Montana Science Model Curriculum Guide by Grade Level: Grades 9-12 Life Science

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Resources	Three Dimensions		
	Disciplinary Core Ideas (DCI's)	Science and Engineering Practices (SEP's)	Crosscutting Concepts (CCC's)
Paul Anderson Videos: Details on each component of the standards Next Generation Science Standards (NGSS) at National Science Teachers Association (NSTA) Hub: Detailed explanations of the three dimensions, videos of what it looks like in the classroom, curriculum guidance, and classroom resources Evidence Statements: Observations of what students should know and be able to do when they perform the standard. Helpful for formative and summative assessments The Framework: The framework for Montana Science Standards and for the Next Generation Science Standards NGSS Storylines: These storylines explain questions that students should investigating and how by grade level; they paint the big picture of the big ideas STEM Teacher Tools: This site has every resource necessary to implement the new standards *Read more about the three dimensions in the NRC Framework online here (NGSS for States, By States)*	Disciplinary core ideas have the power to focus K–12 science curriculum, instruction and assessments on the most important aspects of science. To be considered core, the ideas should meet at least two of the following criteria and ideally all four: • Have broad importance across multiple sciences or engineering disciplines or be a key organizing concept of a single discipline; • Provide a key tool for understanding or investigating more complex ideas and solving problems; • Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge; • Be teachable and learnable over multiple grades at increasing levels of depth and sophistication. Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.	The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The National Research Council (NRC) uses the term practices instead of a term like "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Part of the NRC's intent is to better explain and extend what is meant by "inquiry" in science and the range of cognitive, social, and physical practices that it requires. Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design. Strengthening the engineering aspects of the Next Generation Science Standards will clarify for students the relevance of science, technology, engineering and mathematics (the four STEM fields) to everyday life. (NGSS for States, By States).	Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. They include: Patterns, similarity, and diversity; Cause and effect; Scale, proportion and quantity; Systems and system models; Energy and matter; Structure and function; Stability and change. The Framework emphasizes that these concepts need to be made explicit for students because they provide an organizational schema for interrelating knowledge from various science fields into a coherent and scientifically-based view of the world. (NGSS for States, By States)

Grade 9-12 Life Science

Montana Standard *Students must know and be able to:*	Disciplinary Core Ideas (DCI's)	Science and Engineering Practices (SEP's)	Crosscutting Concepts (CCC's)
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-LS1-1 NGSS Identifier	LS1.A	construct explanations and design solutions	structure and function
develop and use a model to illustrate the organizational structure of interacting systems that provide specific functions within multicellular organisms. HS-LS1-2 NGSS Identifier	LS1.A	developing and using models	system and system models
plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. HS-LS1-3 NGSS Identifier	LS1.A	planning and carrying out investigations	stability and change
use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. HS-LS1-5 NGSS Identifier	LS1.C	developing and using models	energy and matter: flows, cycles and conservation
construct an explanation based on evidence from multiple sources for how carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur may combine with other elements to form organic macromolecules with different structures and functions. HS-LS1-6 NGSS Identifier	LS1.C	construct explanations and design solutions	energy and matter: flows, cycles and conservation
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-LS1-7 NGSS Identifier	LS1.C	developing and using models	energy and matter: flows, cycles and conservation

construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-3 NGSS Identifier	LS2.B	construct explanations and design solutions	energy and matter: flows, cycles and conservation
use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-4 NGSS Identifier	LS2.B	using mathematics & computational thinking	energy and matter: flows, cycles and conservation
use mathematical or computational representations to support arguments about environmental factors that affect carrying capacity, biodiversity, and populations in ecosystems. HS-LS2-1 NGSS Identifier	LS2.A	using mathematics & computational thinking stability and change	scale proportion and quantity
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-LS2-6 NGSS Identifier	LS2.C	engaging in argument from evidence	structure and function
design, evaluate, and refine a solution for reducing the direct and indirect impacts of human activities on the environment and biodiversity and analyze scientific concepts used by American Indians to maintain healthy relationships with environmental resources. HS-LS2-7 NGSS Identifier	LS2.C	construct explanations and design solutions	structure and function
construct an explanation using evidence from multiple sources to describe the role of cellular division and differentiation in producing and maintaining complex organisms. HS-LS1-4 NGSS Identifier	LS1.B	developing and using models	system and system models

make and defend a claim based on evidence from multiple sources that inheritable genetic variations may result from: 1. new genetic combinations through meiosis 2. viable errors occurring during replication 3. mutations caused byenvironmental factors HS-LS3-2 NGSS Identifier	LS3.B	engaging in argument from evidence	cause and effect
apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. HS-LS3-3 NGSS Identifier	LS3.B	analyze and interpret data	scale proportion and quantity
evaluate and communicate scientific information about how common ancestry and biological evolution are supported by multiple lines of empirical evidence HS-LS4-1 NGSS Identifier	LS4.A	obtaining, evaluating, and communicating information	patterns
construct an explanation based on evidence that the process of evolution by natural selection primarily results from four factors: HS-LS4-2 NGSS Identifier	LS4.B LS4.C	construct explanations and design solutions	cause and effect