportion, and Quantity
● Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2)
Systems and System Models
● A system can be described in terms of its components and their interactions. (5-ESS2-1), (5-ESS3-1)
Science Addresses Questions About the Natural and Material World
● Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)</td><td>ESSENTIAL QUESTIONS
● How much water can be found in different places on Earth?
● How do the geosphere, biosphere, hydrosphere, and atmosphere interact?
● How can the Earth's resources and environment be protected?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
ESS2.A: Earth Materials and Systems
● Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's</td><td>Students will be skilled at…
Developing and Using Models
● Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</td></tr>
</table>

likely to meet the criteria and constraints of the problem. ● 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** ● Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5- ESS2-2) **ESS3.C: Human Impacts on Earth Systems** ● Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	● Develop a model using an example to describe a scientific principle. (5-ESS2-1) **Using Mathematics and Computational Thinking** ● Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ● Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2) **Obtaining, Evaluating, and Communicating Information** ● Obtaining, evaluating, and communicating information in 3– 5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. ● Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1) ● RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) ● RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2),(5-ESS3-1) ● W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1) ● SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1),(5-ESS2-2)		*Students will use:* ● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

Mathematics ● MP.2 Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) ● MP.4 Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1) ● 5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Use models to represent the movement and distribution of materials through Earth's systems ● Support an argument on resource conservation ● Provide evidence of ways people use science ideas to conserve resources
	OTHER EVIDENCE: ● Teacher observations ● Classroom discussions ● Small group work/projects ● SAS ● Unit Assessment(s) ● Inquiry Activities

Windham School District Curriculum
Space Systems: Stars and the Solar System - Grade 5

Stage 1 Desired Results

ESTABLISHED GOALS:
Students will use the NGSS science and engineering practices to analyze and interpret data and engage in argument from evidence to demonstrate understanding of stars and the solar system

Content Standards:

- PS2-1 Support and argument that the gravitational force exerted by Earth on objects is directed down
- S-ESS1-1 Support and argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from earth
- S-ESS1-2 Represent date 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

Students will be able to:

- Support an argument that the gravitational force exerted by Earth on objects is directed down.
- Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
- 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

ENDURING UNDERSTANDINGS
Students will understand that…

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze sample rates of change for natural phenomena (S-ESS1-2)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change (S-PS2-1)

Scale, Proportion, and Quantity

- Natural objects from the very small to the immensely large (S-ESS1-1)

ESSENTIAL QUESTIONS

- How do lengths and directions of shadows change from day to day?
- How do relative lengths of day and night change throughout the year?
- How does the appearance of some stars change in different seasons?

Acquisitions

Students will know…

PS2.B: types of Interactions

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center (5-PS2-1).

Students will be skilled at…

Analyzing and Interpreting Data

- Analyzing data 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trucks if qualitative observations. When possible and feasible, digital tools should be used.

	ESS1.A The Universe and its Stars ● The sun is the star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth (5.ESS1.1). **ESS1.B: Earth and the Solar System** ● The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its north and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month and year (S-ESS1-2).	● Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships (S-ESS1-2). **Engaging in Argument from Evidence** ● Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). ● Support and argument with evidence, data, or a model (S-PS21), S-ESS1-1)
Used in Content Area Standards		***21st Century Skills***
ELA/Literacy ● RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS1-1) ● RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1) ● RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1) ● R.I.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS1-1) ● W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-ESS1-1) ● S.L.5.5. Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2) *Mathematics* ● MP.2 Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2) ● MP.4 Model with mathematics. (5-ESS1-1),(5-ESS1-2) ● 5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when		*Students will use:* ● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-ESS1-1) ● 5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Support an argument on gravitational force ● Support an argument comparing sun brightness to other stars ● Represent data on the changes of shadow length and seasonal appearance of stars
	OTHER EVIDENCE: ● Teacher observations ● Classroom discussions ● Small group work/projects ● Individual work/projects ● SAS ● Unit Assessment (s) ● Inquiry Activities

Title of Curriculum: Grade 6: Earth/Space Science: Earth's Place in the Universe

Unit Name	What (DCI)	Why (CC)	How (perf exp.)
Earth's Place in the Universe	**The Universe and Its Stars** ● Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. **Earth and the Solar System** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. ● This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. ● The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. **The History of Planet Earth** ● The geologic time scale interpreted from rock strata provides a way to organize Earth's history . Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.	● **Developing and Using Models** to develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. ● **Analyzing and Interpreting Data** to extend quantitative analysis to investigations, distinguish between correlation and causation, and basic statistical techniques of data and error analysis. ● **Constructing Explanations and Designing Solutions** to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	● 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. ● Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. ● Analyze and interpret data to determine scale properties of objects in the solar system. ● Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Title of Curriculum: Grade 6: Earth/Space Science: Earth's Systems

Unit Name	What (DCI)	Why (CC)	How (perf exp.)
Earth's Systems	**The History of Planet Earth** ● Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. **Earth's Materials and Systems** ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. **Plate Tectonics and Large-Scale System Interactions** ● Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. **The Roles of Water in Earth's Surface Processes** ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. ● The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. ● Global movements of water and its changes in form are propelled by sunlight and gravity. ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.	● **Developing and Using Models** to develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. ● **Planning and Carrying Out Investigations** to include investigations that use multiple variables and provide evidence to support explanations or solutions. ● **Analyzing and Interpreting Data** to extend quantitative analysis to investigations, distinguish between correlation and causation, and basic statistical techniques of data and error analysis. ● **Constructing Explanations and Designing Solutions** to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	● Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. ● Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. ● Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions ● Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity ● Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions ● 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

	● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. **Weather and Climate** ● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. ● Because these patterns are so complex, weather can only be predicted probabilistically. ● The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.		

Title of Curriculum: Grade 6: Earth/Space Science

Unit Name	What (DCI)	Why (CC)	How (perf exp.)
Earth and Human Activity	**Natural Resources** ● Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. **Natural Hazards** ● Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. **Human Impacts on Earth Systems** ● Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ● Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. **Global Climate Change** ● Human activities, such as the release of greenhouse gasses from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	● **Asking Questions and Defining Problems** to specify relationships between variables, and clarifying arguments and models. ● **Analyzing and Interpreting Data** in 6–8 builds on K–5 and progresses to extend quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● **Constructing Explanations and Designing Solutions** to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● **Engaging in Argument from Evidence** to construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).	● 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. ● Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. ● Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. ● Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. ● Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Windham School District Curriculum
Content Topic: Earth's Place in the Universe - Grade 6

Stage 1 Desired Results

ESTABLISHED GOALS:
Students examine the Earth's place in relation to the solar system, Milky Way galaxy, and universe. There is a strong emphasis on a systems approach, and a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories that explain the formation and evolution of the universe.

Content Standards:
Earth's Place in the Universe

- 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.
- MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
- MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Transfer

Students will be able to

- 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.
- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- Analyze and interpret data to determine scale properties of objects in the solar system.
- Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Meaning

ENDURING UNDERSTANDINGS
Students will understand…

Patterns

- Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3),(MS-ESS1-4)

Systems and System Models

- Models can be used to represent systems and their interactions. (MS-ESS1-2)

ESSENTIAL QUESTIONS

- "What is Earth's place in the Universe?"
- "What makes up our solar system and how can the motion of Earth explain seasons and eclipses?"
- "How do people figure out that the Earth and life on Earth have changed through time?"

Acquisition

Students will know…

ESS1.A: The Universe and Its Stars

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)

Students will be skilled at…

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more

● MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) **ESS1.B: Earth and the Solar System** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3) ● This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.(MS-ESS1-1) ● The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2) ESS1.C: The History of Planet Earth The geologic time scale interpreted from rock strata provides a way to organize Earth's history . Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)	abstract phenomena and design systems. ● Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2) **Analyzing and Interpreting Data** ● Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3) **Constructing Explanations and Designing Solutions** ● Constructing explanations and designing solutions in 6– 8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4)
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-ESS1-1)		● One to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3) RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3) WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4) Mathematics MP.4 Model with mathematics. (MS-ESS1-1) 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1) 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS1-1) 6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) 7.EE.B.6 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2) MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)	● Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to explain the Earth-Moon-Sun system ● Use a model to describe the role of gravity in the motion of objects in the Universe ● Construct a scientific explanation based on evidence of the Earth's History ● Analyze and interpret data to determine scale properties of the Solar System
	OTHER EVIDENCE MAY INCLUDE: ● Labs ● Interactive online tools

Windham School District Curriculum
Content Topic: Earth's Systems - Grade 6

Stage 1 Desired Results

ESTABLISHED GOALS:
Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems.
Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students develop understanding of the factors that control weather.

Content Standards:
Earth's Systems

- MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
- MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth

Transfer

Students will be able to

- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions
- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity
- Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions
- 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

Meaning

ENDURING UNDERSTANDINGS

Patterns

- Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS2- 2)
- **Systems and System Models**

ESSENTIAL QUESTIONS

Students will understand…

- "How do the materials in and on Earth's crust change over time?"
- "How does the movement of tectonic plates impact the surface of Earth?"
- "How does water influence weather, circulate in the oceans, and shape Earth's surface?"
- "What factors interact and influence weather?"
- "How have living organisms changed the Earth?"
- "How have Earth's changing conditions impacted living organisms?"

cause patterns of atmospheric and oceanic circulation that determine regional climates. ● MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. ● MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	Models can be used to represent systems and their interactions—such as inputs, processes and outputs— and energy, matter, and information flows within systems. (MS-ESS2-6) **Energy and Matter** ● Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4) **Stability and Change** ● Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)	
	Acquisition	
	Students will know… **ESS1.C: The History of Planet Earth** ● Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3) **ESS2.A: Earth's Materials and Systems** ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)	*Students will be skilled at…* **Developing and Using Models** ● Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. ● Develop and use a model to describe phenomena. (MS-ESS2-1),(MS-ESS2-6) ● Develop a model to describe unobservable mechanisms. (MS-ESS2-4) **Planning and Carrying Out Investigations** ● Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. ● Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

	ESS2.B: Plate Tectonics and Large-Scale System Interactions ● Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3) **ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ● Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2) **ESS2.D: Weather and Climate** ● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all	**Analyzing and Interpreting Data** ● Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) **Constructing Explanations and Designing Solutions** ● Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)

	of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) ● Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) ● The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)	
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy ● SL.8.5 ● Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-ESS1-1) ● RST.6-8.1 ● Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3) ● RST.6-8.7 ● Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3) ● WHST.6-8.2 ● Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4) Mathematics ● MP.4 ● Model with mathematics. (MS-ESS1-1) ● 6.RP.A.1 ● Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1) ● 7.RP.A.2 ● Recognize and represent proportional relationships between quantities. (MS-ESS1-1) ● 6.EE.B.6 ● Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) ● 7.EE.B.6		● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

● Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2) ● MP.2 ● Reason abstractly and quantitatively. (MS-ESS1-3) ● 6.NS.C.5 ● Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. ● Construct an explanation based on evidence for how geoscience processes have changed Earth's surface. ● Analyze and interpret data to provide evidence of the past plate motions ● Develop a model to describe the cycling of water through Earth's systems ● Collect data to provide evidence for how the complex interactions of air masses results in changes in weather conditions ● 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
	OTHER EVIDENCE MAY INCLUDE: ● Labs ● Interactive online tools

Windham School District Curriculum
Content Topic: Earth/Space Science - Grade 6

Stage 1 Desired Results

ESTABLISHED GOALS:
Students understand the ways that human activities impact Earth's other systems. Students use many different practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development.

Content Standards:
Earth and Human Activity

- 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.
- MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Transfer

Students will be able to

- 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.
- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Meaning

ENDURING UNDERSTANDINGS
Students will understand…

Patterns

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

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3- 1),(MS-ESS3-4)

Stability and Change

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

ESSENTIAL QUESTIONS

- "How is the availability of needed natural resources related to naturally occurring processes?"
- "How can natural hazards be predicted?"
- "How do human activities affect Earth systems"
- "How do we know our global climate is changing?"

	Acquisition	
	Students will know…	*Students will be skilled at…*
	ESS3.A: Natural Resources ● Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) **ESS3.B: Natural Hazards** ● Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2) **ESS3.C: Human Impacts on Earth Systems** ● Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) ● Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3),(MS-ESS3-4) **ESS3.D: Global Climate Change** ● Human activities, such as the release of greenhouse gasses from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever	**Asking Questions and Defining Problems** ● Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. ● Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5) **Analyzing and Interpreting Data** ● Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2) **Constructing Explanations and Designing Solutions** ● Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)

	climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	● Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3) **Engaging in Argument from Evidence** ● Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). ● Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)
Used in Content Area Standards		***21st Century Skills***
Common Core State Standards Connections: ELA/Literacy ● SL.8.5 ● Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-ESS1-1) ● RST.6-8.1 ● Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3) ● RST.6-8.7 ● Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3) ● WHST.6-8.2 ● Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4) Mathematics ● MP.4 ● Model with mathematics. (MS-ESS1-1) ● 6.RP.A.1 ● Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1) ● 7.RP.A.2 ● Recognize and represent proportional relationships between quantities. (MS-ESS1-1) ● 6.EE.B.6		● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity. ● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1),(MS-ESS3-4) ● The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. MS-ESS3-2),(MS-ESS3-3)

● Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) ● 7.EE.B.6 ● Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2) ● MP.2 ● Reason abstractly and quantitatively. (MS-ESS1-3) ● 6.NS.C.5 ● Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)	

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● 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. ● Analyze and interpret data on natural hazards to forecast future catastrophic events. ● Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. ● Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. ● Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
	OTHER EVIDENCE MAY INCLUDE: ● Labs ● Interactive online tools

Title of Curriculum: Grade 7: Life Science

Unit Name	What	Why	How
From Molecules to Organisms: Structures and Processes Material is covered throughout the following units: ● Living Things ● Natural Selection/ Evolution ● Cell Structure ● Cell Processes ● Human Body	**Structure and Function** ● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. **Growth and Development of Organisms** ● Animals engage in characteristic behaviors that increase the odds of reproduction. ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. ● Genetic factors as well as local conditions affect the growth of the adult plant. **Organization for Matter and Energy Flow in Organisms** ● Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases	● Cause and effect relationships may be used to predict phenomena in natural systems. ● Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. ● Phenomena that can be observed at one scale may not be observable at another scale. ● Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. ● Matter is conserved because atoms are conserved in physical and chemical processes. ● Within a natural system, the transfer of energy drives the motion and/or cycling of matter. ● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.	● Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. ● Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. ● Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. ● Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. ● Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. ● Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. ● Develop a model to describe how food is rearranged through

	oxygen. These sugars can be used immediately or stored for growth or later use. ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. **Information Processing** ● Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. **Energy in Chemical Processes and Everyday Life** ● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. ● Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.		chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. ● Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Title of Curriculum: Grade 7: Life Science: Interactions, Energy and Dynamics

Unit Name	What	Why	How
Ecosystems: Interactions, Energy, and Dynamics Material is covered throughout the following units: ● Ecosystems ● Natural Selection	**Interdependent Relationships in Ecosystems** ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● Growth of organisms and population increases are limited by access to resources. ● Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	● Patterns can be used to identify cause and effect relationships. ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. ● The transfer of energy can be tracked as energy flows through a natural system. ● Small changes in one part of a system might cause large changes in another part. ● The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. ● Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. ● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.	● Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. ● Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. ● Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. ● Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. ● Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

	Cycle of Matter and Energy Transfer in Ecosystems ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. **Ecosystem Dynamics, Functioning, and Resilience** ● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. ● Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. **Biodiversity and Humans** ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as		

	well as ecosystem services that humans rely on — for example, water purification and recycling. **Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.		

Title of Curriculum: Grade 7: Life Science: Heredity: Inheritance and Variation of Traits

Unit Name	What	Why	How
Heredity: Inheritance and Variation of Traits Material is covered throughout the following units: ● Heredity/Genetics ● Natural Selection ● Cell Processes	**Growth and Development of Organisms** ● Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. **Inheritance of Traits** ● Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. ● Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. **Variation of Traits** ● In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. ● In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	● Cause and effect relationships may be used to predict phenomena in natural systems. ● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/ systems can be analyzed to determine how they function.	● Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. ● 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.

Title of Curriculum: Grade 7: Life Science: Biological Evolution: Unity and Diversity

Unit Name	What	Why	How
Biological Evolution: Unity and Diversity Material is covered throughout the following units: ● Natural Selection/ Evolution ● Heredity/Genetics	**Evidence of Common Ancestry and Diversity** ● The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. ● Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. ● Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. **Natural Selection** ● Natural selection leads to the predominance of certain traits in a population, and the suppression of others. ● In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to their offspring. (MS-LS4-5) **Adaptation** ● Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	● Patterns can be used to identify cause and effect relationships. ● Graphs, charts, and images can be used to identify patterns in data.	● Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. ● Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. ● Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. ● Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. ● Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. ● Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Windham School District Curriculum
Content Topic: Life Science - Grade 7

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS:
Students can gather information and use this information to support explanations of the structure and function relationship of cells. They can communicate understanding of cell theory. They have a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. The understanding of cells provides a context for the plant process of photosynthesis and the movement of matter and energy needed for the cell. Students can construct an explanation for how environmental and genetic factors affect growth of organisms. They can connect this to the role of animal behaviors in reproduction of animals as well as the dependence of some plants on animal behaviors for their reproduction.

Competencies (Standards?):
Content Standards: (ngss.nsta.org)
From Molecules to Organisms: Structures and Processes
● MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
● MS-LS1-2 Develop and use a model to describe the function of a cell as a</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to :
● Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
● Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.
● Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
● Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
● Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
● Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
● Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
● Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand …
● Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)
● Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4), (MS-LS1-5)
● Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)</td><td>ESSENTIAL QUESTIONS
● How can one explain the ways cells contribute to the function of living organisms?
● How do environmental and genetic factors influence the growth of organisms?
● How do matter and energy cycle into and out of organisms?
● What is the (significance) importance of the characteristics that are common to all living things?</td></tr>
</table>

<table>
<tr>
<td rowspan="3">whole and ways parts of cells contribute to the function.
● MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
● MS-LS1-4 Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
● MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
● MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
● MS-LS1-7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
● MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</td>
<td>● Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)
● Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)
● Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)</td>
<td></td>
</tr>
<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>Students will know…
LS1.A: Structure and Function
● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)
LS1.B: Growth and Development of Organisms
● Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
● Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)</td>
<td>Students will be skilled at…
Developing and Using Models
● Develop and use a model to describe phenomena.(MS-LS1-2)
● Develop a model to describe unobservable mechanisms. (MS-LS1-7)
Planning and Carrying Out Investigations
● Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)
Constructing Explanations and Designing Solutions
● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5),(MS-LS1-6)
Engaging in Argument from Evidence
● Use an oral and written argument supported by evidence to support or refute an</td>
</tr>
</table>

	LS1.C: Organization for Matter and Energy Flow in Organisms ● Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) **LS1.D: Information Processing** ● Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8) **PS3.D: Energy in Chemical Processes and Everyday Life** ● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6) ● Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)	explanation or a model for a phenomenon. (MS-LS1-3) ● Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4) **Obtaining, Evaluating, and Communicating information** ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)
Used in Content Area Standards		***21st Century Skills***
not applicable		● *one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.*

	● Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1) ● Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Conduct an investigation to provide evidence that living things are made of cells. ● Develop and use a model to describe the structure and function of a cell as a whole. ● Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. ● Use argument and scientific reasoning to explain how characteristic animal behaviors and specialized plant structures increase the probability of successful reproduction. ● Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. ● Construct a scientific explanation for the role of photosynthesis in the cycling of matter and flow of energy. ● Develop a model to describe how food is rearranged through chemical reactions. ● Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain.
	OTHER EVIDENCE: ***Activities may include:*** ● Labs ● Interactive/online simulations ● Discussion ● Projects

Windham School District Curriculum
Content Topic: Life Science - Grade 7

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS:
Students can analyze and interpret data, develop models, and construct arguments and demonstrate a deeper understanding of resources and the cycling of matter and the flow of energy in ecosystems. They can also study patterns of the interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on population. They evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Competencies (Standards):
Content Standards:
Ecosystems: Interactions, Energy, and Dynamics
● MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
● MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
● MS-LS2-3 Develop a model to describe the cycling of matter and</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to
● Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
● Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
● Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
● Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
● Evaluate competing design solutions for maintaining biodiversity and ecosystem services.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand …
● Patterns can be used to identify cause and effect relationships. (MS-LS2-2)
● Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)
● The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)
● Small changes in one part of a system might cause large changes in another part. (MS- LS2-4), (MS-LS2-5)
● The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)
● Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)</td><td>ESSENTIAL QUESTIONS
● How does a system of living and non-living things operate to meet the needs of the organisms in an ecosystem?
● How do organisms interact with each other within and across multiple ecosystems?
● How do changes to physical or biological components of an ecosystem affect populations of organisms?
● How can humans help maintain the biodiversity of ecosystems?</td></tr>
</table>

flow of energy among living and nonliving parts of an ecosystem. ● MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. ● MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services. ● MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. ● MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)	
	Acquisition	
	Students will know… **LS2.A: Interdependent Relationships in Ecosystems** ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) ● Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) ● Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2) **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)	*Students will be skilled at…* **Developing and Using Models** ● Develop a model to describe phenomena. (MS-LS2-3) **Analyzing and Interpreting Data** ● Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) **Constructing Explanations and Designing Solutions** ● Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2) **Engaging in Argument from Evidence** ● Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4) ● Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

	● Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) **LS4.D: Biodiversity and Humans** ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on — for example, water purification and recycling. (secondary to MS-LS2-5) **ETS1.B: Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)	
Used in Content Area Standards		***21st Century Skills***
not applicable		● One to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity. ● The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) ● Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3) ● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Analyze and interpret data about the effects of resource availability on organisms and populations of organisms. ● Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. ● Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. ● Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. ● Evaluate competing design solutions for maintaining biodiversity and ecosystem services. ● Research and analyze methods for maintaining biodiversity with an emphasis on scientific, economic, and social considerations
	OTHER EVIDENCE: ***Activities may include:*** ● Labs ● Interactive/online simulations ● Discussion ● Projects ● Field Experience

Windham School District Curriculum
Content Topic: Life Science - Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:
Students can use models to describe ways gene mutations and sexual reproduction contribute to genetic variation. They will develop a deeper understanding of how gene structure determines differences in the functioning of organisms.

Competencies (Standards):

Content Standards:

Heredity: Inheritance and Variation of Traits

- MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- MS-LS3-2Develop 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.
- MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Transfer

Students will be able to

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

Meaning

ENDURING UNDERSTANDINGS
Students will understand …

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)
- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

ESSENTIAL QUESTIONS

- How do living organisms pass traits from one generation to the next?
- How does asexual reproduction and sexual reproduction differ in their ability to contribute to the diversity and continuity of life?

Acquisition

Students will know…

LS3.A: Inheritance and Variation of Traits

- Chromosomes are structures in the nucleus of a cell that contain genes. Those genes can undergo changes which may result in changes to phenotypes (outward characteristics)(MS-LS3-1)
- Asexual reproduction results in exact copies of the parent organism. Sexual reproduction

Students will be skilled at…

Developing and Using Models

- Develop a model to describe phenomena. (MS-LS3-1)

Analyzing and Interpreting Data

- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

	creates offspring that have different combinations of traits than the parents (variation)(MS-LS3-2) ● Models of possible genetic combinations can predict outcomes of traits in next generation offspring produced via sexual reproduction (MS-LS3-2) ● The offspring results of sexual reproduction in large populations can inform us of mechanisms of inheritance for those traits (MS-LS3-2)	**Engaging in Argument from Evidence** ● Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)
Used in Content Area Standards		***21st Century Skills***
not applicable		● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity.

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop and use a model to describe why structural changes to genes (mutations) may affect proteins and may result in harmful, beneficial, or neutral effects to an organism. ● 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.
	OTHER EVIDENCE: ***Activities may include:*** ● Labs ● Interactive/online simulations ● Discussion ● Projects

Windham School District Curriculum
Content Topic: Life Science - Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:
Students can construct explanations based on evidence to support fundamental understandings of natural selection and evolution. They can use ideas of genetic variation in a population to make sense of organisms surviving and reproducing, hence passing on the traits of the species. They are able to use fossil records and anatomical similarities of the relationships among organisms and species to support their understanding.

Competencies (Standards):
Content Standards:
Biological Evolution: Unity and Diversity

- MS-LS4-1 Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across

Transfer

Students will be able to

- Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Meaning

ENDURING UNDERSTANDINGS
Students will understand …

- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4-3)
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4),(MS-LS4-5),(MS-LS4-6)

ESSENTIAL QUESTIONS

- How do organisms change over time in response to changes in the environment?
- What is the value of a classification system in informing our knowledge of evolutionary relationships?
- What characteristics do all living things share?

Acquisition

Students will know…

LS4.A: Evidence of Common Ancestry and Diversity

- The collection of fossils and their placement in chronological order (e.g., through the location of

Students will be skilled at…

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

multiple species to identify relationships not evident in the fully formed anatomy. ● MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. ● MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. ● MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1) ● Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2) ● Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3) **LS4.B: Natural Selection** ● Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) ● In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to their offspring. (MS-LS4-5) **LS4.C: Adaptation** ● Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)	● Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1) ● Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6) ● Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2) ● Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4) ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

Used in Content Area Standards	*21st Century Skills*
not applicable	● one to one technology, employing 21st century skills of collaboration, communication, critical thinking and creativity. ● Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth. ● Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and fossil organisms to infer evolutionary relationships. ● Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. ● Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing. ● Research information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. ● Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
	OTHER EVIDENCE: ***Activities may include:*** ● Labs ● Interactive/online simulations ● Discussion ● Projects

Title of Curriculum: Grade 8 Science: Matter and its Interactions

Unit Name	What	Why	How
Matter and its Interactions	**Structure and Properties of Matter** ● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. ● Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. ● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. **Chemical Reactions** ● Substances react chemically in characteristic ways. In a chemical	**Patterns** ● Students should be able to identify macroscopic patterns related to the nature of microscopic and atomic-level structure. **Cause and Effect** ● Students should be able to identify cause and effect relationships that may be used to predict phenomena in natural or designed systems. **Scale, Proportion, and Quantity** ● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **Energy and Matter** ● Matter is conserved because atoms are conserved in physical and chemical processes. ● The transfer of energy can be tracked as energy flows through a designed or natural system. **Structure and Function** ● Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	● Develop models to describe the atomic composition of simple molecules and extended structures. ● Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. ● Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. ● Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. ● Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. ● Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

	process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. ● The total number of each type of atom is conserved, and thus the mass does not change. ● Some chemical reactions release energy, others store energy. **Definitions of Energy** ● The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4) ● The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends		

	jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) **Developing Possible Solutions** ● A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6) **Optimizing the Design Solution** ● Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6) ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6)		

Title of Curriculum: Grade 8 Science: Motion and Stability: Forces and Interactions

Unit Name	What	Why	How
Motion and Stability: Forces and Interactions	**Forces and Motion** ● 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). ● The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. ● All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. **Types of Interactions** ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes	**Cause and Effect** ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Systems and System Models** ● Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. **Stability and Change** ● Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.	● Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. ● 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. ● Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. ● Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. ● Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

	depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. ● Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. ● Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).		

Title of Curriculum: Grade 8 Science: Energy

Unit Name	What	Why	How
Energy	**Definitions of Energy** ● Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. ● A system of objects may also contain stored (potential) energy, depending on their relative positions. ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. **Conservation of Energy and Energy Transfer** ● When the motion energy of an object changes, there is inevitably some other change in energy at the same time. ● The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. ● Energy is spontaneously transferred out of hotter regions or objects and into colder ones. **Relationship Between Energy and Forces** ● When two objects interact, each one exerts a force on the other that can	**Scale, Proportion, and Quantity** ● Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes **Systems and System Models** ● Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. **Energy and Matter** ● 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.	● Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. ● Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. ● Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. ● Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. ● Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

	cause energy to be transferred to or from the object. **Defining and Delimiting and Engineering Problem** ● The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. **Developing Possible Solutions** ● A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.		

Title of Curriculum: Grade 8 Science: Waves and Their Applications in Technologies for Information Transfer

Unit Name	What	Why	How
Waves and Their Applications in Technologies for Information Transfer	**Wave Properties** ● A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. ● A sound wave needs a medium through which it is transmitted. **Electromagnetic Radiation** ● When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. ● The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. ● A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. ● However, because light can travel through space, it cannot be a matter wave, like sound or water waves. **Information Technologies and Instrumentation** ● Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	**Patterns** ● Graphs and charts can be used to identify patterns in data. **Structure and Function** ● Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. ● Structures can be designed to serve particular functions.	● Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. ● Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. ● Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Windham School District Curriculum
Content Topic: Physical Science - Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:
By the end of middle school, students will be able to apply the understanding that pure substances have characteristic physical and chemical properties and are made from a single type of atom or molecule. They will be able to provide molecular level accounts to explain states of matters and changes between states, that chemical reactions involve regrouping of atoms to form new substances, and that atoms rearrange during chemical reactions. Students are also able to apply an understanding of the design and the process of optimization in engineering to chemical reaction systems

Content Standards:
Matter and its Interactions

- MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.
- 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.
- MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a

Transfer

Students will be able to

- Develop models to describe the atomic composition of simple molecules and extended structures.
- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

Meaning

ENDURING UNDERSTANDINGS
Students will understand…

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

ESSENTIAL QUESTIONS

- "How do atomic and molecular interactions explain the properties of matter that we see and feel?

pure substance when thermal energy is added or removed. ● MS-PS1-5: Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. ● MS-PS1-6: Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. ● MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. ● MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	**Structure and Function** ● Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)	
	Acquisition	
	Students will know… ***P*S1.A: Structure and Properties of Matter** ● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2),(MS-PS1-3) ● Gasses and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) ● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) **PS1.B: Chemical Reactions** ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5) ● The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) ● Some chemical reactions release energy, others store energy. (MS-PS1-6)	*Students will be skilled at…* **Developing and Using Models** ● Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. ● Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4) ● Develop a model to describe unobservable mechanisms. (MS-PS1-5) **Analyzing and Interpreting Data** ● Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) **Constructing Explanations and Designing Solutions** ● Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

	PS3.A: Definitions of Energy ● The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4) ● The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) **ETS1.B: Developing Possible Solutions** ● A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6) **ETS1.C: Optimizing the Design Solution** ● Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6) ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	● Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MSPS1-6) Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods. ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)
Used in Content Area Standards		***21st Century Skills***
not applicable		

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will be able to: ● Develop models to describe the atomic composition ● Analyze and interpret data to determine if a chemical reaction has occurred. ● Gather information to describe that synthetic materials come from natural resources and impact society. ● Develop a model that predicts and describes changes when thermal energy is added or removed. ● Develop and use a model to describe how mass is conserved. ● Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
	OTHER EVIDENCE: ● Formatives ● Summatives ● Labs ● Homework

Windham School District Curriculum
Content Topic: Physical Science - Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

By the end of middle school, students will be able to apply Newton's Third Law of Motion to relate forces to explain the motion of objects. Students also apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students will develop understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are also able to apply an engineering practice and concept to solve a problem caused when objects collide.

Content Standards:

Forces and Motion:

- MS-PS2-1:Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- 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.
- MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Transfer

Students will be able to

- Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- 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.
- Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Meaning

ENDURING UNDERSTANDINGS

Students will understand…

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Systems and System Models

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

ESSENTIAL QUESTIONS

- "How can one describe physical interactions between objects and within systems of objects?"

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MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

</td><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
PS2.A: Forces and Motion
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). (MS-PS2-1)
The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)
All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MSPS2-2)
PS2.B: Types of Interactions
Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)
Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)
Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend</td><td>Students will be skilled at…
Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between
variables, and clarifying arguments and models.
Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)
Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and</td></tr>
</table>

	through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)	how much data is needed to support a claim. (MS-PS2-2) ● Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5) **Constructing Explanations and Designing Solution** ● Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1) **Engaging in Argument from Evidence** ● Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. ● Construct and present oral and written arguments 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. (MS-PS2-4)

Used in Content Area Standards	*21st Century Skills*
not applicable	● Influence of Science, Engineering, and Technology on Society and the Natural World ● The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will be able to: ● Design a solution involving two colliding objects ● 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. ● Ask questions to determine the factors that affect the strength of electric and magnetic forces. ● Construct and present arguments to support the claim that gravitational interactions are attractive and depend on the masses of the objects. ● Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
	OTHER EVIDENCE: ● Formatives ● Summatives ● Labs ● Homework

Windham School District Curriculum
Content Topic: Physical Science - Grade 8

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS:
Students develop their understanding of important qualitative ideas about energy including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students will also come to know the difference between energy and temperature, and begin to develop an understanding of the relationship between force and energy. Students are also able to apply an understanding of design to the process of energy transfer.

Content Standards:
Energy:
● MS-PS3-1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to:
● Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
● Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
● Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
● Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
● Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand…
Scale, Proportion, and Quantity
● Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1),(MS-PS3-4)
Systems and System Models
● Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. (MS-PS3-2)
Energy and Matter
● Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5)</td><td>ESSENTIAL QUESTIONS
How can energy be transferred from one object or system to another?</td></tr>
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MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that

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The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)

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<tr>
<td colspan="2">Acquisition</td>
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Students will know…
PS3.A: Definitions of Energy

Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)
A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)
Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)

PS3.B: Conservation of Energy and Energy Transfer

When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)
The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)
Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

PS3.C: Relationship Between Energy and Forces

When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

ETS1.A: Defining and Delimiting an Engineering Problem

The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge

</td>
<td>
Students will be skilled at…
Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
Develop a model to describe unobservable mechanisms. (MS-PS3-2)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS3-4)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

</td>
</tr>
</table>

an optimal design can be achieved.	that is likely to limit possible solutions. (secondary to MS-PS3-3) **ETS1.B: Developing Possible Solutions** ● A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (secondary to MS-PS3-3)	● Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3) **Engaging in Argument from Evidence** ● Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds. ● Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)
Used in Content Area Standards		***21st Century Skills***
not applicable		

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will be able to: ● Construct and interpret graphs to describe the relationships of kinetic energy to mass and the speed of an object. ● Develop a model to describe how potential energy is stored in a system. ● Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. ● Plan an investigation to determine the relationships among energy transferred, type of matter, mass, and temperature of the sample. ● Construct, use, and present arguments to support the claim that when the kinetic energy changes, energy is transferred.
	OTHER EVIDENCE: ● Formatives ● Summatives ● Labs ● Homework

Windham School District Curriculum
Content Topic: Physical Science - Grade 8

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">ESTABLISHED GOALS:
Students are able to describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means to send digital information.

Content Standards:
Waves and Electromagnetic Radiation
● MS-PS4-1: Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
● MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
● MS-PS4-3: Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to
● Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
● Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
● Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>ENDURING UNDERSTANDINGS
Students will understand…
Patterns
● Graphs and charts can be used to identify patterns in data. (MS-PS4- 1)
Structure and Function
● Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
● Structures can be designed to serve particular functions. (MS-PS4-3)</td><td>ESSENTIAL QUESTIONS
● “What are the characteristic properties of waves and how can they be used?”</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
PS4.A: Wave Properties
● A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
● A sound wave needs a medium through which it is transmitted. (MS-PS4-2)
PS4.B: Electromagnetic Radiation
● When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS-PS4-2)</td><td>Students will be skilled at…
Developing and Using Models
● Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
● Develop and use a model to describe phenomena. (MS-PS4-2)
Using Mathematics and Computational Thinking
● Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to</td></tr>
</table>

	● The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2) ● A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) ● However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) ***PS4.C: Information Technologies and Instrumentation*** ● Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)	identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. ● Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1) **Obtaining, Evaluating, and Communicating Information** ● Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods. ▪ Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)
Used in Content Area Standards		***21st Century Skills***
not applicable		**Influence of Science, Engineering, and Technology on Society and the Natural World** ● Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: Students will be able to: ● Use mathematical representations to describe how the amplitude of a wave is related to the energy in a wave. ● Develop and use a model to describe that waves are reflected, absorbed, or transmitted. ● Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information.
	OTHER EVIDENCE: ● Formatives ● Summatives ● Labs ● Homework

WINDHAM SCHOOL DISTRICT

Technology Education Grades 7-8

Thank you to all the staff who assisted in reviewing the Grade 7-8 Science Curriculum. They worked many hours to research/review science education curricula, standards, ask questions and edit.

TEAM

Shannan McKenna	SAU
Michael Koski	SAU
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Mission Statement

The Windham Schools Technology Education curriculum is designed to introduce students to new tools they can use to show what they know, solve problems and design solutions. Additionally, students will explore STEM career options, learn to code computer programs, and use their new skills in a variety of challenges.

Windham School District Curriculum
Curriculum Overview

Unit Name	Why (enduring understandings)	How (skills)	What (content, vocab)
Grade 7 Design Essentials	● The Engineering Design Process is a method that is used to solve technological challenges to change and improve products for the way we live. ● Through individual and collaborative work, students should demonstrate knowledge of the problem-solving process.	● Explain the design process both orally and in written form ● Work independently and in teams to demonstrate knowledge of the problem-solving process. ● Think critically about solutions to problems	● Design process ● Engineering ● Modeling ● Optimization ● Technological Solutions ● Constraints ● Iterative Process ● Criteria
Simple Machines in Action	● Energy and matter interact through forces that result in changes in motion. ● Simple machines make work easier by trading a change in force for a change in distance.	● Name six simple machines and list examples of each ● Explain the meaning of work and energy as it relates to machines ● Explain how each simple machine can be or is integrated into larger machines ● Design and construct a “Rube Goldberg Machine” that includes all of the simple-machine types	● Rube Goldberg Machine ● mechanical advantage ● wheel and axle ● simple machine ● inclined plane ● pulley ● wedge ● screw ● fulcrum ● work ● force ● mass ● effort ● gravity ● load

Transforming Energy (potential to kinetic)	● Energy can be transferred from one object to another and can be transformed from one form to another, but the total amount of energy never changes. (Boundary: Qualitative analysis only of Acceleration)	● Design a vehicle which uses potential energy transformed to kinetic energy for movement ● Test the vehicle for task requirements and design multiple iterations by changing variables ● Create a graph to represent the distance/time relationship	● potential energy ● kinetic energy ● momentum ● acceleration ● friction
Robotics Engineering	● System control and robotics is the future of manufacturing in business and industry. ● System control technology is used in building control systems at school, work, and home applications. ● Computer hardware and software can be used to control a variety of devices to complete specific tasks and do work.	● Build a basic working robot ● Program the robot to autonomously complete a given task	● brick ● motor ● sensor ● block programming ● loop ● automation ● axes ● rotation
Career exploration (Career Fair Related to WHS classes)	● There are many career paths available for students with technical knowledge and training	● Gain knowledge of personal characteristics, interests, aptitudes, and skills ● Gain awareness of and respect for the diversity of the world of work ● Understand of the relationship between school performance and future choices ● Understand personal goal-setting and decision-making patterns and attitudes	● Medical Technology ● Agricultural Technologies and related Biotechnologies ● Energy and Power Technologies ● Information and Communication Technologies ● Transportation Technologies ● Manufacturing Technologies ● Construction Technologies ● Engineering
Grade 8 Computer Programming	● Computer Programming plays a role in either a specific form of entertainment or as a vehicle for self-expression. ● Computer programming is a way to process a series of instructions	● Create programmatic images, animations, interactive art, and games. ● Create a flowchart to demonstrate critical thinking necessary for program design	● Program ● Animation ● Frame ● Parameter ● Variable ● Expression

	entered into the computer where data is entered (input) into a program and manipulated for a desired result (output)		● Boolean ● Conditionals ● Functions
Robotics Engineering	● System control and robotics is the future of manufacturing in business and industry. ● System control technology is used in building control systems at school, work, and home applications. ● Computer hardware and software can be used to control a variety of devices to complete specific tasks and do work.	● Build a basic working robot ● Design and build an arm for the robot to complete a particular task ● Program the robot to autonomously complete a given task	● programming ● brick ● motor ● sensor ● block programming ● loop ● automation ● axis ● rotation
Graphing Calculator Exploration	● Calculators are a useful tool for computation and can be used for communicating data in various ways. ● (Note: Integrated use of graphing tool into other units)	● Complete a designed activity which includes both graphing and other programmable features of the system	● graphing ● plotting ● variables ● commands ● I/O ● functions ● expressions
3D Design	● Engineers use 3D modeling when solving technical problems ● Develop understanding about the difference between a sketch, working drawing and 3D model	● Explain the process of 3D printing from design conception to additive manufacturing ● Using 3D printing software, design and print a small keychain tag using designated constraints ● Using 3D printing software, design and print a container that will float containing a certain mass of materials	● modeling ● axis ● design ● filament ● layer resolution ● slicing ● extruder ● print speed ● positioning precision ● fused filament fabrication (FFF) ● additive manufacturing ● Computer Aided Design (CAD) ● prototype

Career exploration (Career Fair Related to WHS classes)	● There are many career paths available for students with technical knowledge and training	● Gain knowledge of personal characteristics, interests, aptitudes, and skills ● Gain awareness of and respect for the diversity of the world of work ● Understand of the relationship between school performance and future choices ● Understand personal goal-setting and decision-making patterns and attitudes	● Medical Technology ● Agricultural Technologies and related Biotechnologies ● Energy and Power Technologies ● Information and Communication Technologies ● Transportation Technologies ● Manufacturing Technologies ● Construction Technologies ● Engineering

Windham School District Curriculum
Design Essentials: Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- E1. Apply academic concepts and practices in a technological setting.
- H1. Exhibit responsible individual and cooperative work habits.

(NH Computer Science Standards)

- 2-CS-01 Recommend improvements to the design of computing devices, based on an analysis of how users interact with the devices. The study of human–computer interaction (HCI) can improve the design of devices, including both hardware and software. Students should make recommendations for existing devices (e.g., a laptop, phone, or tablet) or design their own components or interface (e.g., create their own controllers). Teachers can guide students to consider usability through several lenses, including accessibility, ergonomics, and learnability. For example, assistive devices provide capabilities such as scanning written information and converting it to speech.
- 2-AP-13 Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. Students should break down problems into subproblems, which can be further broken down to smaller parts. Decomposition facilitates aspects of program development by allowing students to

Transfer

Students will be able to

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (NGSS - MS-ETS1-1)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- The Engineering Design Process is a method that is used to solve technological challenges to change and improve products for the way we live.
- Through individual and collaborative work, students should demonstrate knowledge of the problem-solving process.

ESSENTIAL QUESTIONS

- What is the design process?
- What is Engineering?

Acquisition

Students will know…

- How to use the problem solving process
- How to use the design process.
- How to effectively work in a group to collaborate including brainstorming.
- How to clearly communicate your process in both an oral and written format (documentation, design notebook, reflection).

Students will be skilled at…

- Explaining the design process both orally and in written form
- Working independently and in teams to demonstrate knowledge of the problem-solving process.
- Thinking critically about solutions to problems

focus on one piece at a time (e.g., getting input from the user, processing the data, and displaying the result to the user). Decomposition also enables different students to work on different parts at the same time. For example, animations can be decomposed into multiple scenes, which can be developed independently. **(WSD Digital Literacy Standards)** ● 6-8.CT.e.1 Create a model of a real-world system and explain why some details, features and behaviors were required in the model and why some could be ignored.		
Used in Content Area Standards		***21st Century Skills***
not applicable		● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Design and evaluate competing design solutions ● Based on inputs, anticipate desired outputs
	OTHER EVIDENCE:

Windham School District Curriculum
Simple Machines in Action: Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- H1. Exhibit responsible individual and cooperative work habits.

(NH Computer Science Standards)

- 2-AP-18 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts. Collaboration is a common and crucial practice in programming development. Often, many individuals and groups work on the interdependent parts of a project together. Students should assume pre-defined roles within their teams and manage the project workflow using structured timelines. With teacher guidance, they will begin to create collective goals, expectations, and equitable workloads. For example, students may divide the design stage of a game into planning the storyboard, flowchart, and different parts of the game mechanics. They can then distribute tasks and roles among members of the team and assign deadlines.

Transfer

Students will be able to

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (NGSS - MS-ETS1-4)
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (NGSS - MS-ETS1-2)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Energy and matter interact through forces that result in changes in motion.
- Simple machines make work easier.

ESSENTIAL QUESTIONS

- How does a scientist describe work?
- How do we use machines in our everyday lives?
- How do machines do work?
- How do simple machines combine to make work easier?

Acquisition

Students will know…

- How to identify types of Simple Machines
- How to design a Rube Goldberg Machine using one of each simple machine

Students will be skilled at…

- Naming and listing examples of each of the six simple machines
- Explaining the meaning of work and energy as it relates to machines
- Explaining how each simple machine can be or is integrated into larger machines
- Constructing a “Rube Goldberg Machine” that includes all of the simple-machine types

● 2-AP-19 Document programs in order to make them easier to follow, test, and debug. Documentation allows creators and others to more easily use and understand a program. Students should provide documentation for end users that explains their artifacts and how they function. For example, students could provide a project overview and clear user instructions. They should also incorporate comments in their product and communicate their process using design documents, flowcharts, and presentations.		
Used in Content Area Standards		***21st Century Skills***
not applicable		● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to meet certain criteria ● Evaluate a model related to criteria
	OTHER EVIDENCE:

Windham School District Curriculum
Transforming Energy: Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- H1. Exhibit responsible individual and cooperative work habits.

(NH Computer Science Standards)

- 2-AP-18 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts. Collaboration is a common and crucial practice in programming development. Often, many individuals and groups work on the interdependent parts of a project together. Students should assume pre-defined roles within their teams and manage the project workflow using structured timelines. With teacher guidance, they will begin to create collective goals, expectations, and equitable workloads. For example, students may divide the design stage of a game into planning the storyboard, flowchart, and different parts of the game mechanics. They can then distribute tasks and roles among members of the team and assign deadlines.
- 2-AP-19 Document programs in order to make them easier to follow, test, and debug. Documentation allows creators and others to more easily use and understand a program. Students should provide documentation for end users that explains their artifacts and how they function. For example, students could provide a project overview and clear user instructions. They should also incorporate comments in their product and communicate their process using design documents, flowcharts, and presentations.

Transfer

Students will be able to

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (NGSS - MS-ETS1-4)
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (NGSS - MS-ETS1-2)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Energy can be transferred from one object to another and can be transformed from one form to another, but the total amount of energy never changes. (Boundary: Qualitative analysis only of Acceleration)

ESSENTIAL QUESTIONS

- How are energy transfers and energy transformations alike and different?
- How do you identify kinetic energy vs. potential energy?

Acquisition

Students will know…

- What happens when energy is transformed
- What is an example of energy transformation
- How to differentiate between types of energy
- How to recognize that energy has the ability to cause motion or create change

Students will be skilled at…

- Designing a vehicle which uses potential energy transformed to kinetic energy for movement
- Testing the vehicle for task requirements and design multiple iterations by changing variables
- Creating a graph to represent the distance/time relationship

Used in Content Area Standards	*21st Century Skills*
not applicable	● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Design a model to meet certain criteria ● Evaluate a model related to criteria
	OTHER EVIDENCE:

Windham School District Curriculum
Robotics Engineering: Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- H1. Exhibit responsible individual and cooperative work habits.

(NH Computer Science Standards)

- 2-AP15 Seek and incorporate feedback from team members and users to refine a solution that meets user needs. Development teams that employ user-centered design create solutions (e.g., programs and devices) that can have a large societal impact, such as an app that allows people with speech difficulties to translate hard-to-understand pronunciation into understandable language. Students should begin to seek diverse perspectives throughout the design process to improve their computational artifacts. Considerations of the end-user may include usability, accessibility, age-appropriate content, respectful language, user perspective, pronoun use, color contrast, and ease of use.
- 2-AP-16 Incorporate existing code, media, and libraries into original programs, and give attribution. Building on the work of others enables students to produce more interesting and powerful creations. Students should use portions of code, algorithms, and/or digital media in their own programs and websites. At this level, they may also import libraries and connect to web application program interfaces (APIs). For example, when creating a side-scrolling game, students may incorporate portions of code that create a realistic

Transfer

Students will be able to

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (NGSS - MS-ETS1-4)
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (NGSS - MS-ETS1-2)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- System control and robotics is the future of manufacturing in business and industry.
- System control technology is used in building control systems at school, work, and home applications.
- Computer hardware and software can be used to control a variety of devices to complete specific tasks and do work.

ESSENTIAL QUESTIONS

- How can an autonomously programmed robot be designed to perform specific tasks using a variety of sensors that acquire information about the world external to the robot?
- How can autonomous robots be designed and used to perform manual and repetitive tasks safely?

Acquisition

Students will know…

- Build a basic robot and use the programming effectively to get the robot to move.
- Develop and program an arm that performs a specific purpose

Students will be skilled at…

- Building a basic, working robot
- Designing and build an arm for the robot to complete a particular task
- Programming the robot to autonomously complete a given task

jump movement from another person's game, and they may also import Creative Commons-licensed images to use in the background. Students should give attribution to the original creators to acknowledge their contributions. **(WSD Digital Literacy Standards)** ● **6-8.CS.a.4** Identify and describe the use of sensors, actuators, and control systems in an embodied system (e.g., a robot, an e-textile, installation art, smart room). ● **6-8.CS.a.5** Individually and collaboratively design and demonstrate the use of a device (e.g., robot, e-textile) to accomplish a task.		
Used in Content Area Standards		***21st Century Skills***
not applicable		● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to meet certain criteria ● Evaluate a model related to criteria
	OTHER EVIDENCE:

Windham School District Curriculum
Career Exploration: Grade 7

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A4. Identify basic skills required in technological careers.
- B2. Identify and investigate various types of technology systems (including: medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing, construction and engineering).
- G1. Evaluate technological systems and their impact on people, the environment, culture, and the economy.

(NH Computer Science Standards)

- 2-IC-20 Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. Advancements in computer technology are neither wholly positive nor negative. However, the ways that people use computing technologies have tradeoffs. Students should consider current events related to broad ideas, including privacy, communication, and automation. For example, driverless cars can increase convenience and reduce accidents, but they are also susceptible to hacking. The emerging industry will reduce the number of taxi and shared-ride driver's, but will create more software engineering and cybersecurity jobs.

(WSD Digital Literacy Standards)

- 6-8.CAS.c.1 Describe current events and emerging technologies in computing and the effects they may have on education, the workplace, individuals, communities, and global society.
- 6-8.CAS.c.2 Identify and discuss the technology proficiencies needed in the classroom and the workplace, and how to meet the needs.

Transfer

Students will be able to

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (NGSS - MS-ETS1-1)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- There are many career paths available for students with technical knowledge and training

ESSENTIAL QUESTIONS

- What factors and special skills need to be considered when selecting and preparing for future employment?
- What type of technical skills are required for your chosen career?
- What jobs and careers are available regionally and nationally?

Acquisition

Students will know…

- How to explore the opportunities available in the technology fields.
- That there are a variety of local technological opportunities by interacting with local professionals.

Students will be skilled at…

- Gaining knowledge of personal characteristics, interests, aptitudes, and skills
- Gaining awareness of and respect for the diversity of the world of work
- Understanding of the relationship between school performance and future choices
- Understanding personal goal-setting and decision-making patterns and attitudes

Used in Content Area Standards	*21st Century Skills*
not applicable	● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Research/explore technology careers in various fields ● Present findings using slideshow/powerpoint

Windham School District Curriculum
Computer Programming: Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- C1. Demonstrate skills needed to find, use, and communicate technical information.
- E1. Apply academic concepts and practices in a technological setting.

(NH Computer Science Standards)

- 2-AP-13 Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. Students should break down problems into subproblems, which can be further broken down to smaller parts. Decomposition facilitates aspects of program development by allowing students to focus on one piece at a time (e.g., getting input from the user, processing the data, and displaying the result to the user). Decomposition also enables different students to work on different parts at the same time. For example, animations can be decomposed into multiple scenes, which can be developed independently.
- 2-AP-12 Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. Control structures can be combined in many ways. Nested loops are loops placed within loops. Compound conditionals combine two or more conditions in a logical relationship (e.g., using AND, OR, and NOT), and nesting conditionals within one another allows the result of one conditional to lead to another. For example, when programming an interactive story, students could use a compound conditional within a loop to unlock a door only if a character has a key AND is touching the door.
- 2-AP-14 Create procedures with parameters to organize code and make it easier to reuse. Students should create procedures and/or functions that are used multiple times within a program to repeat groups of instructions. These procedures can be generalized by

Transfer

Students will be able to

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (NGSS - MS-ETS1-1)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Computer Programming plays a role in either a specific form of entertainment or as a vehicle for self expression.
- Computer programming is a way to process a series of instructions entered into the computer where data is entered (input) into a program and manipulated for a desired result (output)

ESSENTIAL QUESTIONS

- What is a computer program?
- How does programming enable creativity and individual expression?
- What practices and strategies will help me as I write programs?
- How can programs be organized so that common problems only need to be solved once?
- How can I build on previous solutions to create even more complex behavior?

Acquisition

Students will know…

- A computer is an electronic device that stores, retrieves, and processes data and can be programmed with instructions.
- There are many programming languages that perform different functions.
- Computer programming is about finding different ways to solve problems.

Students will be skilled at…

- Creating a flowchart to demonstrate critical thinking necessary for program design
- Creating programmatic images, animations, interactive art, and games.

defining parameters that create different outputs for a wide range of inputs. For example, a procedure to draw a circle involves many instructions, but all of them can be invoked with one instruction, such as “drawCircle.” By adding a radius parameter, the user can easily draw circles of different sizes **(WSD Digital Literacy Standards)** ● 6-8.CT.d.3 Create a program, individually or collaboratively, that implements an algorithm to achieve a given goal. ● 6-8.CT.d.4 Implement problem solving solutions using a programming language, including all of the following: looping behavior, conditional statements, expressions, variables, and functions.	● How to use organization tools and a programming language to solve a problem or create something	
Used in Content Area Standards		***21st Century Skills***
not applicable		● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Define the criteria and constraints of a design problem
	OTHER EVIDENCE:

Windham School District Curriculum
Robotics Engineering: Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- H1. Exhibit responsible individual and cooperative work habits.

(NH Computer Science Standards)

- 2-AP-15 Seek and incorporate feedback from team members and users to refine a solution that meets user needs. Development teams that employ user-centered design create solutions (e.g., programs and devices) that can have a large societal impact, such as an app that allows people with speech difficulties to translate hard-to-understand pronunciation into understandable language. Students should begin to seek diverse perspectives throughout the design process to improve their computational artifacts. Considerations of the end-user may include usability, accessibility, age-appropriate content, respectful language, user perspective, pronoun use, color contrast, and ease of use
- 2-AP16 Incorporate existing code, media, and libraries into original programs, and give attribution. Building on the work of others enables students to produce more interesting and powerful creations. Students should use portions of code, algorithms, and/or digital media in their own programs and websites. At this level, they may also import libraries and connect to web application program interfaces (APIs). For example, when creating a side-scrolling game, students may incorporate portions of code that create a realistic jump movement from another person's game, and they may also import Creative Commons-licensed images to use in the

Transfer

Students will be able to

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (NGSS - MS-ETS1-4)
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (NGSS - MS-ETS1-2)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- System control and robotics is the future of manufacturing in business and industry.
- System control technology is used in building control systems at school, work, and home applications.
- Computer hardware and software can be used to control a variety of devices to complete specific tasks and do work.

ESSENTIAL QUESTIONS

- How can an autonomously programmed robot be designed to perform specific tasks using a variety of sensors that acquire information about the world external to the robot?
- How can autonomous robots be designed and used to perform manual and repetitive tasks safely?

Acquisition

Students will know…

- Build a basic robot and use the programming effectively to get the robot to move.

Students will be skilled at…

- Building a basic, working robot
- Designing and building an arm for the robot to complete a particular task

background. Students should give attribution to the original creators to acknowledge their contributions. **(WSD Digital Literacy Standards)** ● 6-8.CS.a.4 Identify and describe the use of sensors, actuators, and control systems in an embodied system (e.g., a robot, an e-textile, installation art, smart room). ● 6-8.CS.a.5 Individually and collaboratively design and demonstrate the use of a device (e.g., robot, e-textile) to accomplish a task.	● Develop and program an arm that performs a specific purpose	● Programming the robot to autonomously complete a given task
Used in Content Area Standards		***21st Century Skills***
not applicable		● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to meet certain criteria ● Evaluate a model related to criteria
	OTHER EVIDENCE:

Windham School District Curriculum
Graphing Calculator Exploration: Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- C1. Demonstrate skills needed to find, use, and communicate technical information.
- E1. Apply academic concepts and practices in a technological setting.
- **(NH Computer Science Standards)**
- 2-DA-07 Represent data using multiple encoding schemes. Data representations occur at multiple levels of abstraction, from the physical storage of bits to the arrangement of information into organized formats (e.g., tables). Students should represent the same data in multiple ways. For example, students could represent the same color using binary, RGB values, hex codes (low-level representations), as well as forms understandable by people, including words, symbols, and digital displays of the color (high-level representations).

(WSD Digital Literacy Standards)

- 6-8.CS.a.6 Use a variety of computing devices (e.g., probes, sensors, handheld devices, Global Positioning System [GPS]) to individually and collaboratively collect, analyze, and present information for content-related problems.

Transfer

Students will be able to

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

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Calculators are a useful tool for computation and can be used for communicating and collecting data in various ways.
- (Note: Integrated use of graphing tool into other units)

ESSENTIAL QUESTIONS

- How can a graphing calculator assist me in solving problems?
- How can a graphing calculator process/represent data?

Acquisition

Students will know…

- How to use the graphing calculator as a programming/data collection tool.
- Complete a lesson using the graphing calculator that requires something to be built.

Students will be skilled at…

- Completing a designed activity which includes both graphing and other programmable features of the system

Used in Content Area Standards

not applicable

21st Century Skills

- WSD Digital Literacy Standards
- NH Computer Science Standards

Stage 2 - Evidence

Evaluative Criteria	*Assessment Evidence*
	ASSESSMENT: ● Design and evaluate competing design solutions ● Based on inputs, anticipate desired outputs
	OTHER EVIDENCE:

Windham School District Curriculum
Technology Education 3D Design: Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- H1. Exhibit responsible individual and cooperative work habits.

(**NH Computer Science Standards)**

- 2-AP-10 Use flowcharts and/or pseudocode to address complex problems as algorithms. Complex problems are problems that would be difficult for students to solve computationally. Students should use pseudocode and/or flowcharts to organize and sequence an algorithm that addresses a complex problem, even though they may not actually program the solutions. Testing the algorithm with a wide range of inputs and users allows students to refine their recommendation algorithm and to identify other inputs they may have initially excluded.

(WSD Digital Literacy Standards)

- 6-8.CT.d.5 Trace programs step-by-step in order to predict their behavior.

Transfer

Students will be able to

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (NGSS - MS-ETS1-4)
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (NGSS - MS-ETS1-2)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Engineers use 3D modeling when solving technical problems
- Develop understanding about the difference between a sketch, working drawing and 3D model

ESSENTIAL QUESTIONS

- What is the value of 3D design?
- What role does 3D design play in society?
- How has technology changed 3D design?

Acquisition

Students will know…

- How to create a technical drawing for a 3D object
- How to use a 3D printer
- How to create a 3D printed design with a purpose or scenario (example: 3D container that can float and hold a certain amount of items)
- How to apply Design Process to 3D Design

Students will be skilled at…

- Explaining the process of 3D printing from design conception to additive manufacturing
- Using 3D printing software, designing a small keychain tag using designated constraints
- Using 3D printing software, designing a container that will float containing a certain mass of materials

Used in Content Area Standards	*21st Century Skills*
not applicable	● WSD Digital Literacy Standards ● NH Computer Science Academic Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Develop a model to meet certain criteria ● Evaluate a model related to criteria ● Based on inputs, anticipate desired outputs

Windham School District Curriculum
Career Exploration: Grade 8

Stage 1 Desired Results

ESTABLISHED GOALS:

Content Standards:

(New Hampshire Technology/Engineering Education Curriculum Guide)

- A4. Identify basic skills required in technological careers.
- B2. Identify and investigate various types of technology systems (including: medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing, construction and engineering).
- G1. Evaluate technological systems and their impact on people, the environment, culture, and the economy.

(NH Computer Science Standards)

- 2-IC-20 Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. Advancements in computer technology are neither wholly positive nor negative. However, the ways that people use computing technologies have tradeoffs. Students should consider current events related to broad ideas, including privacy, communication, and automation. For example, driverless cars can increase convenience and reduce accidents, but they are also susceptible to hacking. The emerging industry will reduce the number of taxi and shared-ride driver's, but will create more software engineering and cybersecurity jobs.

(WSD Digital Literacy Standards)

- 6-8.CAS.c.1 Describe current events and emerging technologies in computing and the effects they may have on education, the workplace, individuals, communities, and global society.
- 6-8.CAS.c.2 Identify and discuss the technology proficiencies needed in the classroom and the workplace, and how to meet the needs.

Transfer

Students will be able to

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (NGSS - MS-ETS1-1)

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- There are many career paths available for students with technical knowledge and training

ESSENTIAL QUESTIONS

- What factors and special skills need to be considered when selecting and preparing for future employment?
- What type of technical skills are required for your chosen career?
- What jobs and careers are available regionally and nationally?

Acquisition

Students will know…

- How to explore the opportunities available in the technology fields.
- How to use the WHS Program of Studies in order to identify technology opportunities.
- That there are a variety of local technological opportunities by interacting with local professionals.

Students will be skilled at…

- Identifying personal characteristics, interests, aptitudes, and skills
- Expressing awareness of and respect for the diversity of the world of work
- Identifying the relationship between school performance and future choices
- Identifying personal goal-setting and decision-making patterns and attitudes

Used in Content Area Standards	*21st Century Skills*
not applicable	● WSD Digital Literacy Standards ● NH Computer Science Standards

Stage 2 - Evidence	
Evaluative Criteria	***Assessment Evidence***
	ASSESSMENT: ● Research/explore technology careers in project related fields ● Present findings using slideshow/powerpoint

Attachments:

New Hampshire Technology/Engineering Education Curriculum Guide
https://www.education.nh.gov/career/career/documents/tech_ed_curr_guide.pdf

Next Generation Science Standards - MS-ETS1 Engineering Design
http://www.nextgenscience.org/dci-arrangement/ms-ets1-engineering-design

Massachusetts Department of Elementary and Secondary Education. (2016, June). 2016

Massachusetts Digital Literacy and Computer Science (DLCS) Curriculum Framework. Retrieved from http://www.doe.mass.edu/frameworks/dlcs.pdf