SCIENCE CURRICULUM

SCHOOL DISTRICT OF THREE LAKES

REVISED: June 2020

Mission Statement: Teaching Students to be Productive Citizens

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Science Curriculum

Philosophy:

Our first task and central purpose of science education is to awaken in the child, whether or not he/she will become a professional scientist, a sense of curiosity and a sense of the intellectual power of science. Science education is intended to increase the child's appreciation of him/herself and the world.

We will strive to set up learning experiences that will enable students to develop to their maximum potential. The major emphasis of the science curriculum is the development of process skills, i.e. opportunities to see, think, question, and apply what is learned. The content is the vehicle to develop these skills, and the major emphasis of evaluation should be directed toward active involvement in the process skills. To embrace these ideals, the Science curriculum has adopted the Next Generation Science Standards as the basis for the District Science Curriculum. The Next Generation Science Standards identify content and science and engineering practices that all students should learn from kindergarten to high school graduation. The main reasons for moving in this direction are two-fold. First the district is in agreement that students need to understand how the content relates to "their" world in terms of what Next Generation refers to engineering practices. The District is firm in its belief that along with rigor, students learn more and with greater ease when relevance is instilled throughout the curriculum; the engineering practices interwoven throughout the Next Generation content provides significance relevance.

General Goals:

- To demonstrate an understanding of the processes of science – observing, classifying, predicting, measuring, estimating, communicating, making operational definitions, interpreting data, formulating questions and hypotheses, experimenting, and formulating models.
- To develop a body of science knowledge through investigative processes.
- To develop an understanding of the nature of science and its impact on society.
- To develop an awareness and appreciation for the environment and the interrelationships within the environment.
- To develop critical thinking skills in order to formulate and substantiate opinions on conflicting issues.
- To develop an understanding of self, both physical and emotional aspects.
- Acquire information about people who have contributed to the development of major ideas in sciences and learn about the cultures in which these people lived and worked.

Program Evaluation

State assessment in science is done at the 4th, 8th, and 10th grade levels. Classroom assessment is primarily done to evaluate instruction and communicate progress to students and parents. This is a combination of observations, projects, quizzes, performance tasks, student notes and journals, and tests.

MODEL SCIENCE CLASSROOM GRADES K-12

The teacher will:

- Make resources available such as books, lab equipment, scientific journals, textbooks, technology, physical models
- Show enthusiasm for learning
- Provide a safe learning environment both physically and psychologically
- Model the Scientific Method
- Extend lessons to include higher order thinking skills
- Link learning to authentic tasks
- Have high expectations for students
- Model various learning strategies
- Provide a variety of activities to accommodate individual learning styles (including Fab Lab when appropriate)
- Maintain professional development
- Keep students up to date with current changes
- Discuss what scientists do with new information and how it affects scientific theory
- Discuss how scientists use technology in the research process
- Demonstrate how to read a dichotomous key or flow chart

Kindergarten

Unit 1: Weather and Sky

Time Frame: 6-9 Weeks

Topics Covered:

- Observing the Sky
- Weather Watchers
- Dangerous Weather
- Warming the Earth
- In the Heat of The Sun

Next Generation Science Standards Addressed:

· 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.

· K-PS3-1: Make observations to determine the effect of sunlight on Earth's surface.

· K-PS3-2: Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface.

· 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.

Materials:

Carolina Science Material list
https://carolinascienceonline.com/bbs-journey/ws/ws_MaterialsList.pdf
See Grade Level Supply List for Mystery Science

Activities/Outcomes:

- As a class, students predict weather conditions and objects that can be observed in the daytime sky and then go outside to record their observations.

- Students develop and use models of weather instruments and use them to carry out an investigation. Using the instruments students determine the direction of the wind, and how much rain has fallen. Students analyze the data to determine weather trends.
- Using various materials, they carry out an investigation to test which materials can redirect sunlight. Using this information, they design a solution to help bring sunlight to various locations.
- Students obtain and evaluate information from a map. Analyzing the hot and cool surfaces, they design a solution to get a person across the pool without burning their feet. Students analyze an image of a playground and construct an explanation about what areas would be coolest and hottest. Students conduct an investigation to determine the warmest and coldest spots outside on a sunny day.
- Students make daily observations of the weather, collect data, and report their findings to the class. A class graph will be constructed at the end of each week.
- Students use a model to explore tornadoes, practice a tornado drill, and discuss dangerous weather safety.
- Students are challenged to build a structure that reduces the warming effect of the Sun. Students test the structure they built, identify any problems, and discuss what they can do to improve their structure's effectiveness.

Unit 2: Forces and Interactions: Pushes and Pulls

Time Frame: 6-9 weeks

Topics Covered:
- Push, Pull, Roll
- Push, Pull, Swing
- Push, Pull, Tumble
- Push, Pull, Spin
- Push, Pull, Invert

Next Generation Science Standards Addressed:

· 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.

· 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.

Materials:
https://carolinascienceonline.com/bbs-journey/ppg/ppg_Materials.pdf
See Grade Level Supply List for Mystery Science

Activities/Outcomes:

- Students roll a ball at different speeds and make observations about its movement.
- To explore motion, students count and sort materials and then use them to build a ramp.
- Students use Unifix® cubes to measure how far a ball travels when it is rolled down a ramp.
- Students use their building pieces to construct a swing set and explain how force makes it move.
- Using dominoes, students explore the motion of tumbling and further investigate forces.
- Students construct a toy top and observe the movement that results from the forces applied.
- Students are challenged to build an invention that uses the ball to tumble the dominoes.
- Students are challenged to build an invention that uses both the swing and the ball to tumble the dominoes.

Unit 3: Living Things and Their Needs

Time Frame: 10 weeks

Topics Covered:

- Living and NonLiving Things
- Needs of Living Things
- Living Things and Their Environment
- Protecting the Environment

Next Generation Science Standards Addressed:

- 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 living things in the local environment.
- 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.

Materials:
Carolina Science Material List
https://carolinascienceonline.com/bbs-journey/lttn/lttn_MaterialsList.pdf
See Grade Level Supply List for Mystery Science

Activities/Outcomes:
- Students categorize living and nonliving things and think about the characteristics that living things share.
- Students plant pumpkin seeds and make predictions about their growth.
- Students are introduced to bessbugs and their habitat.
- In pairs, students handle bessbugs and observe their behavior
- Students make predictions about how plants will grow when different variables are changed.
- Students make predictions and test the preferences of bessbugs.
- Students collect data about the height of their pumpkin plant and count the number of leaves.

1st Grade

Unit 1: Waves: Light & Sound Waves

Time Frame: 10-12 Weeks

Topics Covered:

- Light & Sound Waves
- Sound off
- Travelling Sound
- Light it Up
- Light on the Move
- Communicating with Light & Sound

Materials:

- Rulers
- Flashlights
- Cups
- String
- Opaque Materials
- Translucent Materials
- Crayons
- Scissors
- Paper clips
- Markers
- Index Cards

Activities/Outcomes:

- Paper Stained Glass
- Dark Box
- Secret Signals
- Navigation by Sights & Sounds
- Sound Effect Artist

Next Generation Science Standards Addressed:

- 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-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.

Unit 2: Exploring Organisms

Time Frame: 10-12 Weeks

Topics Covered

- Needs for Survival
- Structures and Functions for Survival
- Raising Young
- Comparing Parents and Their Young
- Solving Human Problems with Organisms' Structures

Materials:

- Beans
- Seeds
- Dixie Cups
- Elbow Macaroni
- Art Supplies
- Paper Cups
- Envelopes
- Play-Dough
- Poster Board
- Aluminum Foil
- Cardboard box
- Soft-stemmed plant

- Straws

Activities/Outcomes:

- Who Has the Best Beak?
- What's Going On?
- Moth Hide and Seek
- Matchup Game
- Windproof Umbrellas
- Plants on the Move

Next Generation Science Standards Addressed:

· 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-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.

Unit 3: Sky Watchers

Time Frame: 10-12 Weeks

Topics Covered:

- Objects in the Sky
- Day & Night
- Sunrise, Sunset, and Seasons
- The Moon & It's Patterns
- Our Place in Space

Materials:

- Craft Sticks

- Clipboards
- Art Supplies
- Rulers
- Aluminum Foil
- Colored Construction Paper
- Clear Report Covers
- Envelopes
- Index Cards
- Dot Stickers

Activities/Outcomes:

- Moving Shadows
- Trace Your Shadow
- Sun Finder
- Summer Sunshine Readers
- Star Projector
- Where is North?

Next Generation Science Standards Addressed:

- 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.

2nd Grade

Unit 1: Interdependent Relationships in Ecosystems

Time Frame: 12 weeks (2 engineering within the unit)

Topics Covered:

- Organisms & Different Habitats
- Plant Growth
- Plant and Animal Interactions
- Diversity of Life
- Relationships in an Ecosystems

Materials:

- Observation sheets
- Investigation sheets
- Topic Maps
- Habitat Card Sets
- Assessment sheets
- Literacy and Science literature
- Vocabulary Charts

Activities/Outcomes:

- What Do Living Things Need?
- What Type of Habitat Do I Live In?
- What Do Plants Need to Grow?
- What Is the Life Cycle of a Plant?
- Where Do Plants Grow?
- How Do Plants Depend on Animals?
- How Do Animals Help to Pollinate or Disperse Seeds?
- Can I Design a Habitat?
- What Will the Pill Bugs Prefer?
- Where Do Pill Bugs Live?
- What Have Humans Done?
- What Have You Learned about Ecosystem Diversity?

Next Generation Science Standards Addressed:

- LS2.A: Interdependent Relationships in Ecosystems
- LS4.D: Biodiversity and Humans

- ETS1.B: Developing Possible Solutions

Unit 2: Matter

Time Frame: 12 weeks (2 engineering within the unit)

Topics Covered:
- Small Parts Make Big Things
- What's the Matter
- Matter, Solid, Liquids, Mixtures
- Describing Matter
- Heating Matter (3 weeks)
- Evaluating Design Plans

Materials
- Observation sheets
- Investigation sheets
- Assessment sheets
- Liquid measurement tools
- Literacy and Science literature
- Vocabulary Charts

Activities/Outcomes:
- Can We Build a Large Pyramid Using Small Cubes?
- How Can We Arrange the Same Pieces to Build Different Things?
- What Are the Three States of Matter?
- Why Can't We See Particles?
- How Does the Motion of Particles Change?
- Is Gas Made of Particles?
- What Are the Properties of Solids?
- What Are the Properties of Liquids?
- What Is a Mixture?
- Which Physical Properties Describe These Materials?
- Which Is the Best Material to Build With?
- How Does Matter Change State?
- How Do Chemical Reactions Cause Identity Changes?

- Why Is It Important to Evaluate Design Plans?

Next Generation Science Standards Addressed:

- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions
- ETS1.A: Defining and Delimiting Engineering Problems
- ETS1.B: Developing Possible Solutions

Unit 3: Earth's Materials

Time Frame: 12 weeks

Topics Covered:

- Water
- Rocks
- Sand
- Soil
- Changing Earth, Changing Land
- My Model Island

Materials:

- Observations sheets
- Investigation Sheets
- Assessment Sheets
- Literacy and Science literature
- Land and Water cards
- Relief Maps
- Globe
- Sand, rock, soil
- Engineering Design

Activities/Outcomes:

- What Do We Know About Earth's Materials?
- Where's the Water?
- How Does Water Change on Earth?
- How Much of Earth Is Water and How Much Is Land?
- What Can We Learn by Studying Rocks?
- Can I Make a Claim About How Landforms Change?

- What Can We Learn by Studying Sand?
- How Can Water Change Sand?
- How Can Wind Change Sand?
- Can We Design a Barrier to Reduce Wind Erosion?
- What Makes Up Soil?
- What Can We Learn by Studying Soil?
- How Can Wind and Water Affect Soil?
- How Do Glaciers Change Land?
- How Do Rivers Change Land?
- How Do Earth's Natural Processes Change Land?
- Can I Make a Model to Show What I Have Learned?
- What Have I Learned About Earth's Materials?

Next Generation Science Standards Addressed:

- ESS1.C: History of the Planet
- ESS2.A: Earth Materials and Systems
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.C: The Roles of Water in Earth's Surface Processes
- ETS1.C: Optimizing the Design Solution
- PS1.A: Structures and Properties of Matter

Unit 4: Engineering

Time Frame: 6 weeks throughout the year (end each unit with 2 week project)

Topics Covered:

- Engineering design Process
- Drawing a sketch/making a model
- Analyzing data

Materials: Listed within units above

Activities/Outcomes:

- How do I design a solution to a real life problem using a new material?
- How do I propose valuable merits of my design?
- How do I design a solution to building a tall tower and a strong tower out of paper?
- How do I change the properties of paper by folding, bending and cutting paper?

- How do I demonstrate/ model the building process by assembling small pieces in order to build an object?

Next Generation Science Standards Addressed:
K-2-ETS1. Define develop, and analyze engineering problems

3rd Grade

Unit 1: Ecosystems

Time Frame: 3 months

Topics Covered:

- Life in ecosystems
- Inheritance and variations of traits
- Adaptations
- Environmental Influences
- Ecosystems, humans, and biodiversity

Materials: See lesson plan resources and digital resources

Activities (Investigations):

- Lesson 1: Life in Ecosystems
    - A: How do we categorize an ecosystem?
    - B: What patterns exist and organisms grow and develop?
    - C: Why do some animals live in groups?
- Lesson 2: Inheritance and variations of traits
    - A: What is a trait and where do I get it from?
    - B: Are humans the only living things to pass on traits to their offspring?
- Lesson 3: Adaptations
    - A: How do adaptations help organisms survive?
    - B: How does the structure of a bird's beak help it survive?
    - C: How can camouflage be beneficial in a predator/prey relationship?
- Lesson 4: Environmental Influences
    - A: How can the environment influence traits?
    - B: What can fossils tell us about past and present organisms?
- Lesson 5: Ecosystems, humans, and biodiversity
    - A: How do we depend on and impact ecosystems?
    - B: Can we evaluate a solution to a problem impacting an ecosystem?

Next Generation Science Standards Addressed:

· 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-LS2-1: Construct an argument that some animals form groups that help members survive.
· 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-LS4-1: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
· 3-LS4-2: 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.
· 3-LS4-3: 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-LS4-4: 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.
· 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.

Supplemental Mystery Science: Time Frame: 2 months
Topics Covered: Animals through time, The Power of Flowers
Materials: computer, projector, classroom consumable based on daily activities
Activities/Outcomes:

- Animals Through Time Mysteries
    - Mystery 1: Where can you find whales in the desert?
    - Mystery 2: How do we know what dinosaurs look like?
    - Mystery 3: Can you outrun a dinosaur?
    - Mystery 4: What kind of animals might there be in the future?
    - Mystery 5: Can selection happen without people?
    - Mystery 6: Why do dogs wag their tails?
    - Mystery 7: What's the best way to get rid of mosquitos?
    - Mystery 8: How long can people and animals survive in outer space?
- The Power of Flowers:
    - Mystery 1: Why do plants grow flowers?
    - Mystery 2: Why do plants give us fruit?
    - Mystery 3: Why are some apples red and some green?
    - Mystery 4: How could you make fruit in the world?

Unit 2: Weather & Climate

Time Frame: 3 months

Topics Covered:

- Weather and the tools to study weather
- Analyze weather data and patterns
- Weather and climate connections
- Dangerous weather
- Possible solutions to reduce impacts of weather hazards

Materials: See lesson plan resources and digital resources

Activities (Investigations):

    - Lesson 1: Weather and the tools to study weather
    - A: What do we know about weather?
    - B: What tools do we use to measure weather?
    - C: What is the benefit of understanding patterns in weather?
- Lesson 2: Analyze weather data and patterns
    - A: Can I analyze and graph weather data?
    - B: Can I analyze patterns and weather in various places?
- Lesson 3: Weather and climate connections
    - A: How are weather and climate related?
    - B: What factors shape climate?
    - C: What are patterns and climate zones?
- Lesson 4: Dangerous weather
    - A: How can dangerous weather affect an area?
    - B: What are examples of weather hazards?
- Lesson 5: Possible solutions to reduce impacts of weather hazards
    - A: How can we reduce the impact of a weather hazard?
    - B: How well does the solution reduce the impact of a weather hazard?
    - C: What have I learned about weather and climate?

Next Generation Science Standards Addressed:

· 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.
· 3-5-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.

Supplemental Mystery Science: Time Frame: 1 month
Topics Covered: Stormy skies
Materials: computer, projector, classroom consumable based on daily activities
Activities/Outcomes: Stormy skies

- Mystery 1: Where do clouds come from?
- Mystery 2: How can we predict when it's going to storm?
- Mystery 3: Why are some places always hot?
- Mystery 4: How can you keep a house from blowing away in a windstorm?

Unit 3: Forces & Interactions

Time Frame: 3 months

Topics Covered:

- Balanced forces
- Unbalanced forces
- Changes in motion
- Magnetism and electricity
- Magnetic solutions

Materials: See lesson plan resources and digital resources

Activities (Investigations):

- Lesson 1: Balanced forces
    - A: How do things become balanced?
    - B: How can we use a balance to estimate mass?
    - C: How does gravity affect balance?
- Lesson 2: Unbalanced forces
    - A: What is inertia?
    - B: How does inertia affect the motion of an object?
    - C: Why does friction slow movement?

- Lesson 3: Changes in motion
    - A: How does force affect the motion of an object?
    - B: How does mass affect the motion of an object?
    - C: How can I increase magnetic forces?
- Lesson 4: Magnetism and electricity
    - A: Are all metals magnetic?
    - B: What is a magnetic field and how can we see it?
    - C: How does the shape of a magnet change its magnetic forces?
    - D: How do electric forces compare to magnetic forces?
- Lesson 5: Magnetic solutions
    - A: Can you illustrate different forces and interactions?
    - B: Can you achieve the project goal by designing a model using magnets?

Next Generation Science Standards Addressed:

· 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.

· 3-5-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.

Supplemental Mystery Science: Time Frame: 2 months
Topics Covered: Invisible forces
Materials: computer, projector, classroom consumable based on daily activities
Activities/Outcomes: Invisible forces:

- Mystery 1: How could you win a tug of war against a bunch of adults?
- Mystery 2: What makes bridges so strong?
- Mystery 3: How can you go faster down a slide
- Mystery 4: What can magnets do?
- Mystery 5: How can you unlock a door using a magnet?

4th Grade

Unit 1: Energy Works

Time Frame: 3 months

Topics Covered:

- Energy Sources Are Everywhere
- Stored and Motion Energy
- Energy Transfers and Transformations
- Energy Moves in Waves
- Recycling Energy
- My Energy Experiment

Materials: See lesson plan resources and digital resources

Activities (Investigations):

- Lesson 1: Energy Sources Are Everywhere
    - A: Where Do You Get Your Energy?
    - B: What Are Some Types of Energy We Use?
- Lesson 2: Stored and Motion Energy
    - A: What Are Stored and Motion Energy?
    - B: How Can I Change the Energy in a Table Tennis Ball?
    - C: What Happens When Objects Collide?
- Lesson 3: Energy Transfers and Transformations
    - A: How Is the Sun's Energy Transferred?
    - B: How Do You Build an Electric Circuit?
    - C: How Can We Use Circuits to Investigate Energy?
    - D: What Have You Learned About Energy?
- Lesson 4: Energy Moves in Waves
    - A: How Can You Use Waves to Send Messages?
    - B: What Do You Know About Waves?
    - C: How Can You Create Waves?
    - D: How Does Energy Move in Waves?
- Lesson 5: Recycling Energy
    - A: What Are Types of Alternative of Energy?
    - B: How Does a Wind Turbine Generate Energy?
    - C: What Can I Build to Demonstrate Water Energy?
- Lesson 6: My Energy Experiment

- A: How Can I Design an Experiment About Energy?
- B: Does My Experiment Support My Prediction?
- C: How Can I Communicate What I Have Learned About Energy?

Next Generation Science Standards Addressed:

· 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 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-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.

· 4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

· 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.

Supplemental Mystery Science Activities

Energizing Everything Activities/Outcomes:

- Mystery 1: How is your body similar to a car? Students build a model of an amusement park ride called the Twist-o-matic. They use the model to carry out an investigation to examine the relationship between energy and speed. Students analyze and interpret data from their models, comparing the speed of the ride using a thin versus thick rubber band.
- Mystery 2: What makes roller coasters go so fast? Students build a model of a roller coaster and carry out an investigation using marbles. Students analyze and interpret data from the model to explain the connection between height, energy and motion.
- Mystery 3: Why is the first hill of a roller coaster always the highest? Students conduct an investigation using a model roller coaster to determine how energy can be stored in the hills of the coaster and how that energy is released to make the marbles go different distances. Students analyze and interpret data from the model to explain how the heights of different hills give marbles the energy to roll.

- Mystery 4: Could you knock down a building using only dominoes? Students begin to design a chain reaction machine. They start by figuring out how to connect two components of the chain reaction: the lever and the slide. This is the basis of the machine they will further develop in Mystery 5.
- Mystery 5: Can you build a chain reaction machine? Students design a chain reaction machine that displays a message at the end. The chain reaction machines use multiple components that transfer energy from one part to the next.
- Mystery 6: What if there were no electricity? Students design a flashlights using batteries, flights and tin foil. Students experiment with different ways of constructing their flashlights so that they turn on and off.
- Mystery 7: How long did it take to travel across the country before cars and planes? Students build a paper spinner and conduct an investigation to explain how heat makes things move.
- Mystery 8: Where does energy come from? Students evaluate the advantages and disadvantages of alternative energy sources to power a town. They obtain and evaluate information about the needs of each source of energy and analyze and interpret data about the town's resources.

Unit 2: Changing Earth

Time Frame: 3 months

Topics Covered:
- Earth's Layers and Plates
- Rock Formations and Patterns
- Weathering and Erosion
- Mapping Earth
- Changing Earth
- Life on a Changing Earth

Materials: See lesson plan resources and digital resources

Activities (Investigations):
- Lesson 1: Earth's Layers and Plates
    - A: What Are Earth's Layers?

    - B: Why Does Earth Have Plates?
    - C: What Is the Ring of Fire?
        - Lesson 2: Rock Formations and Patterns
    - A: What's Your Type?
    - B: What Is the Rock Cycle?
    - C: How Do We Use Different Types of Rocks?
- Lesson 3: Weathering and Erosion
    - A: How Are Canyons Formed?
- Lesson 4: Mapping Earth
    - A: How Have Rivers Changed the Shape of the United States?
    - B: How Can We Use Maps to Learn About Earth?
- Lesson 5: Changing Earth
    - A: Why Do Rocks Form Layers?
    - B: How Are Fossils Formed?
- Lesson 6: Life on a Changing Earth
    - A: Why Is Soil Erosion a Problem?
    - B: Can Soil Erosion Be Prevented?
    - C: Which Model Prevents Soil Erosion?

Next Generation Science Standards Addressed:

- 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-ETS1-2: 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.

Supplemental Mystery Science Activities

The Birth of Rocks Activities/Outcomes:

- Mystery 1: Could a volcano pop up where you live? Students analyze and interpret data from recent volcanic eruptions. They use their findings as evidence for an argument that volcanoes are (or are not) likely to erupt in their backyard.
- Mystery 2: Why do volcanoes explode? Student conduct an investigation to construct an explanation for why some volcanoes explode and why some do not. Students model thick and thin lava to conduct their investigations.

- Mystery 3: Will a mountain last forever? Students conduct an investigation by modeling how rocks erode over time. Students construct an explanation for why rocks erode.
- Mystery 4: How could you survive a landslide? Students design solutions to protect their "homes" from rock slides. Students argue for the merits of their design.

Unit 3: Plant and Animal Structures

Time Frame: 3 months

Topics Covered:
- Structures Used for Survival
- Animal Structures
- Plant Structures
- Using the Senses
- Exploring the Eye
- Structure and Function

Materials: See lesson plan resources and digital resources

Activities (Investigations):
- Lesson 1: Structures Used for Survival
    - A: How Are an Organisms' Structures Adapted for Its Environment?
    - B: Will Seeds Grow Inside a Plastic Bag?
- Lesson 2: Animal Structures
    - A: How Do External Structures Support Survival?
    - B: How Do Internal Structures Support Survival?
- Lesson 3: Plant Structures
    - A: How Does a Seed Grow into a Plant?
    - B: Do Plants Have Structural Adaptations?
    - C: How Do Internal Structures Help Support a Plant's Survival, Growth, and Reproduction?
    - D: How Can We Use Dissection to Learn About Plant Structures?
- Lesson 4: Using the Senses
    - A: How Do We Sense the World Around Us?
    - B: How Is Information Processed?
    - C: How Are Senses Tested?

- Lesson 5: Exploring the Eye
    - A: How Does the Eye Work?
    - B: How Do We See Images?
    - C: How Do Human Eyes Compare to Other Animals' Eyes?
- Lesson 6: Structure and Function
    - A: How Can the Eye Be Improved?
    - B: What Have Eye Learned?

Mystery Science Supplemental Materials

Waves of Sound Activities/Outcomes:

- Mystery 1: How far can a whisper travel? Students document their understanding of how vibrations travel using a model of their paper cup telephones. Students then design their own series of investigations to figure out how to make their telephone work better in different circumstances. Students construct an explanation of how the telephone works. Students extend the lesson by developing a way to send a message using a pattern of sounds.
- Mystery 2: What would happen if you screamed in outer space? Students conduct investigations with balloons to experience the vibrations caused by sound of their voices. Students construct an explanation that sound is a vibration. Students then develop a model to explain how sound travels through a medium and how it can cause distant objects to move.
- Mystery 3: Why are some sounds high and some sounds low? Students analyze and interpret data from oscilloscopes to determine how wavelengths differ between high and low pitch sounds. Students make claims and argue from evidence about which wavelength patterns were generated from different pitches. Students then use a rope to model waves created by different pitches and begin to explore the relationship between wavelength and frequency.

The Human Machine Activities/Outcomes:

- Mystery 1: Why do your biceps bulge? Students build a model of a finger that they then use to construct an explanation for how fingers move.
- Mystery 2: What do people who are blind see? Students build a model of an eyeball that they then use to construct an explanation of why some people have blurry vision.
- Mystery 3: How can some animals see in the dark? Students conduct an investigation to see how pupils change in response to light. Students build a model of an eye (extending the model they built in Mystery 3) to explain how changes in pupil size changes the image that appears on the retina.
- Mystery 4: How does your brain control your body? Students conduct investigations to explore how the brain processes information and responds to that information. Students analyze and interpret data from the investigations to determine how fast their reflexes are.

Materials

- Batteries
- Plastic cups
- Foam cups
- Straws (large and small diameter)
- Medicine Cups
- Wooden dowels
- Clay
- Craft dough
- Paper plates
- Aluminum foil
- Prepared soil mix
- Hook and loop tape
- Toothpicks
- Small/Medium/Large resealable plastic bags
- Fluted catch pans
- White PerfectCast
- Blue PerfectCast
- PerfectCast casting powder
- Plastic spoons
- Absorbent pads
- Blue food coloring
- Radish seeds
- Foam trays
- Disposable gloves
- Squid
- Bean seeds
- Celery
- White carnations
- Chewy and hard candy
- Potato chips
- Cotton balls
- Clove and peppermint oils
- Sheep brains
- Playfoam
- Sandpaper
- Cow eyes

5th Grade Science

Unit 1: Structures and Properties of Matter

Time Frame: 10-12 Weeks

Topics Covered:

- Matter All Around Us
- Energy And States of Matter
- Physical Properties of Matter
- Making Mixtures and Solutions
- Physical And Chemical Changes
- Separating Matter

Activities/Outcomes:

- Classify Different Objects based on the type of matter
- Measure Mass and Volume
- Explore condensation and evaporation
- Graph scenarios to explain the law of conservation of matter
- Test buoyancy, hardness, and magnetism.
- Examine viscosity and density.
- Mixtures and Solutions.
- Chemical and Physical Changes.
- Water purification and filtration

Next Generation Science Standards Addressed:

· 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.

· 3-5-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.

Supplemental Curriculum: Mystery Science (Use as needed to enrich curriculum)

Mystery Science Topics Covered:

- Chemistry and Conservation of Matter
- Dissolving and Particulate Nature of Matter
- Acids, Reactions, and Properties of Matter
- Chemical Reactions
- Gasses and Particle Models

Activities/Outcomes:

- Testing Liquids
- Copper Plate a Steel Nail
- Acid Testing
- The Great Goo Experiment
- Bag of Bubbles

Unit 2: Matter and Energy in Ecosystems

Time Frame: 10-12 Weeks

Topics Covered:

- Biotic and Abiotic Factors
- Interdependence of Biotic Factors
- Energy Flow in an Ecosystem
- Interactions on Earth
- Human Impact
- Protecting the Ecosystem

Activities/Outcomes:

- Create a chart of biotic and abiotic factors
- Review plant structures, the plant life cycle, and photosynthesis.
- Design an experiment to determine the needs of plants for successful growth.
- Dissect an owl pellet

- Food Pyramids/Food Webs
- Examine the four spheres of Earth
- Build an ecocolumn
- Energy Use Survey
- Water Cycle
- Poster Board Design Challenge: Solutions to Limiting Human Impact

Standards Addressed:

· 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.

· 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-ESS2-1: Develop a model using an example to describe the ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

· 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the earth's resources and environment

· 3-5-ETS1-2: Generate and compare multiple solutions to a problem based on how well each is likely to meet the criteria and constraints of a problem

Supplemental Curriculum: Mystery Science: (Use as needed to enrich curriculum)

Topics Covered:

- Food Chains, Predators, Herbivores, and Carnivores
- Plant Needs: Air and Water
- Decomposers, Nutrients, and Matter Cycle
- Ecosystems and Matter Cycle
- Food Webs and Flow of Energy
- Hydrosphere and The Roles of Water
- Groundwater as a Natural Resource
- Water Cycle
- Natural Disasters and Engineering

Activities/Outcomes:

- Map the World's Water
- Underground Water-Wells
- Water Cycle Model

- Save Beachtown from Flooding Activity
- Food Chain Game
- Weighing Air with Balloons and Balances
- Mold Terrarium
- Worm Investigations/Decomposers
- Pond Ecosystem Game
- Create a Dinosaur Food Web

Unit 3: Earth and Space Systems

Time Frame: 10-12 Weeks

Topics Covered:

- Earth's Place in Space
- Stars
- Sun, Moon, and Earth
- Earth's Systems
- Protecting Earth's Systems

Activities/Outcomes

- Informational Planet Poster
- Distance and Brightness of Stars using Flashlights
- Shadow Sticks
- Sun, Earth, Moon Clay model
- Moon Phase Cards
- Earth's Systems Poster
- Distribution of Water Graph
- Positive and Negative Humans Impact
- Develop Unit Quiz for Classmates

Standards Addressed:

· 5-ESS1-1: Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.

· 5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

· 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 of salt 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.
· 5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.
· 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.

Supplemental Curriculum: Mystery Science: (Use as needed to enrich curriculum)

Topics Covered:

- Day, Night, and Earth's Rotation
- Earth's Rotation and Daily Shadow Patterns
- Seasonal Changes and Shadow Length
- Seasonal Patterns and Earth's Orbit
- Moon Phases/Lunar Cycle
- Planets and Solar System
- Gravity
- Star Brightness and Habitable Planets

Activities/Outcomes:

- Spinning Earth
- Shadow Clocks
- Name the Season
- Universe in a Box
- Flashlights and Moon Phases
- Planet Drawings
- Gravity Jump
- Star Explorer

6th Grade

Unit 1: Earth's Systems (Earth Science)

Time Frame: 9 Weeks

Topics Covered:

- Energy Transfer and the Water Cycle
- Chemical and Physical weathering
- Oceans and Currents
- Natural Resources

Materials:

- 2 liter bottle
- Match
- Ziplocs
- Electric motors
- Rokenbok
- Legos

Activities/Outcomes:

- Water cycle poster
- Cloud in a bottle
- Chemical and physical weathering observations (Log)
- Restoring history activity
- Ocean layers diagram
- Sonar exploration
- Lake bottom study
- Lake depth ecosystems
- Conservation speeches
- Windmill/hydroelectric power plant
- Earth Day project

Next Generation Science Standards Addressed:

- MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- MS-ESS2-4. 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-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.

Unit 2: Weather and Climate (Earth Science)

Time Frame: 7 Weeks

Topics Covered:
- Meteorology
- Extreme weather
- Formation of storms
- Oceans impact on weather and climate
- Climate types
- Climate change
- Unequal heating of the Earth

Materials:
- Weather maps
- Storm chaser videos
- 2 liter bottle
- Aquarium for density demonstration
- Balloons
- Maps

Activities/Outcomes:
- Local experts
- News room visit
- Weather forecaster
- Plotting weather data
- Tail of a twister
- Bottle tornado
- Air pressure demonstration
- Specific heat calculations
- Create your own world
- Rain Shadow effect poster
- Climate change current events
- Climate change debate

Next Generation Science Standards Addressed:

- 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 cause patterns of atmospheric and oceanic circulation that determine regional climates.
- MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Unit 3: Matter and Energy in Organisms and Ecosystems (Life Science)

Time Frame: 6 Weeks

Topics Covered:

- Energy in Ecosystems
- Relationships in Ecosystems
- Populations
- Abiotic and Biotic factors

Materials:

- 2 liter bottles
- Variety of food
- Soil varieties
- School Forest
- Tent pegs
- Binoculars
- Magnify glass

Activities/Outcomes:

- Conservation speeches
- Food web poster
- Google draw food web
- Bottle biomes
- Trips outside to explore local ecosystems
- Lake food webs
- Trees for Tomorrow
- School forest trips

- Predator prey activity
- Decomposition rate
- Water quality Test
- Food web disruption
- Natures design challenge
- Project Wild population activity
- Wolf migration study
- Abiotic and Biotic field study
- Animal droppings population study

Next Generation Science Standards Addressed:

- 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-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-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

Unit 4: Energy (Physical Science)

Time Frame: 7 Weeks

Topics Covered:

- Kinetic Energy
- Potential Energy
- Heat and Temperature
- Conservation of Energy
- Energy Transfer

Materials:

- Newton's Cradle
- Marshmallows
- Noodles
- Legos
- Marbles
- Styrofoam Cups

- Sleds
- Hand warmers
- Ice packs

Activities/Outcomes:

- Newton's Cradle Demonstration
- Egg drop experiment
- Catapults
- Siege Tool/Lego castle
- Marble track
- Kinetic marble drop
- Specific heat lab
- Endothermic and Exothermic reactions

Next Generation Science Standards Addressed:

- 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.
- 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.

Unit 5: Forces and Interactions (Physical Science)

Time Frame: 7 Weeks

Topics Covered:

- Interactions of Force and Mass
- Newton's Laws
- Gravity
- Friction
- Straight line motion

Materials:

- Marbles
- Scouters
- Spring Scales
- Cardboard tubes or rocket kits
- Tennis ball
- Basketball
- Furniture movers
- Wax Paper
- Slide

Activities/Outcomes:

- Dude perfect videos/Create your own using flipgrid
- Paper Roller Coasters
- Inertia lab
- Projectile motion
- Rockets
- Ball Drop
- Egg Drop
- Bernoulli's principle
- Friction of different surfaces and materials
- Speed time trials
- Run the bases activity

Next Generation Science Standards Addressed:

- 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-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-ETS1-3. 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.

7th Grade

Unit 1: Launch: Geology on Mars

Time Frame: 2-3 weeks

Topics Covered:

- Introducing Earth Space and Science
- Observing the Surfaces of Mars and Earth
- Investigating a Mystery Object on Mars
- Investigating Landforms on Venus
- Modeling a Geologic Process
- Gathering Additional Evidence from Models
- Evaluating New Information from Mars
- Evaluating the Claims about the Channel on Mars
- Reasoning about Evidence from Mars
- Writing an Argument about the Channel on Mars

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Geology on Mars Kit

Activities/Outcome:

- Video: Meet A Planetary Geologist
- Scale in the Solar System
- SIM: Exploring the Surface of Mars
- Jelly Donut Evidence Card Sort
- Hands On,Observing the Flowing Water Model
- Hands On, Testing an Idea with the Flowing Water Model
- Flowing Lava Model Video
- Hands On, Evaluating New Rock Information
- Writing an Argument About the Channel on Mars

- Rover on Mars Video
- Assessments

Next Generation Science Standards Addressed

- Performance Expectations: MS-ESS1-3; MS-ESS2-2
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: ESS1.B; ESS2.A; ESS2.C
- Crosscutting Concepts: Systems and System Models

Unit 2: Earth, Moon, and Sun

Time Frame: 4-5 weeks

Topics Covered:

- Picturing the Moon
- Modeling and Simulating Light and Dark on the Moon
- Phases of the Moon
- Simulating Moon Phases
- Moon Phase Patterns and Orbit
- Introduction to Lunar Eclipses
- When and Why We See Lunar Eclipses
- Lunar Eclipses Outside Our Solar System
- Discussing Eclipses in a Two-Star System

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Earth, Moon and Sun Kit

Activities/Outcomes:

- Video: Photographing the Moon
- Investigating Light on the Moon
- The Moon Sphere Model: Light and Dark
- Investigating Darkness on the Moon

- Modeling Light and Dark
- Gathering Evidence from a Mode
- Modeling Moon Phases
- Video: Seeing the Earth, Moon, and Sun from Different Angles
- Why We See Phases of the Moon
- Revising Moon Phase Models
- Modeling the Order of Moon Phases
- Modeling Moon Phases on Paper
- The Moon Sphere Model: Lunar Eclipses
- Exploring Lunar Eclipses
- Gathering Evidence from the Sim
- Modeling a Lunar Eclipse and a Full Moon
- Analyzing Evidence
- Sorting Evidence
- Using the Reasoning Tool

Next Generation Science Standards Addressed:

- Performance Expectations: MS-ESS1-3; MS-ESS2-2
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: ESS1.B; ESS2.A; ESS2.C
- Crosscutting Concepts: Systems and System Models

Unit 3: Light Waves

Time Frame: 4 to 5 weeks

Topics Covered:

- Light and Energy
- Explaining Changes from Light
- Investigating Different Light Sources
- Wave Properties
- Effects of Different Types of Light
- Following the Path of Light
- Reflection, Transmission, and Energy
- Light and the Atmosphere
- Explaining Australia's Skin Cancer Rate

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Light Waves Kit

Activities/Outcomes

- Evidence of Energy from Light
- Energy and Light
- Investigating Genetic Material in the Sim
- Modeling The Cause of Skin Cancer
- How Different Light Sources Change Materials
- Video: Sun Paper Demo
- Investigating Different Types of Light
- Video: The Shape of Waves
- Investigating Light's Effect on Genetic Material
- Investigating the Path of Light
- Testing Glass and Aluminum Foil
- Energy in Reflection and Transmission
- Light Traveling Through the Atmosphere
- Modeling Ultraviolet Light in the Atmosphere
- Introducing the Science
- Seminar Evidence Cards
- Sorting Evidence
- Participating in the Science Seminar
- Using the Reasoning Too
- Writing Scientific Arguments

Next Generation Science Standards Addressed:

- Performance Expectations: MS-PS4-1; MS-PS4-2; MS-PS4-3; MS-LS1-1; MS-LS1-2; MS- LS1-6; MS-LS1-8; MS-ESS3-5
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: PS3.D; PS4.A; PS4.B; PS4.C; LS1.A; LS1.C; LS1.D; ESS3.D
- Crosscutting Concepts: Energy and Matter; Cause and Effect; Patterns

Unit 4: Magnetic Fields

Time Frame: 4-5 weeks

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Magnetic Fields Kit

Topics Covered

- Introducing the Magnetic Spacecraft
- Evaluating Magnetic Force Evidence
- Earth's Geomagnetism
- Investigating Magnetic Field Lines
- Analyzing Field Line Data
- The Potential for Speed
- Exploring Potential and Kinetic Energy and Magnetic Force
- Simulating Spacecraft Energy
- Exploring Energy and Force Strength
- Investigating Magnetic Force Strength
- Modeling the Spacecraft Launches
- Introducing Electromagnets
- Evaluating Roller Coaster Experiments and Design Claims

Activities/ Outcomes

- Introducing the Magnetic Spacecraft
- Video: Troubleshooting a Magnetic Launcher
- Exploring Magnets
- Investigating Simulated Magnets
- Evaluating Evidence
- Modeling Systems of Magnets
- Exploring Field Lines

- Modeling Magnetic Field Lines
- Analyzing Magnetic Field Lines
- Evaluating a Claim
- Exploring Energy in Systems
- Simulating Energy Changes
- Simulating Spacecraft Launch Energy
- Modeling Spacecraft Launch Energy
- Exploring Force and Potential Energy
- Simulating Magnetic Force
- Modeling the Spacecraft Launches
- Testing Electromagnets in the Sim
- Testing Roller Coaster Variables
- Analyzing Roller Coaster Evidence
- Participating in the Science Seminar

Next Generation Science Standards:

- Performance Expectations: MS-PS2-3; MS-PS2-4; MS-PS2-5; MS-PS3-1; MS-PS3-2; MS-PS3-5
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: PS2.B; PS3.A; PS3.B; PS3.C
- Crosscutting Concepts: Systems and System Models; Energy and Matter; Patterns; Cause and Effect

Unit 5: Launch: Microbiome

Time Frame: 2-3 weeks

Topics Covered:

- Introduction to the Scale of Living Thing
- Observing Microorganisms
- Investigating Antibiotics
- Analyzing Experiments with Mice
- Analyzing Evidence About Fecal Transplants
- Evaluating Evidence About Bacteria

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Microbiome Kit

Activities/Outcomes

- Quick-Write
- Exploring the Scale Tool
- Understanding the Scale of Cells
- Drawing a Scale Model of Microorganisms
- Comparing the Scale of Cells and Molecules
- Play and Discuss Video Message
- Evaluating Evidence About Antibiotics
- Analyzing an Experiment About the Microbiome
- Discussing Evidence and Reasoning
- Analyzing Experiments About Bacteria
- Using the Reasoning Tool
- Writing Final Argument Paragraphs

Next Generation Science Standards

- Performance Expectations: MS-LS1-1; MS-LS1-2; MS-LS1-3; MS-LS2-1; MS-LS2-2
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: LS1.A; LS2.A
- Crosscutting Concepts: Scale, Proportion, and Quantity; Stability and Change; Cause and Effect; Patterns

Unit 6: Metabolism

Time Frame: 4-5 weeks

Topics Covered:

- Exploring the Classroom Body Systems Model

- Patient Stories: Problems with Body Systems
- Learning More About a Condition
- Conducting Sim Tests: Playing Guess My Model
- Learning About Energy Release in the Body
- Exploring Chemical Reactions
- Cellular Respiration, Growth, and Repair
- Blood Doping: Messing with Metabolism to Win Races
- Modeling Cellular Respiration in an Athlete's Body

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Metabolism Kit

Activities/ Outcomes:

- Introducing the Metabolism Simulation
- Returning to the Patient
- Reading "Molecules Cells Need"
- Modeling Molecules in a Healthy Cell
- Evaluating New Evidence About Elisa
- Playing Body Systems Model Video
- Running the Model
- Modeling a Condition
- Comparing Models to the Sim
- Making Comparisons with the Sim
- Word Relationships: Discussing Conditions
- Playing the Guess My Model Game
- Analyzing Elisa's Test Results
- Writing an Argument to Support a Diagnosis
- Gathering Evidence from Heart and Breath Rates
- Gathering Evidence from the Sim
- Observing a Chemical Reaction3
- Reading About Cellular Respiration
- Observing Cellular Respiration in the Sim
- Modeling Cellular Growth and Repair4

- Writing About Elisa
- Modeling an Athlete's Body4
- Second Read: “Blood Doping”5
- Modeling an Athlete Who Is Blood Doping
- Playing The Bike Race Video2
- Introducing the Science Seminar Sequence
- Participating in the Science Seminar

Next Generation Science Standards:

- Performance Expectations: MS-LS1-1; MS-LS1-2; MS-LS1-3; MS-LS1-7; MS-LS1-8
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: LS1.A; LS1.C, LS1.D; PS3.D
- Crosscutting Concepts: Systems and System Models; Energy and Matter; Scale, Proportion, and Quantity

Unit 7: Engineering Internship: Metabolism

Time Frame: 2-3 weeks

Topics Covered:

- Introducing the Engineering Internship
- Researching Ingredients
- Learning About Target Populations
- Analyzing Ingredients
- Designing FuturaBars
- Choosing an Optimal Design
- Composing Proposal Outlines
- Writing Design Decisions
- Completing the Proposal
- Applying Engineering Skills

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards

- Investigation Notebooks
- Online SIMS
- Metabolism, Engineering Internship Kit

Activities/ Outcomes

- Connecting to Futura WorkspaceT
- Introducing FuturaT
- Exploring RecipeTest2
- Reading About Metabolism
- Introducing the Daily Message NotesT
- Discussing Metabolism and FoodT
- Researching Different Ingredients
- Reading About Target PopulationsT
- Summarizing Test Users' Needs
- Analyzing IngredientsT
- Discussing Trade-Offs
- Testing FuturaBar DesignsT
- Analyzing Designs
- Testing Final Designs
- Outlining Design Decisions
- Revising Design Decisions
- Finalizing the Proposal
- Reflecting on the Internship

Next Generation Science Standards:

- Performance Expectations: MS-ETS1-1; MS-ETS1-2; MS-ETS1-3; MS-ETS1-4; MS-LS1-7
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: ETS1.A; ETS1.B; ETS1.C; LS1.C
- Crosscutting Concepts: Scale, Proportion, and Quantity; Energy and Matter; Cause and Effect; Patterns

Unit 8: Traits and Reproduction

Time Frame: 4-5 weeks

Topics Covered:

- Introducing Spider Silk Research
- Surprising Spider Silk
- Investigating Proteins and Traits
- Hemophilia, Proteins, and Genes
- Gathering Evidence About Genes
- Investigating Gene Copies
- Applying Ideas About Genes
- "Why Are Identical Twins Rare?"
- Gathering Evidence About Inheritance
- Analyzing Variation and Reproduction
- Reproduction in Darwin's Bark Spider
- Analyzing Evidence
- Science Seminar
- Writing a Scientific Argument

Materials

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Investigation Notebooks
- Online SIMS
- Traits and Reproduction Kit

Activities/ Outcomes:

- Video: Studying Spider Silk
- Exploring in the Simulation
- Building Physical Models of Proteins
- Observing Proteins in the Sim3
- Modeling Silk Flexibility
- Testing Protein to Trait Predictions
- Write and Share: Human Muscle Protein
- Modeling the Role of Genes
- Introducing Mutations
- Investigating Gene Copies in the Sim
- Modeling Variation in Spider Offspring3
- Gathering Evidence from the Sim
- Testing Predictions About Inheritance3
- Modeling Venom Inheritance

- Write and Share: ACTN3 Proteins
- Completing the Sim Activity
- Writing an Argument4
- Breeding Spiders
- Introducing the Science Seminar3
- Analyzing Evidence
- Sorting Evidence
- Participating in the Science Seminar
- Writing a Scientific Argument

Next Generation Science Standards:
Performance Expectations: MS-LS1-2; MS-LS1-3; MS-LS1-4; MS-LS1-5; MS-LS3-1; MS-LS3-2; MS-LS4-5
Science and Engineering Practices: Practice 1; 2; 4; 6; 7; 8
Disciplinary Core Ideas: LS3.A; LS3.B; LS1.A; LS1.B; LS4.B
Crosscutting Concepts: Structure and Function; Cause and Effect; Scale, Proportion, and Quantity

Unit 9: Populations and Resources

Time Frame: 4-5 weeks

Topics Covered:
- Mysterious Moon Jelly Increase
- Births and Deaths in Populations and Jelly Populations
- "Reproduction and Energy"
- Energy Storage Molecules
- Births Changing in a Population
- Deaths Changing in a Population
- Claims About the Jelly Increase
- “Jelly Population Explosion”
- Competition in Ecosystems
- More Indirect Effects
- Final Arguments About the Jelly Increase
- The South Pacific Island Ecosystem

Materials:

- Unit Question Cards
- Chapter Question Cards
- Key Concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online SIMS
- Populations and Resources Kit

Activities/Outcomes:

- Video: Studying Jelly Populations2
- Introduction to the Glacier Sea Ecosystem
- Exploring the Populations and Resources Sim
- Birth and Death Token ModelT
- Playing Stability and Change Video
- Sampling a Jelly Population Video2
- Evaluating Moon Jelly Population Evidence
- Modeling the Moon Jelly Population
- Setting Up the Yeast Experiment
- Second Read: Reproduction and Energy Article Set
- Returning to the Yeast Experiment
- Changing the Number of Births in the Sim
- Changing the Number of Deaths in a Population
- Modeling the Jelly Ecosystem3
- Evaluating Evidence
- Competition in the Sim
- More Indirect Effects in the Sim
- Evaluating and Analyzing Evidence3
- Writing Final Arguments4
- Beginning Final Models of the Population Increase
- Analyzing the Food Web
- Evidence Sorting
- Participating in the Seminar

Next Generation Science Standards:

- Performance Expectations: MS-LS1-7; MS-LS2-1; MS-LS2-2; MS-LS2-3; MS- LS2-4; MS-LS2-5; ESS3-3
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8

- Disciplinary Core Ideas: LS1.C; LS2.A; LS2.B; LS2.C; PS3.D; ESS3.C
- Crosscutting Concepts: Stability and Change; Systems and System Models; Energy and Matter; Cause and Effect

8th Grade

Unit 1: Plate Motion

Time Frame: 4-5 weeks

Topics Covered:

- Using Fossils to Understand Earth
- Exploring Earth's Plates
- Analyzing Patterns at Plate Boundaries
- Considering What;s Underneath Earth's Plates
- Listening to Earth
- Explaining and Modeling Plate-Mantle Interactions
- Identifying Plate Motion at a Plate Boundary
- Exploring Iceland's Plate Boundary
- Rates of Plate Boundary Movement
- A Continental Puzzle"
- Reconstructing Gondwanaland
- Writing About Mesosaurus
- Plate Motion Near Jalisco, Mexico
- Science Seminar
- Writing a Scientific Argument

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Plate Motion Kit

Activities/Outcomes:

- Sim Exploring Earth's Outer Layers
- Analyzing Maps
- Simulating Earthquake
- Modeling a Plate Boundary
- Sim Considering the Mantle
- Exploring Characteristics of the Mantle

- Creating Physical Models of Plate Motion
- Sim Exploring Plate Boundaries
- Model What Happens at Plate Boundaries
- Sim Observing How Plates Move
- Reconstructing Gondwanaland
- Analyzing Evidence
- Participate in Science Seminar
- Write a Scientific Argument

Next Generation Science Standards Addressed:

- Performance Expectations: MS-ESS1-4; MS-ESS2-2; MS-ESS2-3
- Science and Engineering Practices: Practice 1; 2; 4; 6; 7; 8
- Disciplinary Core Ideas: ESS1.C; ESS2.A; ESS2.B
- Crosscutting Concepts: Patterns; Scale, Proportion, and Quantity; Cause and Effect; Systems and System Models

Unit 2: Plate Motion Engineering Internship

Time Frame: 2 weeks

Topics Covered:

- Introducing the Engineering Internship
- Modeling a Tsunami Wave
- Researching Plate Motion and Tsunamis
- Learning About Tsunami Warning Systems
- Designing Tsunami Warning Systems
- Choosing an Optimal Design
- Composing Proposal Outlines
- Writing Design Decisions
- Completing the Proposal
- Applying Engineering Skills

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards

- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Plate Motion Engineering Kit

Activities/Outcomes:
- Exploring TsunamiAlert
- Modeling a Tsunami Wave
- Intro to Scientific Communication
- Investigate Earthquakes with TsunamiAlert
- Test and Analyze Designs
- Review and Test Final Designs
- Revise Design Decisions
- Finalizing the Proposal

Next Generation Science Standards Addressed:
- Performance Expectations: MS-ETS1-1; MS-ETS1-2; MS-ETS1-3; MS-ETS1-4; MS-ESS2-2; MS-ESS2-3; MS-ESS3-2
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: ETS1.A; ETS1.B; ETS1.C; ESS1.C; ESS2.A; ESS2.B
- Crosscutting Concepts: Patterns, Systems and System Models; Structure and Function; Cause and Effect

Unit 3: Chemical Reactions

Time Frame: 4 weeks

Topics Covered:
- Pre-Unit Assessment
- A Water Mystery in Westfield
- Analyzing Substances and Properties
- “Atomic Zoom-In”
- Investigating Atoms and Properties
- Identifying the Reddish-Brown Substance
- Investigating Substance Changes
- Explaining Chemical Reactions

- Explaining How the Rust Formed
- Critical Juncture Assessment
- Reflecting on Chemical Reactions
- “What Happens When Fuels Burn?”
- Burning at the Atomic Scale
- Investigating How Products Form
- What’s in Westfield’s Water?
- Chemistry at the Crime Scene
- Analyzing Claims and Evidence
- Engaging in a Science Seminar
- End-of-Unit Assessment

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Chemical Reactions Kit

Activities/Outcomes:

- Investigate a Mysterious Substance/Make Detailed Observations
- Evaluate Evidence
- Sim Investigating Substances
- Investigate Substance Change
- Sim Mixing Substances
- Explain Chemical Reaction
- Model How Rust is Formed
- Play Sodium and Hydrogen Chloride
- Analyze Results of Experiment
- Intro to Questions and Claims
- Sim Burning Fuel
- Share Evidence and Discuss Claims
- Modeling Products of a Reaction
- Write Letter to Westfield
- ID an Unknown Substance
- Analyze New Evidence
- Participate in Science Seminar

Next Generation Science Standards Addressed:

- Performance Expectations: MS-PS1-1; MS-PS1-2; MS-PS1-3; MS-PS1-5; MS-PS1-6; MS-LS1-6; MS-LS1-7; MSS-ESS3-1; MS-ESS3-3; MS-ESS3-5
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: PS1.A; PS1.B; LS1.C; ESS3.A; ESS3.C; ESS3.D
- Crosscutting Concepts: Scale, Proportion, and Quantity; Patterns; Energy and Matter; Cause and Effect

Unit 4: Phase Change

Time Frame: 4 weeks

Topics Covered:

- Pre-Unit Assessment
- Introducing Titan's Disappearing Lake
- Investigating the Molecular Scale
- Weird Water Events
- Investigating Evaporation and Freezing
- Modeling the Molecular Scale
- Causing Freedom of Movement Changes
- Understanding Energy Transfers
- Evaluating Evidence and Claims
- “Liquid Oxygen”
- Focusing on Molecular Attraction
- Modeling Attraction
- Critical Juncture Assessment
- Investigating Office Mysteries
- Introducing the Liquid Oxygen Problem
- Analyzing Claims and Evidence
- Science Seminar
- Writing a Scientific Argument
- End-of-Unit Assessment

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Phase Change Kit

Activities/Outcomes:

- Investigate Methane on Titan
- Sim Investigate the Molecular Scale
- Model a Phase Change
- Model Evaporating and Freezing
- Sim Weird Water Events
- Model Weird Water Events
- Magnetic Marbles
- Sim Energy Transfer
- Interpret Evidence About Phase Change
- Write a Scientific Argument
- Investigate Molecular Attraction
- Sim Exploring Attraction
- Model Attraction
- Sim Investigate Office Mysteries
- Share Evidence
- Model Liquid Oxygen Tanks
- Interpreting and Sorting Evidence
- Participate in Science Seminar
- Write a Scientific Argument

Next Generation Science Standards Addressed:

- Performance Expectations: MS-PS1-1; MS-PS1-4; MS-PS3-4; MS-PS3-5; MS-ESS1-3; MS-ESS2-4
- Science and Engineering Practices: Practice 1; 2; 4; 6; 7; 8
- Disciplinary Core Ideas: PS1.A; PS3.A; ESS1.B; ESS2.C
- Crosscutting Concepts: Scale, Proportion, and Quantity; Energy and Matter; Cause and Effect

Unit 5: Phase Change Engineering Internship

Time Frame: 2-3 weeks

Topics Covered:

- Introducing the Engineering Internship
- Learning About Phase Change Materials
- Researching the Temperature Plateau
- Analyzing Incubator Materials
- Designing Portable Incubators
- Choosing an Optimal Design
- Composing Proposal Outlines
- Writing Design Decisions
- Completing the Proposal
- Applying Engineering Skills

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Phase Change Engineering Internship Kit

Activities/Outcomes:

- Modeling Thermal Energy Transfer
- Temperature Plateau/Investigate Plateaus in BabyWarmer
- Analyze Incubator Materials
- Insulating Materials
- Test and Analyze Incubator Designs
- Review Design Feedback
- Test Final Designs
- Introduce Proposal/Outline Design Decisions
- Revise Design
- Finalize Proposal

Next Generation Science Standards Addressed:

- Performance Expectations: MS-ETS1-1; MS-ETS1-2; MS-ETS1-3; MS-ETS1-4; MS-PS1-4; MS-PS3-3; MS-PS3-4
- Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: ETS1.A; ETS1.B; ETS1.C; PS1.A; PS3.A; PS3.B
- Crosscutting Concepts: Energy and Matter; Systems and System Models; Cause and Effect; Structure and Function

Unit 6: Rock Transformations

Time Frame: 4-5 weeks

Topics Covered:

- Pre-Unit Assessment
- Studying Rock Formations and Samples
- Investigating How Rocks Are Formed
- Modeling How Rocks Are Formed
- Examining Evidence About Rocks
- Exploring How Magma and Sediment Form
- "Devils Tower"
- Energy's Role in Forming Rocks
- Explaining How Energy Affects Rocks
- Critical Juncture Assessment
- Investigating Hawaiian Rocks
- "The Oldest Rock Formations on Earth"
- Moving Rock Formations
- Plate Motion and Rock Transformations
- Preparing the Final Report
- Examining Evidence from Venus
- More Evidence About Venus
- Engaging in a Science Seminar
- End-of-Unit Assessment

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards

- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Rock Transformations Kit

Activities/Outcomes:

- Thinking Like a Geologist
- Observing Hand Samples of Rock
- Sim Forming Rocks
- Play Cooling Magma
- Rock Types and How They Form
- Model How Rocks Form
- Evaluate Rock Observations
- Sim Exploring How Magma and Sediment Form
- Play Underwater Weathering
- Sorting Rock Processes
- Make Sediment with Hard Candy
- Model How Rocks Form Part 2
- Oldest Rock Formations on Earth
- Moving Through Rock Transformations
- Mapping Rock Transformation Paths
- Write and Share: Moving Rock Formations
- Model Rock Transformations
- Rock Transformations on Venus
- Evaluate and Compare Rock on Earth and Venus
- Science Seminar
- Write Final Argument

Next Generation Science Standards Addressed:

- Performance Expectations: MS-ESS1-3; MS-ESS2-1; MS-ESS2-2; MS-ESS2-3; MS-ESS3-1
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: ESS1.B; ESS2.A; ESS2.C; ESS3.A; ESS3.C
- Crosscutting Concepts: Energy and Matter; Systems and System Models; Stability and Change; Cause and Effect

Unit 7: Natural Selection

Time Frame: 4-5 weeks

Topics Covered:

- Pre-Unit Assessment
- The Mystery of the Poisonous Newts
- Exploring Variation and Distribution in Populations
- Investigating Changes in Trait Distribution
- Adaptive Traits
- Explaining Changes in Trait Distribution
- Reproduction and Traits
- Survival and Reproduction
- "The Deadly Dare"
- Reasoning About the Newt Mystery
- Critical Juncture Assessment
- Reviewing Key Ideas About Natural Selection
- Introduction to Mutations
- Mutations in a Population
- Wrapping Up the Mystery
- Examining Evidence About Sticklebacks
- Engaging in a Science Seminar
- Writing a Scientific Argument
- End-of-Unit Assessment

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Natural Selection Kit

Activities/Outcomes:

- Mystery of the Poisonous Newt
- Observing Traits
- Sim Exploring Variation and Distribution
- Building Histograms

- Sim Observing Fur Traits and Temperature
- Model Changes to the Distribution of Traits
- Sim Testing Predictions
- Sim Investigate Adaptive Traits
- Model Trait Distribution in Thornpalms
- Explain Changes in the Newt Population
- Sim Reproduction
- Traits of Generations
- Observing Genes, Protein Molecules and Traits
- Reasoning About the Rough-Skinned Newts
- Investigating Adaptive Traits
- Sim Investigating Mutant Fur Traits
- Prepare a Final Model
- Examine Evidence About Sticklebacks
- Participate in Science Seminar
- Write a Scientific Argument

Next Generation Science Standards Addressed:

- Performance Expectations: MS-LS2-4; MS-LS3-1; MS-LS4-4; MS-LS4-5; MS-LS4-6
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: LS2.C; LS3.A; LS3.B; LS4.B; LS4.C
- Crosscutting Concepts: Patterns; Cause and Effect; Structure and Function; Scale, Proportion, and Quantity; Stability and Change

Unit 8: Natural Selection Engineering Internship

Time Frame: 2-3 weeks

Topics Covered:

- Introducing the Engineering Internship
- Researching Selection Pressure
- Understanding Drug Resistance
- Exploring Antimalarial Drugs
- Designing Malaria Treatments
- Choosing an Optimal Design
- Composing Proposal Outlines
- Writing Design Decisions

- Completing the Proposal
- Applying Engineering Skills

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Natural Selection Engineering Internship Kit

Activities/Outcomes:

- Reading About Malaria
- Exploring MalariaMed
- Antimalarial Drugs as Selection Pressure
- Model Population Shifts
- Review Natural Selection in Parasites
- Analyze Diagrams and Histograms
- Investigate MalariaMed Variables
- Analyze Designs
- Examine Optimal Designs
- Test Optimal Designs
- Introduce the Proposal
- Outline Design Decisions
- Revise Design Decision
- Discuss Trade-Offs
- Finalize the Proposal

Next Generation Science Standards Addressed:

- Performance Expectations: MS-ETS1-1; MS-ETS1-2; MS-ETS1-3; MS-ETS1-4; MS-LS4-4; MS- LS4-6; MS-LS3-1
- Science and Engineering Practices: Practice 1; 2; 3; 4; 5; 6; 7; 8
- Disciplinary Core Ideas: ETS1.A; ETS1.B; ETS1.C; LS3.B; LS4.B; LS4.C
- Crosscutting Concepts: Cause and Effect; Scale, Proportion, and Quantity

Unit 9: Evolutionary History

Time Frame: 4-5 weeks

Topics Covered:

- Pre-Unit Assessment
- Welcome to the Natural History Museum
- "How You Are Like a Blue Whale"
- Interpreting Evolutionary Trees
- Finding Similarities with the Mystery Fossil
- How Body Structures Differ
- Where Do Species Come From
- Investigating Speciation
- How Differences Build Up Over Time
- Reflecting on Differences in Body Structures
- Critical Juncture Assessment
- Reviewing Ideas About How Species Change
- Exploring Relatedness
- Determining Species Relatedness
- Placing the Mystery Fossil
- Investigating the Tometti Fossil
- Considering Evidence from the Museum
- Participating in the Science Seminar
- End-of-Unit Assessment

Materials:

- Unit Question card
- Chapter Question cards
- Key concepts Cards
- Vocabulary Cards
- Investigation Notebooks
- Online Sims
- Amplify Evolutionary History Kit

Activities/Outcomes:

- Student Paleontologist Role
- Find Similarities Between Species
- Sim Evolutionary History
- Tracing Structures in an Evolutionary Tree

- Compare Mystery Fossil to Whales and Wolves
- Predict Body Structures of a Common Ancestor
- Observe Organisms to Consider Differences
- How One Population Becomes Two Species
- Structure Change Card Sort
- Sim Evolutionary Time
- Model Changes Over Evolutionary Time
- Considering Whale and Wolf Claims
- Model Evolutionary Relationships with K'NEX
- Model Shared Structures in Common Ancestors
- Considering Similar Structures
- Examining Diagnostic Structures
- Place Mystery Fossil on Evolutionary Tree
- Intro Tometti Fossil Mystery
- Sort Evidence
- Examine and Discuss Evidence and Claims
- Participate in Science Seminar

Next Generation Science Standards Addressed:

- Performance Expectations: MS-LS4-1; MS-LS4-2; MS-LS4-3; MS-LS4-6
- Science and Engineering Practices: Practice 1; 2; 3; 4; 6; 7; 8
- Disciplinary Core Ideas: LS4.A; LS4.C
- Crosscutting Concepts: Stability and Change; Structure and Function; Patterns; Scale, Proportion, and Quantity

Physical Science

Unit 1: Nature of Science

Time Frame: 11 lessons/2 weeks

Topics Covered:
- Methods of science
- Standards and Measurement
- Communicating with graphs

Materials:
- Lab materials
- Text Chpt 1
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit 2: Motion and Forces

Time Frame: 13 lessons/ 2.6 weeks

Topics Covered:
- Describing motion
- Velocity and momentum
- Acceleration

Materials:

- Lab materials
- Text chapter 2 - 3
- Videos
- presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-PS2-1.Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- HS-PS2-3 Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision
- HS-PS2-4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects

Unit 3: Energy

Time Frame: 15 lessons / 3 weeks

Topics Covered:

- Work & forces
- Describing energy
- Conservation of energy
- Temperature, thermal energy, and radiation
- Using thermal energy

Materials:

- Lab materials

- Text chapter 4-5
- Videos
- presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).
- HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
- HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation

Unit 4: Waves

Time Frame: 45 lessons /15 weeks

Topics Covered:

- Nature of waves
- Properties of waves
- Behavior of waves
- Nature of waves
- Properties of sound
- Science of Music
- Using sound
- Electromagnetic waves
- Electromagnetic spectrum

- Behavior of light
- Light and color
- Producing light
- Using light
- Mirrors
- Lenses
- Optical instruments

Materials:

- Lab materials
- Text chapter 9-13
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- HS-PS4-2 Evaluate questions about the advantages of using digital transmission and storage of information.
- HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other
- HS-PS4-4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Unit 5: Matter

Time Frame: 12 lessons / 2.4

Topics Covered:

- Matter and thermal energy
- Properties of fluids
- Behavior of gases
- Composition of matter
- Properties of matter

Materials:
- Lab materials
- Text chapter 14-15
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:
- HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms
- HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties
- HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles
- HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs

Unit 6 : Chemical Reactions

Time Frame: 15 lessons / 3 weeks

Topics Covered:

- Stability in bondings
- Types of bonds
- Writing formulas
- Naming compounds
- Chemical changes
- Classifying chemical reactions
- Chemical reactions and energy
- Reaction rates and equilibrium

Materials:
- Lab materials
- Text chapter 18-19
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:
- HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs
- HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Unit 7: Applications of Chemistry

Time Frame: 14 lessons / 2.8 weeks

Topics Covered:

- Formation of solutions
- Concentration and solubility
- Particles in solution
- Dissolving without water
- Acids and bases
- Strength of acids and bases
- Salts

Materials:
- Lab materials
- Text chapter 21-22
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:
- HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs

Unit 8: The Earth

Time Frame: 25 lessons /5 weeks

Topics Covered:
- Plate tectonics
- Earthquakes
- Earth's interior
- Volcanoes
- Weathering

- Shaping the landscape
- Groundwater
- Geologic time

Materials:
- Lab materials
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:
- HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
- HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history
- HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features
- HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios**.**

Unit 9: Space

Time Frame: 10 lessons /2 weeks

Topics Covered:
- Earth in space
- Time and seasons
- Earth's moon
- Manned space flight
- Rocketry

Materials:

- Lab materials
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
- HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Biology

Unit 1: Study of life

Time Frame: 3 lessons/6 weeks

Topics Covered:

- Methods of science
- Standards and Measurement
- Communicating with graphs

Materials:

- Lab materials
- Text Chpt 1
- Videos
- presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis
- HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Unit 2: The Cell

Time Frame: 31 lessons/6 weeks

Topics Covered:

- Chemistry in biology

- Atoms, Elements, and Compounds
- Chemical Reactions
- Biological Molecules
- Cell discovery & theory
- Cellular Structures and organelles
- Cellular Functions
- Photosynthesis/ Cellular Respiration
- Cellular Reproduction

Materials:

- Lab materials
- Text Chpt 6-9
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms
- HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
- HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
- HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Unit 3: Genetics

Time Frame: 28 lessons/5.6 weeks

Topics Covered:

- Sexual Reproduction
- Mendelian Genetics
- Inheritance Patterns
- History of DNA
- Replication, Transcription & Translation
- Gene Regulation & Mutation
- Biotechnology

Materials:

- Lab materials
- Text Chpt 10-13
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells
- HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis
- HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring
- HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors
- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Unit 4: History of Biological diversity

Time Frame: 15 lessons/3 weeks

Topics Covered:

- The History of Life
- Darwin's Theory of Evolution
- The Diversity of Life

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
- HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
- HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
- HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
- HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species
- HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Unit 5: First Kingdoms

Time Frame:15 lessons/3 weeks

Topics Covered:

- Bacteria
- Viruses
- Protists
- Fungi

Materials:

- Lab materials
- Text Chpt 18-20
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Unit 6: Plants

Time Frame:12 lessons/ 2.4 weeks

Topics Covered:

- Plant Taxonomy
- Plant Structure & Function
- Plant Reproduction

Materials:

- Lab materials
- Text Chpt 21-23
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets

Next Generation Science Standards Addressed:

- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems
- HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features

Unit 7: Invertebrates

Time Frame: 15 lessons/3 weeks

Topics Covered:

- Sponges & Cnidarians
- Worms & Mollusks
- Arthropods
- Echinoderms

Materials:

- Lab materials
- Text Chpt 24-27
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Dissections

Next Generation Science Standards Addressed:

- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

Unit 8: Vertebrates

Time Frame:
15 lessons/3 weeks

Topics Covered:

- Methods of science
- Standards and Measurement
- Communicating with graphs

Materials:

- Lab materials
- Text Chpt 28-31
- Videos
- Presentations

Activities/Outcomes:

- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Dissections

Next Generation Science Standards Addressed:

- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

Unit 9: Ecology

Time Frame:
15 lessons/3 weeks

Topics Covered:
- Principles of Ecology
- Ecological Communities
- Biomes
- Ecosystems
- Population Ecology
- Biodiversity

Materials:
- Lab materials
- Text Chpt 2-4
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Scavenger Hunt

Next Generation Science Standards Addressed:
- HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

- HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
- HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce
- HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere
- HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection

Human Biology

Unit 1: Introduction to Anatomy and Physiology

Time Frame: 2 weeks

Topics Covered:
- Language of anatomy and physiology
- Body orientation
- Homeostasis
- Chemistry review
- Cellular biology review

Materials:
- Lab materials
- Anatomical models
- Text Chpt 1 & 2
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Practical Tests

Unit 2: Histology

Time Frame: 2 weeks

Topics Covered:
- Epithelial tissues
- Connective tissues
- Muscular tissues

Materials:
- Lab materials
- Anatomical models
- Microscope slides
- Text Chpt 3
- Videos

- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Microscope work
- Practical Tests

Unit 3: Skeletal system

Time Frame: 3 weeks

Topics Covered:
- Anatomy of the axial skeletal system
- Anatomy of the appendicular skeletal system
- Histology of bone
- Physiology of bone

Materials:
- Lab materials
- Text Chpt 5
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Practical Tests

Unit 4: Muscular System I (physiology)

Time Frame: 3 weeks

Topics Covered:
- Cytology of muscles
- Sliding filament theory of muscle movement
- Cellular respiration

Materials:
- Lab materials
- Text Chpt 6
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Practical Tests

Unit 5: Muscular System II (anatomy)

Time Frame: 3 weeks

Topics Covered:
- Muscle anatomy

Materials:
- Lab materials
- Text Chpt 6
- Videos
- Anatomical models
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- Practical Tests

Unit 6: Nervous System

Time Frame: 4 weeks

Topics Covered:
- Cytology of nervous tissues

- Anatomy the central nervous system
- Anatomy the peripheral nervous system
- Physiology of the nervous system

Materials:
- Lab materials
- Text Chpt 7
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- dissections
- Practical Tests

Unit 7: The Digestive System

Time Frame: 5 weeks

Topics Covered:
- Cytology & histology of the digestive system
- Anatomy of the Nervous system
- Physiology of the Nervous system

Materials:
- Lab materials
- Text Chpt 14
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- dissections
- Practical tests

Unit 8: The Cardiovascular system

Time Frame: 5 weeks

Topics Covered:
- Cytology & histology of The Cardiovascular system
- Blood histology
- Anatomy of The Cardiovascular system
- Physiology of The Cardiovascular system

Materials:
- Lab materials
- Text Chpt 10 & 11
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- dissections
- Practical Tests

Unit 9: The Urinary System

Time Frame: 3 weeks

Topics Covered:
- Cytology & histology of The Urinary system
- Anatomy of The Urinary system
- Physiology of The Urinary system

Materials:
- Lab materials
- Text Chpt 15
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations

- Worksheets
- dissections
- Practical Tests

Unit 10: The Endocrine system

Time Frame: 2 weeks

Topics Covered:
- Cytology & histology of The Endocrine system
- Anatomy of The Endocrine system
- Physiology of The Endocrine system

Materials:
- Lab materials
- Text Chpt 16
- Videos
- Presentations

Activities/Outcomes:
- Various lab activities
- Virtual labs
- Student presentations
- Worksheets
- dissections
- Practical Tests

Chemistry

Unit 1: Basic Chemistry Tools

Time Frame: 5 weeks

Topics:
- Scientific Method
- Matter & Chemistry
- Scientific Research
- Theories & Laws
- Analyzing Data
- SI System & Conversions
- Scientific Notation
- Accuracy & Precision
- Graphing

Materials:
- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- HS-PS1-7 Matter and its Interactions: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

- HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS2-6 Motion and Stability: Forces and Interactions. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 2: Properties & Structure of Matter

Time Frame: 12 weeks

Topics:
- Properties of Matter
- Changes in Matter
- Mixtures
- Elements & compounds
- Models of the atom
- Isotopes
- Radioactive decay & unstable nuclei
- Quantum theory
- Electron Configurations
- Periodic Table & Trends
- Classification of the Elements

Materials:
- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving
- Create video knowledge

Next Generation Standards Addressed:

- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-8 Matter and its Interactions: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay
- HS-PS2-6 Motion and Stability: Forces and Interactions. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
- HS-PS4-1 Waves and their Applications in Technologies for Information Transfer: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- HS-PS4-3 Waves and their Applications in Technologies for Information Transfer: Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

Unit 3: Bonding and Reactions

Time Frame: 12 weeks

Topics:

- Ion formation
- Ionic bonds
- Names & formulas of ionic compounds
- Metallic bonding
- Sharing electrons (covalent bonds)
- Names & formulas of covalent compounds
- Molecular structure
- Molecular shapes
- Electronegativity & polarity
- Reactions and equations

- Classifying chemical reactions
- Reactions in aqueous solution

Materials:
- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving
- Create video knowledge

Next Generation Standards Addressed:
- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-7 Matter and its Interactions: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 4: Stoichiometry

Time frame: 4 weeks

Topics:

- The mole
- Measuring matter
- Mass and the mole
- Moles of compounds
- Empirical & Molecular Formulas
- Stoichiometric calculations
- Limiting Reactants
- Percent yield

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving
- Create video knowledge

Next Generation Standards Addressed:

- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- HS-PS1-7 Matter and its Interactions: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Unit 5: Kinetic Molecular Theory

Time frame: 3 weeks

Topics:

- Gases
- Intermolecular forces
- Liquids & solids
- Phase changes
- Gas Laws
- Ideal Gas Law
- Gas stoichiometry

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving
- Create video knowledge

Next Generation Standards Addressed:

- HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS1-5 Matter and its Interactions: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

- HS-PS3-4 Energy: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Chemistry II

Unit 1: Chemistry Review

Time Frame: 6 weeks

Topics:

- SI system
- Units & measurement
- Chemical & Physical Properties
- Models of the atom
- Quantum Theory
- Periodic Trends
- Ionic bonding
- Covalent bonding
- Metallic bonding
- Chemical Reactions
- Moles
- Stoichiometry
- States of matter
- Gases

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Matter and its Interactions: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- HS-PS1-7 Matter and its Interactions: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- HS-PS1-8 Matter and its Interactions: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay
- HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
- HS-PS3-4 Energy: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
- HS-PS4-1 Waves and their Applications in Technologies for Information Transfer: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

- HS-PS4-3 Waves and their Applications in Technologies for Information Transfer: Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

Unit 2: Mixtures & Solutions

Time Frame: 3 weeks

Topics:
- Types of mixtures
- Solution concentrations
- Factors affecting solvation
- Colligative properties

Materials:
- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

- HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Matter and its Interactions: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Unit 3: Energy and Chemical Change & Equilibria

Time Frame: 6 weeks

Topics:

- Energy
- Heat
- Thermochemical equations
- Enthalpy change
- Reaction spontaneity
- Models for reaction rates
- Factors affecting reaction rates
- Reaction rate laws
- Instantaneous reaction rates and reaction mechanisms
- Equilibrium
- Le Chatelier's Principle
- Factors affecting equilibrium
- Using equilibrium constants

Materials:

- Lab materials
- Text
- Videos

- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5 Matter and its Interactions: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

Unit 4: Acids & Bases

Time Frame: 4 weeks

Topics:
- Acid & base models
- Strength of acids/bases
- Hydrogen ions and pH
- Neutralization
- Dissociation & equilibria & strength

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-5 Matter and its Interactions: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Unit 5: Electrochemistry

Time Frame: 5 weeks

Topics:
- Voltaic cells
- Batteries
- Electrolysis

Materials:
- Lab materials

- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-5 Energy: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Unit 6: Organic Chemistry

Time Frame: 6 weeks

Topics:
- Hydrocarbons
- Alkanes
- Alkenes
- Alkynes
- Geometric & Structural isomers

- Aromatic hydrocarbons
- Alkyl halides
- Aryl halides
- Alcohols
- Ethers
- Amines
- Aldehydes
- Ketones
- Carboxylic acids
- Esters
- Reactions of organic compounds
- Polymers

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-4 Matter and its Interactions: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-6 Matter and its Interactions: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Unit 7: Chemistry of Life

Time Frame: 4 weeks

Topics:

- Proteins
- Carbohydrates
- Lipids
- Nucleic Acids
- Metabolism

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HTMAA

Unit 1: 2D Design Software & Vinyl Cutting/Laser Engraving

Time Frame: 4 weeks

Topics:

- Become familiar with Adobe Illustrator design software
- Use software to import and modify a pre-made design
- Operate a vinyl cutter
- Operate a laser engraver
- Troubleshoot and test machine functionality
- Modify a design to have the desired outcome on a machine or particular material

Materials Needed:

- Roland Vinyl Cutter
- Epilog Laser Engraver
- Various vinyl colors and types
- Cardboard
- Various colors/thicknesses of acrylic
- Various types of wood
- Transfer tape
- Scissors
- Tweezers
- Rulers
- Cutting boards
- Adobe Illustrator

Materials:

- Roland Vinyl Cutter
- Epilog Laser Engraver
- Various vinyl colors and types
- Cardboard
- Various colors/thicknesses of acrylic
- Various types of wood
- Transfer tape
- Scissors

- Tweezers
- Rulers
- Cutting boards
- Adobe Illustrator

Activities:
- Cut/print/engrave a pre-made pattern
- Create a unique product design
- Raster as well as vector cut various materials for a unique product design
- Create a Multi-Colored, Multi-Layered Sticker or Heat Transfer

Next Generation Standards addressed:
- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Unit 2: 3-D Design & Modeling

Time Frame: 6 weeks

Topics:
- Use 3-D software to create simple shapes
- Use 3-D software to modify existing parts and drawings
- Use 3-D software to import file and create a press fit design
- Operate the Laser Engraver
- Troubleshoot software problems in their designs

Materials:
- SolidWorks
- 123D Make
- Epilog Laser engraver
- Cardboard

- Acrylic
- Wood
- Scissors
- Tweezers
- Rulers

Activities:
- Make something from one of the press fit methods
- Work through SolidWorks Certification practice tests making parts
- Use 3-D software to create a 3-D part

Next Generation Standards addressed:
- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Engineering Design: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Unit 3: 3D Printing

Time Frame: 2 weeks

Topics:
- Get a small part from Thingiverse.com to 3-D print
- Use both 3-D printer types and their software

Materials:
- Makerbot printers
- Uprint printer
- PLA plastic, various colors
- SolidWorks
- GrabCad

- Makerbot Desktop

Activities:

- Create an original part on SolidWorks to print on the 3-D printer with interlocking or moving parts
- Analyze costs for both printing system, optimize product for lowest price, highest quality

Next Generation Standards addressed:

- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Engineering Design: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
- HS-PS3-3 Energy: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Unit 4: CNC Routering and Plasma Cutting

Time Frame: 6 weeks

Topics:

- Operate the ez-router plasma cutter
- Operate the ez-router wood router
- Plan toolpaths using Aspire and Sheetcam software
- Change bits and settings on router and plasma cutter
- Use Sheetcam software to create g-code to import to plasma cutter

Materials:

- EZ-Router plasma cutter
- EZ-Router CNC wood router
- Plywood (or other woods as desired)
- Sheet steel (¼”and ⅛” thicknesses)
- Aspire software

- SheetCAM software
- SolidWorks software

Activities:
- Use Aspire software to design a part
- Use Aspire Software to create g-code to import to the router
- Use SolidWorks to create a project that is imported to Aspire
- Create product with plasma cutter
- Create finished 3d object with CNC router

Next Generation Standards addressed:
- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Engineering Design: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

Unit 5: Reverse Engineering & 2D & 3D Milling

Time Frame: 6 weeks

Topics:
- Recreate a part in SolidWorks using the microscribe.
- Modify a part in SolidWorks that they re-created using the microscribe.
- Export G-code to MDX-40A or Tormach 1100

Materials:
- Microscribe
- REVWORKS software
- Solid Works
- Pre-designed part to re-produce
- Azek plastic wood products

- Styrene foam
- Aluminum sheeting
- SRP player
- VPanel
- Aspire
- Adobe Illustrator
- Dr. Engrave software
- Models MDX-40A scanner unit
- Makerbot scanner
- Kinect scanner
- Roland MDX-40A
- Tormach 1100 PCNC
- Aluminum or steel blank stock

Activities:

- Design and produce a part or engraving using the MDX-40 A milling machine or Tormach 1100 PCNC
- Recreate and modify part using reverse engineering

Next Generation Standards addressed:

- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Engineering Design: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

Unit 6: Final Project

Time Frame: 9 weeks

Topics:

- Design and create a final product that uses at least 3 different machines to produce parts for the product

Materials:

- Makerbot printers
- Uprint printer
- PLA plastic, various colors
- ABS plastic, various colors
- SolidWorks
- Adobe Illustrator
- Acrylic, various colors
- Metal
- Wood, Modela MDX-40
- Microscribe
- CNC router
- CNC plasma
- Roland Vinyl Cutter
- Epilog Laser
- Vinyl, various colors
- Tormach 1100 PCNC

Activities:

- Design and create a final product that utilizes a minimum of 3 machines in the final design
- Prepare and present a final paper and oral presentation describing their design and building process.
- Students will demonstrate their proficiency in use of software, hardware and the engineering design process through the process of creating their final product.

Next Generation Standards addressed:

- HS-ETS1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Engineering Design: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

- HS-ETS1-4 Engineering Design: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

Global Science

Unit 1: GPS: Navigation and Use

Time Frame: 3 weeks

Topics:

- GPS Basic research
- Finding waypoints
- Marking waypoints
- Plan and follow routes
- GPS wrap-up

Materials:

- GPS units

Activities:

- Hands on work with GPS
- Using GPS to find waypoints, mark waypoints, make and follow routes

Next Generation Standards Addressed:
No standards, above standards

Unit 2: Navigation with Compass

Time Frame: 2 weeks

Topics:

- Step count & measuring distances
- Using and setting up bearings
- Setting and follow routes using compass

Materials:

- Compasses
- Maps

Activities:

- Learn compass and map basics
- Taking bearings
- Step count and measuring distances
- Create and follow routes with bearings

Next Generation Standards Addressed:
No standards, above standards

Unit 3: Wild Rice

Time Frame: 2 weeks

Topics:

- Wild rice characteristics
- Wild rice habitat
- Wild rice struggles
- Human impact on wild rice
- Planting wild rice

Materials:

- Research materials (online)
- Wild Rice
- Canoes

Activities:

- Wild rice research
- Create wild rice videos
- Plant wild rice
- Eat wild rice soup

Next Generation Standards Addressed:

- HS-ESS3-1 Earth and Human Activity: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-4 Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

- HS-ESS3-5 Earth and Human Activity: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Unit 4: Deer Hunting and Conservation

Time Frame: 4 weeks

Topics:
- Deer hunting research
- Hunting brochures
- Video analysis project

Materials:
- Resource books and online sources
- Oh, Deer game pieces

Activities:
- Deer research
- Oh, Deer deer population game and analysis
- Big Game Outfitter brochure creation
- Hunting video analysis project

Next Generation Standards Addressed:
- HS-ESS3-3 Earth and Human Activity: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-ESS3-1 Earth and Human Activity: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-2 Earth and Human Activity: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Unit 5: Rated MPG for Confusion

Time Frame: 1 week

Topics:

- Use gas mileages and graphing to find best ratio of cost and efficiency

Materials:

- Computer and spreadsheet program

Activities:

- Discuss in groups choices for various questions
- Create spreadsheets to do calculations and graphs to compare mpg and costs

Next Generation Standards Addressed:

- HS-ESS3-2 Earth and Human Activity: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- HS-ESS3-4 Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Unit 6: Elk Habitat Case Study

Time Frame: 3 weeks

Topics:

- Overview of elk in Yellowstone Park
- Information about park habitat
- Introduce two different elk herds and different characteristics
- Differences in valley geology and relationship to elk life span
- Predators in Yellowstone Park and effects on elk population

Materials:

- Elk case study sheets (digital)
- Computer
- Internet or print research resources

Activities:

- Group brainstorming initial research
- Find maps and locations, digitally markup
- Class discussions and question asking
- Video creation

Next Generation Standards Addressed:

- HS-ESS3-3 Earth and Human Activity: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- HS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Unit 7: Primitive Fire Building

Time Frame: 3 weeks

Topics:

- Fire basics
- Primitive methods of fire building

Activities:

- Fire building methods and materials research
- Fire building practice, gathering materials, and starting fire
- Fire assessment (making fire)

Next Generation Standards Addressed:

No standards, goals are outside of standards

Unit 8: Winter Survival Skills

Time Frame: 3 weeks

Topics:
- Survival and Winter survival
- Skills needed
- Snow shelter types
- Frostbite
- Building winter survival shelters

Activities:
- Shelter type research
- Winter survival skills discussion
- Building survival shelter

Next Generation Standards Addressed:
No standards, goals are outside of standards

Unit 9: Ice Fishing and Conservation

Time Frame: 1 week

Topics:
- Fish species and identification
- Fish species preferred habitat
- Techniques for catching different species
- Methods of cleaning and cooking
- Fishing regulations and importance
- Equipment

Materials:
- Computer
- Ice fishing equipment
- Warm clothes

Activities:

- Fish species research
- Fish species identification quiz
- Equipment familiarization and use
- Ice fishing trip
- Catching and cleaning fish
- Eating fish

Next Generation Standards Addressed:

- HS-ESS3-3 Earth and Human Activity: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Unit 10: Maple Syrup

Time Frame: 6 weeks

Topics:

- Maple syrup formation
- Science behind maple syrup
- Tapping trees
- Collecting sap
- Boiling into syrup

Materials:

- Computer
- Spiles
- Sap bags
- Spiles
- Sap Shack
- Evaporating Pans
- Firewood
- Bottles

Activities:

- Maple syrup research
- Tapping trees
- Collecting sap

- Boiling into syrup
- Consuming syrup (pancakes and/or ice cream)

Next Generation Standards Addressed:

- HS-ESS3-1 Earth and Human Activity: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-2 Earth and Human Activity: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- HS-ESS3-5 Earth and Human Activity: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- HS-ESS3-6 Earth and Human Activity: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Unit 11: Solar Olympics

Time Frame: 5 weeks (along with other units as well)

Topics:

- Solar energy
- Energy calculations

Materials:

- Solarwise information
- Solar panels
- Various wheels, motors,etc.
- Other materials depending on individual projects

Activities:

- What's in an Energy Bill calculations
- Build, test, evaluate, refine a solar energy device or project

Next Generation Standards Addressed:

- HS-ESS3-4 Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

- HS-ESS3-6 Earth and Human Activity: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
- HS-PS3-3 Energy: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Unit 12: Buckthorn and Other Invasive Species

Time Frame: 3 weeks

Topics:
- Invasive species as problems
- Buckthorn
- Proper removal and disposal of invasive species
- Careful planning and observation of species used

Materials:
- Computer
- Gloves
- Round-up
- Saws

Activities:
- Research into invasive species
- Create brochure and videos showing problems and how to take care of them
- Work to eliminate buckthorn in school woods
- Work with town/county on invasive species projects

Next Generation Standards Addressed:
- HS-ESS3-4 Earth and Human Activity: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

Global Science 2

Independent Course (Student Driven projects)

Global Science 2 is a continuation of Global Science, letting students further develop advanced skills and research in environmental, outdoor education, and natural resource use and conservation. This course was student interest driven, with students deciding what topics or projects or skills they wanted to explore, do more in depth work with, or research.

Student work in Global Science 2 could consist of doing more advanced work with skills they learned in Global Science. This past year, we had students work on more primitive methods of fire building (bow drills), and on building and staying overnight in survival shelters, as examples. For these advanced skills projects, students documented their progress, successes and failures with video they took of themselves, as would be seen in TV shows like Survivorman. Students also discussed what they were doing, why, and what obstacles they were overcoming in the videos.

Students in Global Science 2 also could choose to do more advanced research and design experiments to collect data to analyze for both short term and long term projects. Projects such as studying and recording temperatures and sap production for maple trees, more research on other invasive species, including interviews with knowledgeable experts and videos showing them identifying and correctly removing and disposing of them.

Student projects were individually chosen, and Next Generation Science Standards would apply depending on the topic being studied,or some may not have a standard attached, as they would fall beyond the scope of the standards for high school, but still be important life skills, or traditional skills for the Northwoods.

Physics

Unit 1: Motion

Time Frame: 8 weeks

Topics:

- SI system
- Metric conversions
- Measurement/Graphing
- Picturing motion
- Position/Time graphs
- Constant velocity
- Acceleration
- Motion with constant acceleration
- Free Fall

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-1 Motion and Stability: Forces and Interactions: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

Unit 2: Forces and Motion

Time Frame: 9 weeks

Topics:

- Force and motion
- Newton's Laws of Motion]
- Interaction Forces
- Vectors
- Friction
- Force and motion in two dimensions
- Projectile motion
- Circular motion
- Relative velocity

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-1 Motion and Stability: Forces and Interactions: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- HS-PS3-2 Energy: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

Unit 3: Gravitation

Time Frame: 2 weeks

Topics:

- Planetary motion and gravitation
- Using the law of Universal Gravitation

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-4 Motion and Stability: Forces and Interactions: Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
- HS-ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Unit 4: Rotational Motion

Time Frame: 3 weeks

Topics:

- Describing Rotational Motion
- Rotational Dynamics
- Equilibrium

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-1 Motion and Stability: Forces and Interactions: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration
- HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

Unit 5: Momentum & Conservation

Time Frame: 3 weeks

Topics:

- Impulse and momentum
- Conservation of momentum

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs

- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-2 Motion and Stability: Forces and Interactions: Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- HS-PS2-3 Motion and Stability: Forces and Interactions: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Unit 6: Energy, Work, Simple Machines, Conservation

Time Frame: 5 weeks

Topics:

- Energy
- Work
- Energy-Work Theorem
- Power
- Machines
- Forms of Energy
- Conservation of Energy

Materials:

- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:

- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:

- HS-PS2-3 Motion and Stability: Forces and Interactions: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision
- HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-3 Energy: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy

Unit 7: Vibrations and Waves

Time Frame: 4 weeks

Topics:
- Periodic Motion
- Wave Properties
- Wave Behavior
- Properties and Detection of Sound
- Physics of Music

Materials:
- Lab materials
- Text
- Videos
- Smartboard Presentations

Activities:
- Mini-labs
- Labs
- Worksheets
- Problem Solving

Next Generation Standards Addressed:
- **HS-PS4-1 Waves and their Applications in Technologies for Information Transfer:** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **HS-PS4-2 Waves and their Applications in Technologies for Information Transfer:** Evaluate questions about the advantages of using digital transmission and storage of information.

- **HS-PS4-5 Waves and their Applications in Technologies for Information Transfer:** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Astronomy

Independent Study (based on Community College classes)

Unit 1: The Nature of Astronomy

Time Frame: 3 weeks

Topics:

- The Nature of Astronomy
- The Laws of Nature
- Numbers in Astronomy
- Consequences of Light Travel Time
- Tour of the Universe
- The Sky Above
- Ancient Astronomy

Materials:

- Online Text
- Lab materials
- Online video discussions

Activities:

- Readings
- Videos to watch & create
- Problem Solving
- Writing

Unit 2: Laws of Planetary Motion and Earth/Sky

Time Frame: 3 weeks

Topics:

- Laws of Planetary Motion
- Newton's Universal Law of Gravitation
- Orbits in the Solar System
- Motions of satellites and spacecraft

- Gravity with more than two bodies
- Earth and Sky
- The seasons
- Time
- The Calendar
- Phases and motion of the Moon
- Tides and the Moon
- Eclipses

Materials:
- Online Text
- Lab materials
- Online video discussions

Activities:
- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:
- HS-ESS1-4 Earth's Place in the Universe: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Unit 3: Light and Observing Light

Time Frame: 3 weeks

Topics:
- The behavior of light
- The electromagnetic spectrum
- Spectroscopy in Astronomy
- The Structure of the Atom
- Formation of spectral lines
- The Doppler effect
- Telescopes
- Visible light detectors and instruments

- Radio telescopes
- Observations outside Earth's atmosphere

Materials:
- Online Text
- Lab materials
- Online video discussions

Activities:
- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:
- HS-ESS1-2 Earth's Place in the Universe: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

Unit 4: The Solar System

Time Frame: 8 weeks

Topics:
- Composition and structure of planets
- Dating planetary surfaces
- Origin of the solar system
- Earth's crust
- Earth's atmosphere
- Life, chemical evolution, and climate change
- Cosmic influence of the evolution of Earth
- The Moon
- Impact craters
- Mercury
- Geology of Venus
- Atmosphere of Venus
- Geology of Mars

- Water and life on Mars
- Divergent Planetary Evolution
- Exploring the outer planets
- The giant planets
- Atmospheres of giant planets
- Ring and moon systems
- Galilean moons of Jupiter
- Planetary rings
- Asteroids
- Comets
- Meteors
- Formation of the solar system
- Comparison with other planetary systems

Materials:

- Online Text
- Lab materials
- Online video discussions

Activities:

- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:

- HS-ESS1-2 Earth's Place in the Universe: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe
- HS-ESS1-6 Earth's Place in the Universe: Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.
- HS-ESS2-4 Earth's Systems: Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.

Unit 5: The Sun

Time Frame: 3 weeks

Topics:

- The structure and composition of the sun
- The solar cycle
- Solar activity above the photosphere
- Space weather
- Sources of sunshine
- Massm, energy, and the theory of relativity
- The solar interior

Materials:

- Online Text
- Lab materials
- Online video discussions

Activities:

- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:

- HS-ESS1-1 Earth's Place in the Universe: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

Unit 6: Stars

Time Frame: 9 weeks

Topics:

- The brightness of stars
- The color of stars
- The spectra of stars
- Using spectra to measure radius, composition, and motion
- A stellar census

- Measuring stellar masses
- Diameter of stars
- The H-R diagram
- Fundamentals units of distance
- Surveying the stars
- Variable stars
- The interstellar medium
- Interstellar gas
- Cosmic dust
- Cosmic rays
- The life cycle of cosmic material
- Star formation
- Evidence that planets form around other stars
- Explanets
- Evolution from main sequence to red giants
- Star clusters
- Evolution of stars
- Death of low-mass stars
- Evolution of massive stars
- Supernova
- Pulsars and neutron stars

Materials:

- Online Text
- Lab materials
- Online video discussions

Activities:

- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:

- HS-ESS1-2 Earth's Place in the Universe: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
- HS-ESS1-3 Earth's Place in the Universe: Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Unit 7: Galaxies

Time Frame: 7 weeks

Topics:

- Black holes
- The architecture of the galaxy
- Mass of the galaxy
- The center of the galaxy
- Stellar populations in the galaxy
- The formation of the galaxy
- The discovery of galaxies
- Types of galaxies
- Properties of galaxies
- The extragalactic distance scale
- The expanding universe
- Quasars
- Supermassive black holes
- Observations of distant galaxies
- Galaxy mergers
- The distribution of galaxies in space
- The challenge of dark matter
- The formation and evolution of galaxies and structure in the universe
- The age of the universe
- A model of the universe
- The beginning of the universe
- The cosmic microwave background

Materials:

- Online Text
- Lab materials
- Online video discussions

Activities:

- Readings
- Videos to watch & create
- Problem Solving
- Writing

Next Generation Standards Addressed:

- HS-ESS1-2 Earth's Place in the Universe: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
- HS-ESS1-1 Earth's Place in the Universe: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation.

Integrated Science

Independent Course (Student project driven)

Integrated Science pulls principles from several different sciences, including physical science, chemistry, biology, and physics, to study themes and phenomena from the world around us. Students design and perform experiments for both long term and short term projects on topics that interest them in science, and then analyze their data and present their findings in several different formats including interviews, papers, video or oral presentations.

Students complete three short term projects per quarter, and one long term project for the year. Each project has similar characteristics:

- Science topic that students want to learn more about
- Formulate a hypothesis for what they believe is happening or will happen
- Design an experiment to test their hypothesis
- Analyze data using various statistical tools
- Report/present findings through formal papers, or through video creation

Long term studies this year included:

- Study of whether betta fish would grow better by being fed flakes or pellets
- Study of plant growth with various liquids used to water them
- Study of effect of caffeine on body temperature when used daily

Short term study examples this year included:

- Rate of milk spoilage based on fat content of milk
- Methods of making strawberries last longer before spoiling
- Can lemons provide enough electricity to charge a cell phone
- Making an electroscope and testing different materials to find out which produced and conducted the most static electricity
- Does the distance between hot objects affect how fast they cool?
- Measuring the speed of light using a microwave oven
- The best way to shoot a basketball
- How much does food choice affect saliva pH over time

For each project, students are required to submit a project proposal that discusses the following: What problem or situation will be studied, Why should this be studied, a hypothesis of what the students believes will be the result or explanation, a detailed experimental design, what scientific literature already says about this topic, and what additional information or topic the student needs to know.

After performing the experiment, the students will analyze their data using basic statistical methods and report their findings in either a paper, or a video or oral presentation.
Next Generation Science standards were addressed as the course was designed. The open nature of the topics to be investigated opens up all science areas, and all the science standards to possibly be addressed. Student project choices will direct which science standards are used, and will vary yearly.