Montana Small Schools Alliance

Presents

2020
Curriculum Guide

Science
K-8

Complied by

Montana Rural Teachers
Montana County Superintendents Montana Small Schools Alliance

Physical Science

Students, through the inquiry process, the Science and Engineering Practices, the Crosscutting Concepts, and technology, will investigate how matter and energy exist in a variety of forms and how physical and chemical interactions change matter and energy.

K	1	2
Plan and conduct an investigation to compare the effects of different strengths or differing directions of pushes and pulls on the motion of an object.	Plan and conduct an investigation to provide evidence that vibrating materials can make sound, and that sound can make materials vibrate. Design a solution or build a device that shows this relationship.	Demonstrate knowledge of matter. Create mixtures and separates them (ex. oil and water, soil and iron filings)
Analyze data to determine if a design solution works as planned to change the speed or direction of an object	Make observations to construct an evidence-based explanation that objects can be seen only when illuminated. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	Recognize objects have many physical properties (ex: color, shape, size, texture). Sort objects based on common property.
Construct an explanation based on observations of the effect of sunlght on earth's surface, and use tools and materials to design and build a structure to reduce the warming effect of sunlight on an area.	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can cause materials to vibrate. Design a solution or build a device that facilitates communication using light or sound.	Identify the different forms of matter. Introduce the change of matter from one form to another, and construct an argument with evidence that some changes caused by heating and cooling can be reversed and some cannot
		Plan and conduct an investigation to describe and classify various materials by their observable properties.
		Conduct an investigation and analyze data to determine which materials have the properties best suited for an intended purpose.
		Make observations to construct an evidence-based claim of how an object made of a small set of pieces can be disassembled and made into a new object.
		Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

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3	4	5
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	Develop a model to communicate that matter is made of particles too small to be seen
Observe and record qualitative and quantitative data about an object's motion to provide evidence that a pattern can be used to predict future motion, and plan and conduct an investigation to provide evidence of balanced and unbalanced forces on the motion of an object	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	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
Observe and perform investigations manipulating forms of energy, and define a simple design problem that can be solved by applying scientific ideas about magnets.	Develop a model of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move.	Conduct an investigation that produces quantitative and qualitative data to analyze whether the mixing of two or more substance results in new substances.
	Ask questions and predict outcomes about the changes in energy that occur when objects collide, and use evidence to describe the relationship between the speed of an object and the energy of that object	Identify physical interactions involving changes in energy, and use models to describe that energy in animals' food was once energy from the sun.
	Generate and compare multiple solutions that use patterns to transfer information.	Identify and build examples of simple machines. Gather information to describe that synthetic materials come from natural resources and impact society
	Select and safely uses tools for the simple measurement of each state of matter. Observe and record qualitative and quantitative evidence to support identification of materials based of their properties	Identify characteristics of motion and gravity. Investigate the effect of position, speed, and external forces on an object, and support an argument that the gravitational force exerted by Earth on objects is directed toward the center of the Earth.

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6 through 8			
Matter	**Motion, Forces, and Interactions**	**Energy**	**Waves**
develop and critique models that describe the atomic composition of simple molecules and extended structures	apply Newton's Third Law of Motion to design a solution to a problem involving the motion of two colliding objects	construct and interpret graphic displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object	use mathematical representations to describe a simple model for waves that includes how the amplitude and wavelength of a wave is related to the energy in a wave
analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred	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	develop and critique models to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system	develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials
gather information to describe that synthetic materials come from natural resources and impact society	ask questions about data to determine the factors affecting electric and magnetic force strengths	apply scientific principles to design, construct, and test a device that minimizes or maximizes thermal energy transfer	conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers and types of cells
develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed	construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the mass of interacting objects	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	
develop, use, and critique a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved	design and conduct an investigation to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact	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	

Life Science

Students, through the inquiry process, technology, the Science and Engineering Practices and the Crosscutting Concepts, will investigate the characteristics, structures, and functions of living things; the processes and diversity of life; and how living organisms interact with each other and their environments.

K	1	2
Describe healthy eating habits, and what humans need to survive.	Through observation, identify living (biotic) and non-living (abiotic) objects and describe patterns of what plants and animals need to survive. Illustrates a simple food chain with herbivores, carnivores.	Identify plants and animals have structures that help them grow, and make an evidence-based explanation of how young plants and animals are like, but not exactly like, their parents
Identify parts of an ecosystem, and use materials to design a solution to a human problem by mimicking plant and animal structures and functions which help them survive, grow, and meet their needs.	Trace the lifecycle of plants and animals, and use information from print and other media to identify patterns in behavior of parents and offspring that help offspring survive.	Relate nutrition to body function, identify the basic requirements of energy and nutrition needed by the human body, and identify the digestive, circulatory, and nervous system.
	Using print and other media, gather information to identify patterns in behavior of parents and offspring that help offspring survive.	Compare features of plant and animal life cycles, develop a simple model that mimics the structure and function of an animal in dispersing seeds or pollinating plants.
	Use evidence to explain how young plants and animals are like, but not exactly like, their parents.	Make observations of plants and animals to compare and contrast the diversity of life in different habitats, and plan and conduct a cause and effect investigation to determine whether plants need sunlight and water to grow.
	Groups objects based on attributes	Group plants and animals according to more complex characteristics using a classification system.
		Plan and conduct an investigation to determine if plants need sunlight and water to grow.
		Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants
		Make observations of plants and animals to compare the diversity of life in different habitats.

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3	4	5
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, Identify that plants and animals have structures and systems that serve different functions for growth, survival, and reproduction,	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, find mates, and reproducing. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Use models to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
Identify food groups and the food pyramid. Describe basic energy requirements of energy needed by the human body	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death	Support an argument that plants get the materials they need for growth chiefly from air and water
Construct a cause and effect argument communicating some animals, including humans, form groups and communities that help members survive, and 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.	Identify, measure, and describe basic requirements of energy and nutritional needs for an organism.	Support an argument on how abiotic factors, such as temperature, air, water and sunlight, affect the ability of plants to create their own food through photosynthesis. Explain how populations are affected by predator-prey relationships. Describe common food webs in different Montana ecosystems
Explain cause and effect relationships between nonliving and living components within ecosystems; and Identify the difference between an instinctual, inherited, and learned behavior.	Use evidence to support that traits can be influenced by the environment. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. Make a claim about the effectiveness of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.		Identify that reproduction is a characteristic of living systems and it is essential for the continuation of every species
Construct an argument that some animals form groups that help members survive.		Identify that organisms can survive and reproduce only in environments that meet their basic needs, and develop and critique a model to describe the movement of matter among plants, animals, decomposers and the environment
Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago		Classify organisms based on similarities and differences in basic structure, function, and life cycle processes of each system (e.g. photosynthesis, respiration, adaptations, food chains and ecosystems)
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.		
Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.		
Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change		

Life Science

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6 through 8		
Molecules and Organisms	**Ecosystems**	**Heredity and Biological Diversity**
conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers and types of cells	analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem and analyze scientific concepts used by American Indians to maintain healthy relationships with environmental sources	use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively
develop and use a model to describe the structure and function of a cell as a whole and ways parts of cells contribute to the function	develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem	construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth and development of organisms
Compare the structure and function of prokaryotic cells (bacteria) and eukaryotic cells (plant, animal, etc.) including the levels of organization of the structure and function, particularly with humans. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time	construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems	develop and use a model to describe why structural changes to genes, such as mutations, may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism
use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells	evaluate competing design solutions for maintaining biodiversity and ecosystem services	develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation
Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the		gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms

probability of successful reproduction of animals and plants respectively.		
Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms		analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past
Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.		apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships
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.		apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships
Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories		construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
		use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time

Earth and Space Science

Students will use the inquiry process, the Science and Engineering Practices and the Crosscutting Concepts, while investigating the composition, history, structures, processes and interactions of Earth's systems, the solar system, and the universe.

K	1	2
Construct an argument supported by evidence for how plants and animals, including humans, can change the environment to meet their needs, and use a model to represent the relationship between the needs of different plants or animals, including humans, and the places they live	Name and describe the four seasons, and make observations at different times of year to relate the amount of daylight to the time of year	Develop models to represent the shapes and kinds of land and bodies of water in an area, use information from several sources to provide evidence that Earth events can occur quickly or slowly, and construct explanations to compare multiple physical and naturally built designs which impact wind or water's effect on the shape of the land.
Identify tools used to measure weather, use and share observations of local weather condition described patterns over time, and ask questions to obtain information about the purpose of weather forecasting to predict, prepare for, and respond to weather.	Use observations of the sun, moon and stars to describe patterns that can be predicted and graph the daily changes in the length, shape, and direction of shadows; lengths of day and night; and the seasonal appearance of select stars to communicate the patterns of Earth's movement, and describe how astronomical knowledge is used by American Indians.	Describe rocks and recognize they have a variety of physical properties. Recognize the many uses of earth's rocks.
Identify a tool that can be used to study space, and use evidence or models to support the claim that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth	Name Earth's features and build models to demonstrate knowledge of Earth and Objects in space.	Identify seasonal and weather changes, and obtain information to identify where water is found on Earth and that it can be solid, liquid or gas
Idenify Earth's basic materials (rocks, soil, water, gases) and communicate ideas about the impact of humans on the land, water, air, or other living things in the environment.		Identify fossils give information about plants, animals, and the environment of long ago.
		Understand light and heat come from the sun. Understand the shape of the moon changes from day to day in a cycle.
		Describe the use of technology to study of space and the objects in space.

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3	4	5
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. Obtain and combine information to describe climates in different regions of the world	Describe and give examples of earth's changing features, identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time, analyze and interpret data from maps as evidence to make a claim about patterns of Earth's features, and make observations or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation.	Obtain and combine information from various sources about ways individual communities use science ideas to protect the Earth's resources, environment and systems, and describe examples of how American Indians scientific knowledge and practices are used to maintain relationships with the natural worl
Describes Earth's features and illustrates changes of those features. Describe soil and recognize it has properties such as color, texture, ability to retain water, and support plant growth. Identify the gases of earth's atmosphere	Investigate fossils and make inferences about life the plants, animals, and the environment at that time. Investigates and makes inferences from fossils.	Define rocks and minerals.
Describe the environment long ago and make inferences about life long ago.	Describe and measure the physical properties of earth's basic materials (including soil, rocks, water and gases) and the resources they provide.	. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
Obtain and represent data using tables and graphical displays to describe observed and predicted weather conditions during a particular season, identify tools to predict weather and measure wind conditions	Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured. Observes and records changes in weather (e.g. water cycle)	Describe the atmosphere as a mixture of nitrogen, oxygen, and trace gases, and develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, or atmosphere interact
Obtain and combine information to describe climate patterns in different regions of the world and make a claim based on information about the merit of design solution that reduces the impacts of a weather-related hazard.	Explain the difference between weather and climate, and obtain and combine information from a variety of sources to communicate that energy and fuels are derived from natural resources and their uses affect the environment, and generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Investigate plant and animal fossils. Explain fossil formation.

Identifies objects in the sky (e.g. moon, stars, sun, planets),	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	Graph the daily changes in the length, shape, and direction of shadows; lengths of day and night; and the seasonal appearance of select stars to communicate the patterns of the Earth's movement and describe how astronomical knowledge is used by American Indians, and use evidence or models to support the claim that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
Identify and give examples of technology and methods used to study and explore space. (e.g. satellites, space probes, the use of the space station)	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans	Describe the uses of technology to study space relating the discoveries to the origin of the earth.
	Identify objects (e.g. moon, stars, and meteors) in the sky and their patterns of movement and explain that light and heat comes from a star called the sun. Identifies patterns of movement of stars, moon, sun, and planets.	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.
	Identify technology and methods used for space exploration (e.g. star parties, space shuttles, telescopes).	

Earth and Space Science

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6	7	8
Earth in the Universe	**Earth's Systems**	**Earth and Human Activity**
develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons	construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time scales and spatialscales	ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century
develop and use a model to describe the role of gravity in the motions within galaxies and the solar system	analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions	analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects
analyze and interpret data to determine scale properties of objects in the solarsystem	develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity	apply scientific principles to design a method for monitoring and minimizing a human impact on the environment
construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 billion-year-old history	develop a model to describe the cycling of earth's materials and the flow of energy that drives this process	construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems including indigenous populations
	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions	
	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	

Engineering and Design

Students will use the inquiry process, the Science and Engineering Practices and the Crosscutting Concepts, while investigating the use of technology and design to solve problems.

K-3	3-5	6-8
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.	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	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.
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.	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.	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	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.	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.
		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.