

9th-12th Grade Science

Science Content Standard 1. Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.		
Benchmark Upon Graduation	Essential Learning Expectation	Essential Vocabulary
1. Generate a question, identify dependent and independent variables, formulate testable, multiple hypotheses, plan an investigation, predict its outcome, safely conduct the scientific investigations, and collect and analyze the data.	A. Identify the various applications of scientific investigations (explore new phenomena, check on previous results, to test how well a hypothesis predicts, and to compare hypotheses) ⁽¹⁰⁾ B. Identify a testable question ⁽¹⁰⁾ C. Identify, from a set of questions, which question can be analyzed using a given set of sample data ⁽¹⁰⁾ D. Distinguish the independent and dependent variables by examining a scientific experiment/investigation ⁽¹⁰⁾ E. Write a testable question ⁽¹⁰⁾	testable question, independent variable, dependent variable
	F. Generate a valid hypothesis ⁽¹⁰⁾ G. Discriminate between a testable question and a hypothesis ⁽¹⁰⁾ H. Compare and contrast a list of hypotheses to determine if they are testable. I. Formulate a single or multiple hypotheses on any given experiment/investigation ⁽¹⁰⁾	hypothesis, experiment, investigation
	J. Use the independent and dependent variable to determine the materials, tools and techniques needed for an investigation ⁽¹⁰⁾ K. Formulate a sequential plan for an investigation ⁽¹⁰⁾ L. Identify the appropriate safety practices for an investigation ⁽¹⁰⁾ M. See benchmark 2 for data collection and analysis ELEs	
2. Select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations using appropriate mathematical analysis, error analysis, and graphical representation	A. Design data tables/setup and show an organizational strategy ⁽¹⁰⁾ B. Gather data (qualitative/quantitative) using appropriate measurements and methods ⁽¹⁰⁾ C. Apply the metric system by appropriate use of units and conversion factors ⁽¹⁰⁾	qualitative, quantitative, error analysis
	D. Apply appropriate mathematical analysis ⁽¹⁰⁾ E. Demonstrate graphing design (placement of dependent and independent variables/scaling/units/keys/titles/labels/graph types) ⁽¹⁰⁾ F. Identify possible sources of error ⁽¹⁰⁾ G. Identify and interpret trends in data using graphical analysis ⁽¹⁰⁾	

<p>3. Review evidence, communicate and defend results, and recognize that the results of a scientific investigation are always open to revision by further investigations. (e.g. through graphical representation or charts)</p>	<p>A. Identify techniques used to review evidence (summary, graphical organizers, models)⁽¹⁰⁾ B. Identify relationship between data trends and scientific concepts⁽¹⁰⁾ C. Determine appropriate communication techniques to communicate and defend results⁽¹⁰⁾ D. Communicate interpretations and conclusions using scientific concepts, mathematical relationships and technology⁽¹⁰⁾ E. Justify and defend conclusions based on evidence⁽¹⁰⁾ F. Explain why conclusions based on evidence are open to revision upon further investigation⁽¹⁰⁾</p>	<p>evidence</p>
<p>4. Analyze observations and explain with scientific understanding to develop a plausible model (e.g., atom, expanding universe)</p>	<p>A. Identify that various types of models (physical, mental, graphical, and mathematical) can be used to illustrate scientific concepts⁽¹⁰⁾ B. Explain why models are used to express scientific concepts⁽¹⁰⁾ C. Use models to investigate and represent scientific concepts⁽¹⁰⁾ D. Generate a model based on evidence gathered in an investigation⁽¹⁰⁾</p>	<p>model</p>
<p>5. Identify strengths, weaknesses, and assess the validity of the experimental design of an investigation through analysis and evaluation</p>	<p>A. Identify and assess the characteristics of a valid investigation⁽¹⁰⁾ B. Identify experimental error and communicate suggestions for modified or redesigned experiment⁽¹⁰⁾ C. Compare and contrast the validity of various experiments designed to measure the same outcome⁽¹⁰⁾</p>	<p>valid, experimental design</p>
<p>6. Explain how observations of nature form an essential base of knowledge among the Montana American Indians</p>	<p>A. Explain how observations of nature form and essential base of knowledge⁽¹⁰⁾ B. Describe an example of Montana American Indians using observation to develop cultural knowledge and practices⁽¹⁰⁾</p>	

Content Standard 2—Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.

Benchmark Upon Graduation	Essential Learning Expectation	Essential Vocabulary
<p>1. Describe the structure of atoms, including knowledge of (a) subatomic particles and their relative masses, charges, and locations within the atom, (b) the electrical and nuclear forces that hold the atom together, (c) fission and fusion, and (d) radioactive decay</p>	<p>A. Compare and contrast subatomic particles in relation to their relative masses, charges and location ⁽¹⁰⁾ B. Compare and contrast the number of subatomic particles in different elements and their isotopes ⁽¹⁰⁾</p>	<p>electron, proton, neutron, element, isotope, atomic mass, atomic number</p>
	<p>C. Recognize there is an electrical force of attraction/repulsion ⁽¹⁰⁾ D. Recognize there are strong nuclear forces that keeps the nucleus intact</p>	<p>electrical force, nuclear force</p>
	<p>E. Explain radioactive decay and provide examples ⁽¹⁰⁾ F. Explain nuclear fission and fusion and provide examples</p>	
<p>2. Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of (a) valence electrons on the chemical properties of elements and the resulting periodic trends in these properties, (b) chemical bonding,(c) molecular geometry and intermolecular forces, (d) kinetic molecular theory on phases of matter, and (e) carbon-carbon atom bonding on biomolecules</p>	<p>A. Recognize the Periodic Table is organized based on a series of repeating patterns ⁽¹⁰⁾ B. Utilize the periodic Table to determine the number of valence electrons of an element⁽¹⁰⁾ C. Utilize the Periodic Table to predict, from neutral atoms, the formation of ions with the number of electrons gained or lost ⁽¹⁰⁾ D. Recognize that chemical properties of electrons change with the number of valence electrons</p>	<p>valence electrons, ions</p>
	<p>E. Compare and contrast ionic, covalent and hydrogen bonds ⁽¹⁰⁾ F. Describe the significance of electrons in interactions between atoms and why they sometimes form bonds G. Explain how the chemical bonding of a molecule affects its macroscopic (physical) properties</p>	<p>chemical bond</p>
	<p>H. Explain how the molecular geometry of a molecule (e.g. water) affects polarity and cohesive/adhesive properties ⁽¹⁰⁾</p>	<p>polarity, cohesion, adhesion, molecular geometry</p>
	<p>I. Describe the physical properties of each state of matter: solid, liquid, and gas ⁽¹⁰⁾ J. Describe, using the kinetic molecular theory, the behavior of particles in each state of matter: solid, liquid, and gas K. Use a phase change diagram to describe changes energy and state</p>	<p>melting, freezing, sublimation, deposition, condensation, vaporization (boiling and evaporation)</p>

	<p>L. Explain how electrons are shared in single, double, triple bonds</p> <p>M. Explain how the variety of carbon-carbon bonds leads to the diversity of biomolecules</p>	<p>single, double, triple bonds, carbon-carbon bonds, biomolecules</p>
<p>3. Describe the major features associated with chemical reactions, including (a) giving examples of reactions important to industry and living organisms, (b) energy changes associated with chemical changes, (c) classes of chemical reactions, (d) rates of reactions, and (e) the role of catalysts</p>	<p>A. Provide evidence that a chemical change has occurred⁽¹⁰⁾B. Illustrate a chemical reaction using chemical formulas⁽¹⁰⁾C. Describe properties of chemical reaction classes (combustion, decomposition, synthesis, single-replacement, and double-replacement, etc.) D. Describe the energy changes in exothermic and endothermic reactions.</p>	<p>reactants, products, exothermic, endothermic, combustion, synthesis, single-replacement, double-replacement, oxidation/reduction, acid/base</p>
	<p>E. Describe factors that effect the rate of reactions⁽¹⁰⁾</p>	<p>catalyst</p>
	<p>F. Give examples of chemical reactions important to industry and living organisms⁽¹⁰⁾</p>	
<p>4. Identify, measure, calculate, and analyze relationships associated with matter and energy transfer or transformations, and the associated conservation of mass</p>	<p>A. Describe the law of conservation of mass⁽¹⁰⁾ B. Measure and/or calculate energy transfer for a sample set of data or experiment C. Analyze the relationship between energy transfer and physical properties of matter D. Explain the unique circumstances allowing mass to transform into energy, or energy into mass</p>	<p>law of conservation of mass</p>
<p>5. Explain the interactions between motions and forces, including (a) the laws of motion and (b) an understanding of the gravitational and electromagnetic forces</p>	<p>A. Explain, given $F = ma$, the relationship between force and acceleration in uniform motion⁽¹⁰⁾B. Solve simple kinematics problems using the kinematics equations for uniform acceleration: $v_{avg} = d/t$, $a = \Delta v/t$, and $d = 1/2 at^2$⁽¹⁰⁾C. Distinguish between a scalar quantity and a vector quantity.</p>	<p>scalar quantity, vector quantity, force, mass, acceleration, velocity</p>
	<p>D. List examples of different types of forces⁽¹⁰⁾ E. Describe the role of friction in motion⁽¹⁰⁾ F. Describe situations that illustrate Newton's three laws of motion⁽¹⁰⁾ G. Explain the relationship between mass and distance in relation to gravitational force⁽¹⁰⁾ H. Describe the relationship between magnetism and electricity and the resulting electromagnetic force</p>	<p>inertia, gravitational force, electromagnetic force</p>

<p>6. Explain how energy is stored, transferred, and transformed, including (a) the conservation of energy, (b) kinetic and potential energy and energy contained by a field, (c) heat energy and atomic and molecular motion, and (d) energy tends to change from concentrated to diffuse</p>	<p>A. Describe the differences between kinetic energy and potential energy ⁽¹⁰⁾ B. Explain the relationship between kinetic energy and potential energy in a system ⁽¹⁰⁾ C. Discuss the conservation of energy ⁽¹⁰⁾</p>	<p>energy, potential energy, kinetic energy</p>
<p>7. Describe how energy and matter interact, including (a) waves, (b) the electromagnetic spectrum, (c) quantization of energy, and (d) insulators and conductors</p>	<p>D. Recognize heat as a form of energy transfer ⁽¹⁰⁾ E. F. Explain the relationship between temperature, heat and thermal energy ⁽¹⁰⁾ F. Define the kinetic molecular theory and its relationship to heat (thermal energy transfer). G. Relate how energy tends to change from concentrated to diffuse states.</p>	<p>joules, calories, temperature, heat</p>
<p>7. Describe how energy and matter interact, including (a) waves, (b) the electromagnetic spectrum, (c) quantization of energy, and (d) insulators and conductors</p>	<p>A. Identify and illustrate different types of waves ⁽¹⁰⁾ B. Compare and contrast the similarities and differences between longitudinal and transverse mechanical waves ⁽¹⁰⁾ C. Explain how waves interact with media. ⁽¹⁰⁾</p>	<p>amplitude, wavelength, frequency, period</p>
<p>7. Describe how energy and matter interact, including (a) waves, (b) the electromagnetic spectrum, (c) quantization of energy, and (d) insulators and conductors</p>	<p>D. Compare the various electromagnetic waves (gamma rays, x-rays, ultraviolet, visible, infrared, microwave, and radio waves) in terms of energy and wavelength ⁽¹⁰⁾ E. Identify practical uses of various electromagnetic waves ⁽¹⁰⁾ F. Compare the visible light colors in terms of energy and wavelength G. Recognize that atoms and molecules can gain or lose energy only in particular discrete amounts. H. Recognize that every substance emits and absorbs certain wavelengths I. Explain how electromagnetic waves are superposed, bent, reflected, refracted, and absorbed.</p>	<p>electromagnetic spectrum, photon, reflection, refraction</p>
<p>7. Describe how energy and matter interact, including (a) waves, (b) the electromagnetic spectrum, (c) quantization of energy, and (d) insulators and conductors</p>	<p>J. Describe the difference between an electrical conductor and an electrical insulator ⁽¹⁰⁾ K. Describe the difference between a heat conductor and a heat insulator ⁽¹⁰⁾ L. Explain how electricity is involved in the transfer of energy ⁽¹⁰⁾</p>	<p>current, resistance, voltage, power, conductor, insulator</p>

Content Standard 3—Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, process and diversity of life, and how living organisms interact with each other and their environment.

Benchmark Upon Graduation	Essential Learning Expectation	Essential Vocabulary
<p>1. Investigate and use appropriate technology to demonstrate that cells have common features including differences that determine function and that they are composed of common building blocks (e.g., proteins, carbohydrates, nucleic acids, lipids)</p>	<p>A. Demonstrate appropriate microscopic techniques ⁽¹⁰⁾ B. Recognize that a variety of microscopes exist ⁽¹⁰⁾</p>	<p>compound light microscope, micrometer, field of view, depth of field</p>
	<p>C. Identify common features among all cells ⁽¹⁰⁾ D. Compare and contrast prokaryotes and eukaryotes ⁽¹⁰⁾</p>	<p>cell membrane, ribosome, genetic material, prokaryote, eukaryote</p>
	<p>E. Compare and contrast the structure, function and relationship of key cellular components ⁽¹⁰⁾ F. Identify key differences between plant and animal cells ⁽¹⁰⁾</p>	
	<p>G. Explain how concentration of substances affects diffusion and osmosis ⁽¹⁰⁾</p>	<p>diffusion, osmosis, dynamic equilibrium</p>
	<p>H. Explain the role of key biologically important macromolecules ⁽¹⁰⁾</p>	<p>organic molecule, proteins, carbohydrates, lipids, nucleic acids</p>
<p>2. Describe and explain the complex processes involved in energy use in cell maintenance, growth, repair and development</p>	<p>A. Explain and give examples of the importance of a constant internal environment ⁽¹⁰⁾ B. Identify processes that maintain homeostasis ⁽¹⁰⁾</p>	<p>homeostasis</p>
	<p>C. Classify, compare and contrast various organisms as a heterotroph or autotroph ⁽¹⁰⁾</p>	<p>heterotroph, autotroph</p>
	<p>D. Describe the role of ATP in the body ⁽¹⁰⁾ E. Identify the key components involved in the chemical reaction of cellular respiration ⁽¹⁰⁾ F. Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP) ⁽¹⁰⁾ G. Compare and contrast aerobic and anaerobic respiration ⁽¹⁰⁾</p>	<p>cellular respiration, ATP, ADP, aerobic, anaerobic, mitochondria</p>
	<p>H. Summarize the conversion of light energy to chemical energy by photosynthetic organisms ⁽¹⁰⁾</p>	<p>glucose, chloroplast, photosynthesis</p>

	I. Explain the relationship between the products and reactants of photosynthesis and cellular respiration ⁽¹⁰⁾	glucose, carbon dioxide, oxygen, water, ATP
	J. Explain the purpose of the cell cycle ⁽¹⁰⁾ K. Describe the stages of mitosis in plants and animals ⁽¹⁰⁾	chromosome, interphase, mitosis, prophase, metaphase, anaphase, telophase
	L. Identify the major events that occur in meiosis ⁽¹⁰⁾ M. Differentiate between haploid and diploid chromosome numbers ⁽¹⁰⁾ N. Compare and contrast the process and purpose of mitosis and meiosis ⁽¹⁰⁾	meiosis I and II, gamete, diploid, haploid, homologous pairs, zygote
3. Model the structure of DNA and protein synthesis, discuss the molecular basis of heredity, and explain how it contributes to the diversity of life	A. Explain the functions of DNA and RNA ⁽¹⁰⁾ B. Compare and contrast the structure of DNA and RNA ⁽¹⁰⁾ C. Identify complementary base pairs ⁽¹⁰⁾	RNA, DNA, nucleotide, adenine, cytosine, guanine, thymine, uracil, helical structure
	D. Explain the purpose and process of DNA replication ⁽¹⁰⁾ E. Explain the purpose and process of transcription and translation ⁽¹⁰⁾	replication, transcription, translation, ribosome, DNA, protein synthesis, gene
	F. Explain the relationship between DNA and heredity (Central Dogma) ⁽¹⁰⁾ G. Summarize the law of segregation and the law of independent assortment ⁽¹⁰⁾ H. Summarize how the process of meiosis produces genetic recombination ⁽¹⁰⁾	heredity, Law of Independent Assortment, Law of Segregation, crossing over
	I. Explain the difference between dominant and recessive alleles ⁽¹⁰⁾ J. Distinguish between genotype and phenotype ⁽¹⁰⁾ K. Use the law of probability and Punnett squares to predict genotypic and phenotypic ratios ⁽¹⁰⁾	Punnett square, monohybrid cross, dominant allele, recessive allele, homozygous, heterozygous, phenotype, genotype

	<p>L. Identify and explain the different ways in which alleles interact to determine the expression of traits ⁽¹⁰⁾</p> <p>M. Distinguish between sex chromosomes and autosomes ⁽¹⁰⁾</p> <p>N. Explain how sex linked inheritance influences some genetic traits ⁽¹⁰⁾</p>	<p>complete dominance, incomplete dominance, codominance, autosomal, sex chromosome, sex-linked inheritance, pedigree</p>
<p>4. Predict and model the interaction of biotic and abiotic factors that affect populations through natural selection, and explain how this contributes to the evolution of species over time</p>	<p>A. Differentiate between biotic and abiotic factors in ecosystems ⁽¹⁰⁾</p> <p>B. Discuss how abiotic and biotic factors influence biomes ⁽¹⁰⁾</p> <p>C. Explain biogeochemical cycles ⁽¹⁰⁾</p> <p>D. Recognize that the sun is the ultimate source of energy in MOST ecosystems ⁽¹⁰⁾</p> <p>E. Explain the difference between a food chain and food web. ⁽¹⁰⁾</p> <p>F. Explain trophic levels and pyramids in terms of energy transfer, biomass and number of individuals ⁽¹⁰⁾</p> <p>G. Identify and predict density dependent and density independent factors that impact a population ⁽¹⁰⁾</p> <p>H. Describe predator-prey dynamics ⁽¹⁰⁾</p> <p>I. Compare and contrast the symbiotic relationships that exist between species ⁽¹⁰⁾</p> <p>J. Describe how communities progress through a series of changes (succession) ⁽¹⁰⁾</p> <p>K. Recognize that evolution involves a change in allele frequencies in a population across successive generations ⁽¹⁰⁾</p> <p>L. Model and explain how natural selection can change a population ⁽¹⁰⁾</p> <p>M. Describe the major factors that influence speciation ⁽¹⁰⁾</p> <p>N. Explain the theory of evolution by natural selection ⁽¹⁰⁾</p> <p>O. Explain the multiple lines of supporting scientific evidence of biological evolution ⁽¹⁰⁾</p>	<p>mutation, virus, nondisjunction</p> <p>ecology, biotic, abiotic, ecosystem, biome, biogeochemical cycle</p> <p>food chain, food web, trophic level, energy pyramid, biomass pyramid, pyramid of numbers</p> <p>community, limiting factors, competition, population, niche, carrying capacity</p> <p>symbiosis, commensalism, parasitism, mutualism, succession</p> <p>natural selection, biological evolution, speciation</p>
<p>5. Generate and apply biological classification schemes to infer and discuss the degree of divergence between ecosystems</p>	<p>A. List and explain the characteristics of the three domains ⁽¹⁰⁾</p>	<p>domain, bacteria, archaea, eukarya</p>

	<p>B. Compare and contrast the key characteristics of each kingdom⁽¹⁰⁾ C. Explain how similarities and differences in the key characteristics of each kingdom indicate the degree of divergence between them⁽¹⁰⁾</p>	<p>kingdom, eubacteria, archaeobacteria, protista, fungi, plantae, animalia,</p>
	<p>D. Explain the classification of living organisms from the domain to species level⁽¹⁰⁾</p>	<p>classification, taxonomy, species</p>
	<p>E. Explain the importance of binomial nomenclature⁽¹⁰⁾ F. Generate and use a dichotomous key⁽¹⁰⁾</p>	<p>binomial nomenclature, dichotomous key</p>
	<p>G. Differentiate between vascular and nonvascular plants H. Explain the difference between angiosperms and gymnosperms</p>	<p>gymnosperm, angiosperm , vascular tissue, xylem, phloem</p>
	<p>I. Compare and contrast major animal phyla J. Compare and contrast body systems between major animal phyla</p>	<p>invertebrate, vertebrate, body system</p>

Content Standard 4—Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth’s systems and other objects in space.

Benchmark Upon Graduation	Essential Learning Expectation	Essential Vocabulary
<p>1. Understand the theory of plate tectonics and how it explains the interrelationship between earthquakes, volcanoes, and sea floor spreading</p>	<p>A. Describe the independent movement of Earth's crustal plates ⁽¹⁰⁾ B. Describe the observations and evidence that led to the formation of the theory of plate tectonics ⁽¹⁰⁾ C. Model the interaction of heat-driven convection and the movement of the plates ⁽¹⁰⁾ D. Identify the types of plate boundaries ⁽¹⁰⁾ E. Model ways plates interact at plate boundaries ⁽¹⁰⁾ F. Contrast the different types of plate boundaries and the products of these plate interactions ⁽¹⁰⁾</p>	<p>continental drift, plate tectonics, subduction, convergent, divergent, transform, lithosphere, asthenosphere, sea floor spreading, convection</p>
	<p>G. Identify the causes of earthquakes ⁽¹⁰⁾ H. Explain volcanic processes ⁽¹⁰⁾ I. Relate earthquakes and volcanic activity to plate boundaries and other geologic settings ⁽¹⁰⁾</p>	<p>magma, viscosity, lava, seismic waves, stress, strain, fault</p>
<p>2. Identify and classify rocks and minerals based on physical and chemical properties and the utilization by humans (e.g., natural resources, building materials)</p>	<p>A. Define mineral ⁽¹⁰⁾ B. Describe the physical and chemical properties and equipment used to identify minerals ⁽¹⁰⁾ C. Classify minerals using observable properties, tools, and reference materials ⁽¹⁰⁾ D. Describe environments and processes that lead to the formation of various minerals ⁽¹⁰⁾</p>	
	<p>E. Define rock ⁽¹⁰⁾ F. Summarize the rock cycle and its process ⁽¹⁰⁾ G. Describe the physical and chemical properties and equipment used to identify rocks ⁽¹⁰⁾ H. Classify rocks into rock types using observable properties, tools, and reference materials ⁽¹⁰⁾</p>	<p>deposition, erosion, weathering, igneous, sedimentary, metamorphic</p>
	<p>I. Identify various mineral and rock resources, their value, their uses, and their importance to humans ⁽¹⁰⁾ J. Explain how various mineral and rock resources are obtained ⁽¹⁰⁾</p>	<p>ore, vein, mining</p>

<p>3. Explain scientific theories about how fossils are used as evidence of changes over time</p>	<p>A. Explain the concept of scientific theory ⁽¹⁰⁾ B. Explain how various fossils show evidence of past life ⁽¹⁰⁾ C. Model the scale of geologic time ⁽¹⁰⁾ D. Interpret rock layers using principles of relative and absolute age dating ⁽¹⁰⁾ E. Give examples of major biologic, climactic, and geologic changes in Earth's history and provide supporting rock and fossil evidence of these changes ⁽¹⁰⁾ F. Relate major changes to the divisions of geologic time ⁽¹⁰⁾</p>	<p>index fossils, fossil record, extinct, geologic time</p>
<p>4. Collect and analyze local and regional weather data to make inferences and predictions about weather patterns; explain factors influencing global weather patterns and climate; and describe the impact on earth of fluctuations in weather and climate (e.g., drought, surface and ground water, glacial instability)</p>	<p>A. Identify measurable weather-related variables commonly used in forecasting ⁽¹⁰⁾ B. Identify the instruments and technology used to collect weather data ⁽¹⁰⁾ C. Collect weather data and observe weather conditions ⁽¹⁰⁾</p>	<p>temperature, relative humidity, barometric pressure, dew point, wind, precipitation</p>
	<p>D. Summarize how cloud formation and precipitation are affected by changes in atmospheric conditions ⁽¹⁰⁾ E. Discuss the role of energy transfer in the atmosphere and its effects on weather changes ⁽¹⁰⁾ F. Describe the impacts of fronts, air masses, and pressure systems on local and regional weather ⁽¹⁰⁾ G. Analyze the effect of local geographic factors on weather ⁽¹⁰⁾ H. Use data to infer and predict weather patterns ⁽¹⁰⁾</p>	<p>air mass, wind , Jet Stream, front, pressure system, weather, convection, water cycle</p>
	<p>I. Identify the geographic factors that influence climate ⁽¹⁰⁾ J. Determine which geographic factors result in specific local and regional climate ⁽¹⁰⁾ K. Examine the importance of the structure and composition of the atmosphere as influencing factors on Earth's weather and climate ⁽¹⁰⁾ L. Describe how global wind patterns influence weather and climate ⁽¹⁰⁾ M. Explain the relationship between ocean currents, weather, and climate ⁽¹⁰⁾</p>	<p>coriolis effect, wind belts, ocean currents, latitude, elevation, climate, heat transfer, El Nino/La Nina, ozone layer</p>
	<p>N. Compare the conditions that generate various types of severe weather ⁽¹⁰⁾ O. Discuss the impacts of various types of severe weather ⁽¹⁰⁾</p>	<p>tornado, hurricane</p>

<p>5. Explain the impact of terrestrial, solar, oceanic, and atmosphere conditions on global climatic patterns</p>	<p>A. Identify examples of natural phenomena (terrestrial, atmospheric, oceanic, and astronomical) that impact global climate patterns ⁽¹⁰⁾ B. Explain the short and long term-effects of these natural phenomena on global climate patterns ⁽¹⁰⁾ C. Examine the geologic, astronomical, and human factors that contribute to global climate change ⁽¹⁰⁾ E. Describe socioeconomic and environmental implications of climate change⁽¹⁰⁾</p>	<p>climate,climate zones, climate change</p>
<p>6. Describe the origin, location, and evolution of stars and their planetary systems in respect to the solar system, the Milky Way, the local galactic group, and the universe</p>	<p>A. Describe the Big Bang Theory ⁽¹⁰⁾ B. Summarize evidence supporting the Big Bang Theory ⁽¹⁰⁾ C. Summarize the evolution of stars from birth to death ⁽¹⁰⁾ D. Identify the importance of fusion in a star's evolutionary cycle ⁽¹⁰⁾ E. Explain the relationship between stars and planets in a solar system ⁽¹⁰⁾</p>	<p>Big Bang Theory, nebula, nova, nuclear fusion</p>
	<p>F. Compare and contrast the characteristics of planets and stars ⁽¹⁰⁾ G. Explain current theories of the formation of a solar system ⁽¹⁰⁾ H. Explain how the formation and evolution of a solar system influences the composition and placement of objects within it ⁽¹⁰⁾</p>	<p>planet, star, solar system, accretion</p>
	<p>I. Define galaxy ⁽¹⁰⁾ J. Describe the shape of the Milky Way Galaxy and our place in it ⁽¹⁰⁾ K. Illustrate the hierachy of stars, planets, solar systems, galaxies and galactic group in the universe ⁽¹⁰⁾</p>	<p>galaxy</p>
<p>7. Relate how evidence from advanced technology applied to scientific investigations (e.g., large telescopes and spaceborne observatories), has dramatically impacted our understanding of the origin, size, and evolution of the universe.</p>	<p>A. Discuss how various types of technology are used to study space ⁽¹⁰⁾ B. Compare the advantages and disadvantages of various tools used to study space ⁽¹⁰⁾ C. Assess how our understanding of the universe changes as technology advances⁽¹⁰⁾</p>	

Content Standard 5—Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities cultures and societies.

Benchmark Upon Graduation	Essential Learning Expectation (Essential Vocabulary
<p>1. Predict how key factors (e.g., technology, competitiveness, and world events) affect the development and acceptance of scientific thought</p>	<p>A. Identify an example of scientific thought that has been or is affected by key factors such as technology, competitiveness (industrial, political, religious, etc.), world events, etc⁽¹⁰⁾ B. Analyze how the development and/or acceptance of this example was influenced by various factors⁽¹⁰⁾ C. Justify the analysis using cited peer-reviewed sources⁽¹⁰⁾ D. Predict and discuss how key factors could impact the development and acceptance of scientific thought⁽¹⁰⁾</p>	<p>peer-review</p>
<p>2. Give examples of scientific innovation challenging commonly held perceptions</p>	<p>A. Identify and discuss examples of commonly held perceptions or ideas being challenged by science (i.e. heliocentrism, flat earth, spontaneous generation)⁽¹⁰⁾</p>	
<p>3. Evaluate the ongoing, collaborative scientific process by gathering andcritiquing information</p>	<p>A. Identify and discuss the practices employed by scientists to collaborate, share, and critique scientific information⁽¹⁰⁾ B. Summarize the peer review process scientists use to critique and publish scientific research⁽¹⁰⁾ C. Compare and contrast the formal and informal methods by which scientists communicate with each other and the public⁽¹⁰⁾</p>	

<p>4. Analyze benefits, limitations, costs, consequences, and ethics involved in using scientific and technological innovations (e.g., biotechnology, environmental issues)</p>	<p>A. Identify various scientific and technological innovations ⁽¹⁰⁾ B. Compare and contrast the benefits and limitations of the various innovations ⁽¹⁰⁾ C. Analyze the cost and consequences of the innovations ⁽¹⁰⁾ D. Examine the ethical issues involved with the innovations ⁽¹⁰⁾</p>	
<p>5. Explain how the knowledge of science and technology applies to contemporary Montana American Indian communities (e.g., natural resources development, management and conservation)</p>	<p>A. Identify current practices by Montana American Indian tribes that are influenced by knowledge of science and technology ⁽¹⁰⁾ B. Explain how tribal sovereignty affects the use of science and technology within Montana American Indian communities ⁽¹⁰⁾</p>	

Content Standard 6—Students understand historical developments in science and technology.

Benchmark Upon Graduation	Essential Learning Expectation	Essential Vocabulary
<p>1. Analyze and illustrate the historical impact of scientific and technological advances, including Montana American Indian examples</p>	<p>A. Identify important historical events in science and technology ⁽¹⁰⁾ B. Analyze the positive and negative impacts of past, present, and future science and technological advances ⁽¹⁰⁾</p>	
<p>2. Trace developments that demonstrate scientific knowledge is subject to change as new evidence becomes available</p>	<p>A. Identify examples of scientific knowledge that have changed over time ⁽¹⁰⁾ B. Discuss the developments that contributed to the progression of the scientific knowledge ⁽¹⁰⁾ C. Analyze the impact of each development on the scientific knowledge ⁽¹⁰⁾ D. Summarize the process of the advancement of scientific knowledge ⁽¹⁰⁾</p>	
<p>3. Describe, explain, and analyze science as a human endeavor and an ongoing process</p>	<p>A. Discuss the purpose of science ⁽¹⁰⁾ B. Summarize the parameters that guide the process of science ⁽¹⁰⁾ C. Examine the role of human reasoning in the process of science ⁽¹⁰⁾ D. Analyze how human interpretation of evidence affects the process of science ⁽¹⁰⁾ E. Describe how science is an ongoing process ⁽¹⁰⁾</p>	