Helena Public Schools
K – 12
Science Curriculum

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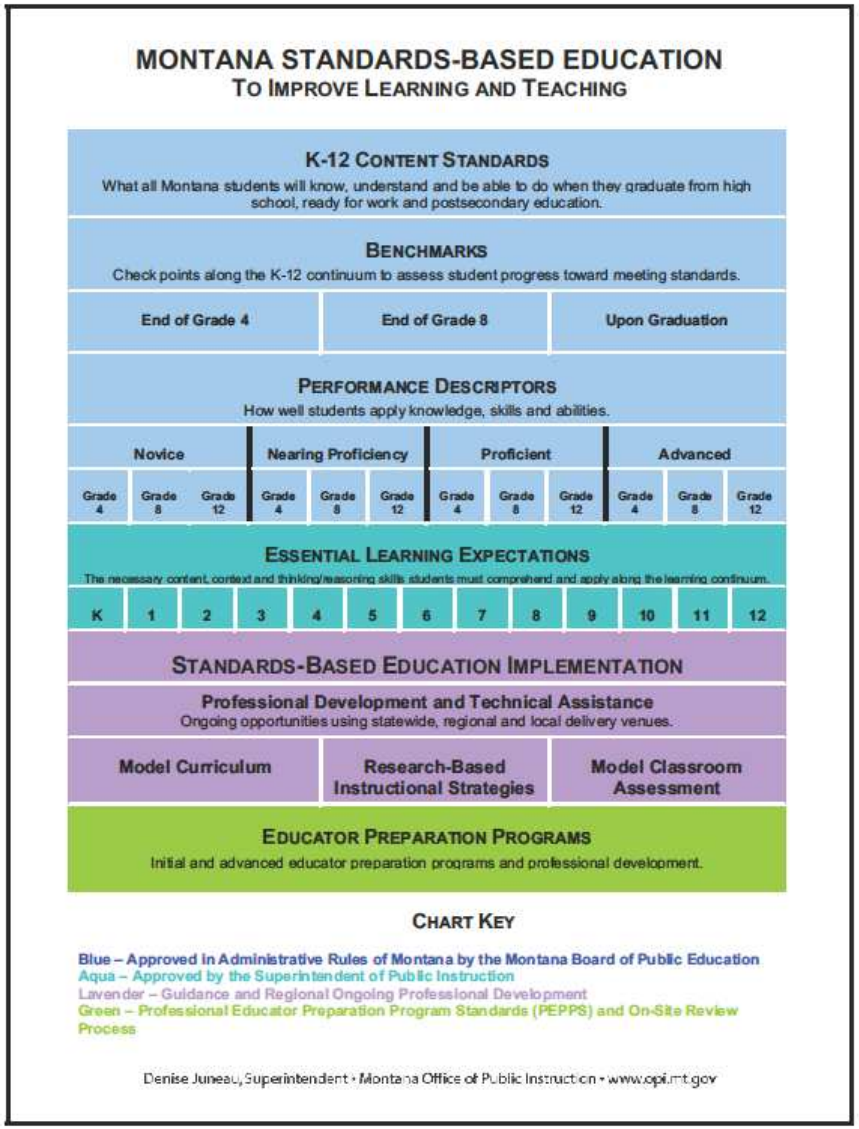
MONTANA STANDARDS-BASED EDUCATION
TO IMPROVE LEARNING AND TEACHING
K-12 CONTENT STANDARDS
What all Montana students will know, understand and be able to do when they graduate from high school, ready for work and postsecondary education.
BENCHMARKS
Check points along the K-12 continuum to assess student progress toward meeting standards.
End of Grade 4
End of Grade 8
Upon Graduation
PERFORMANCE DESCRIPTORS
How well students apply knowledge, skills and abilities.
Novice
Nearing Proficiency
Proficient
Advanced
Grade 4
Grade 8
Grade 12
ESSENTIAL LEARNING EXPECTATIONS
The necessary content, context and thinking/reasoning skills students must comprehend and apply along the learning continuum.
K
1
2
3
4
5
6
7
8
9
10
11
12
STANDARDS-BASED EDUCATION IMPLEMENTATION
Professional Development and Technical Assistance
Ongoing opportunities using statewide, regional and local delivery venues.
Model Curriculum
Research-Based Instructional Strategies
Model Classroom Assessment
EDUCATOR PREPARATION PROGRAMS
Initial and advanced educator preparation programs and professional development.
CHART KEY
Blue – Approved in Administrative Rules of Montana by the Montana Board of Public Education
Aqua – Approved by the Superintendent of Public Instruction
Lavender – Guidance and Regional Ongoing Professional Development
Green – Professional Educator Preparation Program Standards (PEPPS) and On-Site Review Process
Denise Juneau, Superintendent • Montana Office of Public Instruction • www.opi.mt.gov

What is Inquiry

Good science education requires both scientific concepts and developing scientific thinking skills. Inquiry is an approach to learning/teaching that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries, and testing those discoveries in the search for new understanding. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science [1, 4].

All approaches to inquiry-based science are not alike—each approach has distinguishable characteristics. Different approaches to inquiry science support different objectives for learning. Effective science teaching requires using a variety of approaches and matching the appropriate approach with specific content, process, and attitudinal learning goals [1].

Inquiry lessons can range from structured, guided inquiry to open inquiry. These different approaches vary in the level of learner control or teacher control. Using the "Essential features of Classroom Inquiry "[2, 4] as a template, lessons can be designed with the level of student control appropriate for the desired objective.

Inquiry Misconceptions Addressed

- Inquiry is not an either/or proposition
- Within inquiry, educators match teaching approach to learning objectives.
- Not all hands-on is inquiry; not all inquiry is hands-on
- Inquiry involves students:
  - raising their own questions
  - planning, designing, and conducting their own investigations
- There is no dichotomy between process and content
  Inquiry processes and the development of concepts work in concert
- Inquiry teaching is not chaotic-it is carefully choreographed
- Inquiry teaching requires a high level or organization, planning, and structure both by teacher and student

Two Frameworks for Inquiry
Frame work I
5 E's –based on the BSCS model

	Teachers Role	Students Role
Engage	• Generates interest and curiosity • Raises Questions • Assesses Current knowledge, including misconceptions	• Asks questions such as, "Why did this happen? What do I already know about this? What can I find out about this?' • Shows interesting the topic
Explore	• Provides time for students to work together • Observes and listens to students as they interact • Asks probing questions to redirect students' investigations when necessary	• Thinks creatively, but within the limits of the activity • Tests predictions and hypotheses • Records observations and ideas
Explain	• Asks for evidence and clarification from student • Uses students' previous experiences as a basis for explaining concepts • Encourages students to explain concepts and definitions in their own words, then provides scientific explanations and vocabulary	• Explains possible solutions to others • Listens critically to explanations of other students and the teacher • Uses recorded observations in explanations
Elaborate	• Expects students to apply scientific concepts, skills, and vocabulary to new situations • Reminds students of alternative explanations • Refers students to alternative explanations	• Applies new labels, definitions, explanations, and skills in new but similar situations • Uses previous information to ask questions, propose solutions, make decisions, design experiments
Evaluate	• Observes and assesses students as they apply new concepts and skills • Allows students to assess their own learning and group process skills • Asks open-ended questions	• Demonstrates an understanding of the concept or skill • Answers open-ended questions by using observations, evidence, and previously accepted explanations • Evaluates his/her own progress and knowledge

Frame work II - Based on The Exploratorium's Fundamentals of Inquiry

Inquiry Structure for Learning Science Content

Inquiry Starters	Focused Investigation	Sharing Understanding
Learners explore materials, make observations, and raise questions related to content goals	Learners plan and carry out investigations based on their questions	Learners share investigation findings with each other to further understanding of scientific concepts.

Inquiry Starter
In the Inquiry Starter, the teacher plays a limited but important role-encouraging learners to explore materials freely and to raise and record all of their questions.

Focused Investigation
As students transition from Inquiry Starters to the first part of focused, the teacher helps them identify questions they can investigate and those they won't be able to pursue. Some questions cannot be pursued because they do not fit with the topic under study; others would require more time, material, and resources than are available.

During this initial part of the Focused Investigation, the teacher begins by checking in with students doing a quick assessment based on early investigation plans and steps the groups are taking. Teacher assistance may come in the form of asking questions, making suggestions about materials or the design of experiments, or simply providing encouragement.

Sharing Understanding
In the Sharing Understanding phase of the inquiry, learners explain what they did and present their findings to the entire group.

During the presentations, the teacher asks questions to elicit and clarify ideas, and to make connections between various groups' presentations. Where appropriate, the teacher adds information or ideas to illuminate and tie together the groups' findings.

After the presentations, the teacher builds on the foundation of knowledge and experience communicated by the investigation groups with a ***SYNTHESIS*** that relates the presentations to each other and to the conceptual goals of the inquiry.

Process Skills: Definitions and Examples

The science process skills are the tools that students use to investigate the world around them and to construct science concepts, so it's essential for teachers to have a good understanding of these skills. However, identifying and defining the process skills is not always a simple task.

The first problem is that the skills aren't practiced discretely. When you look at a real-life situation, you're likely to find several related skills being used more or less at the same time. Consider, for example, trying to explain why water drops appear on the outside of a can filled with ice: You're observing the phenomenon, you're interpreting what your observation means, and you're proposing a hypothesis, or explanation. It can be challenging to tease out separate skills because to a certain extent the boundaries are artificial. But it's necessary to be able to distinguish individual skills in order to work effectively with students.

The second problem concerns how broadly or narrowly the skills should be defined. The skill of classifying, for example, while often found listed as a separate skill, can also be viewed as a subskill of observing. Because it can be quite cumbersome to work with a long list of narrowly defined skills, this document presents seven broadly defined skills and indicates subskills where appropriate.

The definitions and examples given below are based on a number of sources and represent commonly accepted uses of the process skill terms.

Observing

Using the senses and appropriate tools to gather information about an object, event, or phenomenon.

SUBSKILLS include collecting evidence, identifying similarities and differences, classifying, measuring, and identifying relevant observations.

EXAMPLE: Listing the similarities and differences of a cube of ice and a ball of ice.

Questioning

Raising questions about an object, event, or phenomenon.

SUBSKILLS include recognizing and asking investigable questions; suggesting how answers to questions can be found; and turning a noninvestigable question into a question that can be acted upon.

EXAMPLE: Asking "Will ice melt faster with or without salt sprinkled on it?"

Process Skills: Definitions and Examples

Hypothesizing

Giving a tentative explanation, based on experience, of a phenomenon, event, or the nature of an object. A hypothesis is testable. A hypothesis is *not* the same thing as a prediction, which is the expected outcome of a specific event. However, a hypothesis can be used to explain specific events.

SUBSKILLS include inferring, constructing models to help clarify ideas, and explaining the evidence behind a hypothesis.

EXAMPLE: Increased surface area causes faster melting. (This explains why crushed ice will melt faster than a block of ice of the same mass.)

Predicting

Forecasting the outcome of a specific future event based on a pattern of evidence or a hypothesis (an explanation). A prediction based on a hypothesis can be used in planning a test of that hypothesis. NOTE: A prediction is *not* a wild guess.

SUBSKILLS include justifying a prediction in terms of a pattern in the evidence, and making a prediction to test a hypothesis.

EXAMPLE: Water flowing from a height of eight inches will wash away more sand than water flowing from a height of six inches; this prediction is based on the pattern that water flowing from six inches washed away more sand than water flowing from four inches, and water flowing from four inches washed away more sand than water flowing from two inches.

Planning and Investigating

Designing an investigation that includes procedures to collect reliable data. Planning includes devising a way to test a hypothesis. NOTE: Planning is not always formal.

SUBSKILLS include identifying and controlling variables, and using measuring instruments.

EXAMPLE: Deciding to put a teaspoon of salt on one ice cube and a teaspoon of sugar on another identical ice cube; setting them side by side, and observing their relative melting rates in order to determine if one melts faster than the other.

Process Skills: Definitions and Examples

Interpreting

Considering evidence, evaluating, and drawing a conclusion by assessing the data: In other words, answering the question, "What do your findings tell you?" Finding a pattern or other meaning in a collection of data.

SUBSKILLS include interpreting data statistically, identifying human mistakes and experimental errors, evaluating a hypothesis based on the data, and recommending further testing where necessary.

EXAMPLE: After observing the melting rates of an ice cube sprinkled with salt and one without salt, concluding that salt reduces the freezing point of water.

Communicating

Representing observations, ideas, theoretical models, or conclusions by talking, writing, drawing, making physical models, and so forth.

SUBSKILLS include talking with a more knowledgeable person, using secondary sources, presenting reports, constructing data tables, and creating charts and graphs.

EXAMPLE: Describing the relationship between the melting time for an ice cube and amount of salt sprinkled on the cube by writing about it or by constructing a graph.

NOTE: These definitions are adapted from the following sources:

American Association for the Advancement of Science. "The Nature of Science." Chap. 1 in *Benchmarks for Science Literacy*. New York: Oxford University Press, 1993.

The American Heritage Stedman's Medical Dictionary. Boston: Houghton Mifflin, 2002.

Harlen, Wynne. *The Teaching of Science in Primary Schools.* 3rd ed. London: David Fulton Publishers, 2000.

National Research Council. "Science Content Standard." Chap. 6 in *National Science Education Standards.* Washington, DC: National Academy Press, 1996.

Ostlund, Karen. "What the Research Says About Science Process Skills." *Electronic Journal of Science Education* vol. 2, no. 4 (June 1998) http://unr.edu/homepage/jcannon/ejse/ostlund.html.

Padilla, Michael J. "The Science Process Skills." *Research Matters– to the Science Teacher* no. 9004 (March 1, 1990) http://www.educ.sfu.ca/narstsite/publications/research/skill.htm

Inquiry Strategies

- **Process Skills-**These are the tools that students use to investigate the world around them (INQUIRY). Students should be given ample opportunities and activities to practice the process skills in order to become more adept at inquiry.

- **O.W.L Charts** (Observations, Wonderings, Learned) developed by Ansberry and Morgan, is a three column chart in which students record their observations about a phenomenon or object, then their wondering about it, and subsequently what they learned (3.)

- **Science journal/notebooks**-Journals are powerful ways to have students record observations, plan investigations, and write reflections on discoveries.

- **Formative assessment probes-** Use probes to uncover students' prior knowledge and/or misconceptions about a particular science concept.

- **Poster Walk-** Have students/groups prepare presentations about what was discovered/learned and then have each group present to the class.

Resources included –

Montana K- 12 Science Content Standards
Frameworks for Inquiry and their variations – 2 templates
Process Skills and Definitions

Works Cited

1. Ansberry, Karen. *More Picture Perfect Science Lessons*. Arlington,Virginia: NSTA press, 2007. Print.

2. Committee on the Development of an Addendum to the National Science Education Standards on scientific Inquiry, comp. *Inquiry and the National Science Education Standards*. Ninth ed. Washington,D.C.: National Academy, 2008. Print.

3. Cracolice, Mark. "Inquiry." Inquiry Professional Development workshop. Montana, Helena. Oct. 2008. Lecture.

4. "Fundamentals of Inquiry." *Institute for Inquiry*. Exploratorium. Web. Oct. 2009. <www.exploratorium.edu>.

Montana K-12 Science Content Standards

<u>Content Standards</u> indicate what all students should know, understand, and be able to do in a specific content area.

<u>Benchmarks</u> define our expectations for students' knowledge, skills, and abilities along a developmental continuum in each content area. That continuum is focused at three points----the end of grades 4, 8, and 12.

Content Standard 1---Students through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.

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

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

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.

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

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

Montana K-12 Science Content Standards and Performance Descriptors--Office of Public Instruction
Linda McCulloch, Superintendent
November 2006

Technology Profiles

The technology profiles suggested for each critical competency are suggested applications only. As the district's philosophy is to apply the state technology standards across the curriculum, teachers may utilize these connections in these curricular areas or others at their discretion.

Grades PK–2 (Ages 4–8)	
The following experiences with technology and digital resources are examples of learning activities in which students might engage during PK-Grade 2 (Ages 4-8):	
1.	Illustrate and communicate original ideas and stories using digital tools and media-rich resources. (ISTE 1,2; MT 2,3)
2.	Identify, research, and collect data on an environmental issue using digital resources and propose a developmentally appropriate solution. (ISTE 1,3,4; MT 2,3)
3.	Engage in learning activities with learners from multiple cultures through e-mail and other electronic means. (ISTE 2,6; MT 2,4)
4.	In a collaborative work group, use a variety of technologies to produce a digital presentation or product in a curriculum area. (ISTE 1,2,6; MT 2,3,4)
5.	Find and evaluate information related to a current or historical person or event using digital resources. (ISTE 3; MT 1)
6.	Use simulations and graphical organizers to explore and depict patterns of growth such as the life cycles of plants and animals. (ISTE 1,3,4; MT 1,3)
7.	Demonstrate safe and cooperative use of technology. (ISTE 5; MT 1,2,3)
8.	Independently apply digital tools and resources to address a variety of tasks and problems. (ISTE 4,6; MT 1,4)
9.	Communicate about technology using developmentally appropriate and accurate terminology. (ISTE 6; MT 4)
10.	Demonstrate the ability to navigate in virtual environments such as electronic books, simulation software, and Web sites. (ISTE 6; MT 4)

Grades 3–5 (Ages 8–11)	
The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 3-5 (Ages 8-11):	
1.	Produce a media-rich digital story about a significant local event based on first-person interviews. (ISTE 1,2,3,4; MT 1,2,3,4)
2.	Use digital-imaging technology to modify or create works of art for use in a digital presentation. (ISTE 1,2,6; MT 2,3,4)
3.	Recognize bias in digital resources while researching an environmental issue with guidance from the teacher. (ISTE 3,4; MT 1)
4.	Select and apply digital tools to collect, organize, and analyze data to evaluate theories or test hypotheses. (ISTE 3,4,6; MT 1,4)
5.	Identify and investigate a global issue and generate possible solutions using digital tools and resources (ISTE 3,4; MT 1)
6.	Conduct science experiments using digital instruments and measurement devices. (ISTE 4,6; MT 1,2)
7.	Conceptualize, guide, and manage individual or group learning projects using digital planning tools with teacher support. (ISTE 4,6; MT 1,4)
8.	Practice injury prevention by applying a variety of ergonomic strategies when using technology. (ISTE 5; MT 1,2,3)
9.	Debate the effect of existing and emerging technologies on individuals, society, and the global community. (ISTE 5,6; MT 1,2,3,4)
10.	Apply previous knowledge of digital technology operations to analyze and solve current hardware and software problems. (ISTE 4,6; MT 1,4)

Grades 6–8 (Ages 11–14)	
The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 6-8 (Ages 11-14):	
1.	Describe and illustrate a content-related concept or process using a model, simulation, or concept-mapping software. (ISTE 1,2; MT 2,3)
2.	Create original animations or videos documenting school, community, or local events. (ISTE 1,2,6; MT 2,3,4)
3.	Gather data, examine patterns, and apply information for decision making using digital tools and resources. (ISTE 1,4; MT 1,3)
4.	Participate in a cooperative learning project in an online learning community. (ISTE 2, MT 2)
5.	Evaluate digital resources to determine the credibility of the author and publisher and the timeliness and accuracy of the content. (ISTE 3; MT 1)
6.	Employ data-collection technology such as probes, handheld devices, and geographic mapping systems to gather, view, analyze, and report results for content-related problems. (ISTE 3,4,6; MT 1,4)
7.	Select and use the appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. (ISTE 3,4,6; MT 1,4)
8.	Use collaborative electronic authoring tools to explore common curriculum content from multicultural perspectives with other learners. (ISTE 2,3,4,5; MT 1,2,3)
9.	Integrate a variety of file types to create and illustrate a document or presentation. (ISTE 1,6; MT 3,4)
10.	Independently develop and apply strategies for identifying and solving routine hardware and software problems. (ISTE 4,6; MT 1,4)

Grades 9–12 (Ages 14–18)	
The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 9-12 (Ages 14-18):	
1.	Design, develop, and test a digital learning game, simulation or presentation to demonstrate knowledge and skills related to curriculum content. (ISTE 1,4; MT 1,3)
2.	Create and publish an online art, photo or graphic gallery with examples and commentary that demonstrate an understanding of different historical periods, cultures, and countries. (ISTE 1,2; MT 2-3)
3.	Select digital tools or resources to use for a real-world task and justify the selection based on their efficiency and effectiveness. (ISTE 3,6; MT 1,4)
4.	Employ curriculum-specific simulations to practice critical-thinking processes. (ISTE 1,4; MT 1,3)
5.	Identify a complex global issue, develop a systematic plan of investigation, and present innovative solutions. (ISTE 1,2,3,4; MT 1,2,3)
6.	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs. (ISTE 4,5,6; MT 1,2,3,4)
7.	Use technology to share information to a wide audience. (ISTE 1,5; MT 1,2,3)
8.	Model legal and ethical behaviors when using information and technology by properly selecting, acquiring, and citing resources. (ISTE 3,5; MT 1,2,3)
9.	Create media-rich presentations for other students while demonstrating the appropriate and ethical use of digital tools and resources. (ISTE 1,5; MT 1,2,3)
10.	Configure and troubleshoot hardware, software, and network systems to optimize their use for learning and productivity. (ISTE 4,6; MT 1,4)

Helena Public Schools
Science Curriculum
K-12

Part I
Introduction and Scope and Sequence

Preface:

The revision of this document was started as a summer work project in June 2008. The need to realign the Helena School District No. 1 Science Curriculum with the Montana Standards for Science and the National Science Education Standards was a driving force for the creation of this publication. Review of the 2001 Science Curriculum Guide, what material is being taught in classrooms, and current trends had to be completed before proceeding to realign our curriculum with the standards. In the summer of 2008, the draft of the Helena School District No. 1 Science Curriculum Guide was started.

Revision of the 2008 draft will be completed during the 2008-2009 school year and summer of 2009 in the following areas: philosophy and goals, scope and sequence, class/course descriptions and curriculum alignment to Montana Standards.

This document prepared by the K-12 Science Curriculum Summer Work Committee delivers a valid expression of the science community on what constitutes current literacy in science. Science curriculum is dynamic and thus in constant revision and work needs to be done in the ongoing months and years to improve the science program, quality of science teaching and provide a compelling vision of achievable goals.

Helena
Public Schools
…a great place to learn

MISSION

The mission of the Helena Public Schools is to challenge and empower each student to maximize individual potential and become a competent, productive, responsible, caring citizen.

This mission will be supported through the wise use of resources to meet student's needs, regardless of interests and talents. Students, families, educators and the community are committed to sharing the responsibility for creating a student-centered educational community that acknowledges learning as a lifelong process.

Helena School District No. 1
Science Curriculum Philosophy Statement

Science ***is a method of understanding how nature works in earth, space, life, and physical systems through the utilization of tools of inquiry and by employing the process skills of observing, questioning, hypothesizing, predicting, testing, drawing conclusions, and communicating.***

As stated in the Montana Standards "Science education strengthens students' investigative skills and fosters their understanding of the world. Students acquire and apply critical thinking and problem-solving skills necessary to participate as citizens in dynamic, global technological societies." – (OPI Montana Science Standards – page 1)

The purpose of science education in Helena is to develop life long learners who can understand how science, technology, and society are interconnected and who can then use this knowledge in everyday decision-making. Learners should have a substantial knowledge of basic facts, concepts, environmental responsibility, and process skills, which enable him/her to continue to learn and think logically.

In order to ensure continued quality education in the standards based science curriculum, it is imperative that there be budgetary support to include:

- ***initial purchase of materials and equipment necessary to implement the program.***
- ***replenishment of materials and equipment when needed.***
- ***ongoing professional development to support teachers in their efforts to implement the curriculum***
- ***sufficient prep-time for labs in their classroom***
- ***limit teaching assignments to 5 classes/semester with no more that 2 science preps***

Science Curriculum Goals Statement

The goals of science education in Helena School District No. 1 are outlined in the six content standards and associated benchmarks of the Montana Standards for Science. These standards shall serve as goals to be achieved and not criteria to be measured.

Science Standards Proficiency Statement

The goal of the Helena School District No. 1 high school science curriculum is to ensure student proficiency in science as described by the Montana Standards for Science. In order to achieve this proficiency level upon graduation, students will have to successfully complete a minimum of one course in each of the following curricular areas: Earth Science, Biology, Chemistry, and Physics.

Rationale for Alignment Work

The State of Montana Standards for Science were approved in November 2006. Helena School District #1 recognizes the need to align the K-12 science curriculum with these standards. In doing this, the discordance found in the curriculum has been addressed.

Rationale for K – 12 Format Differences

Variations in the state standards alignment format between elementary and high school levels exist due to differences in the design of the instructional day, course requirements and delivery systems.

NSTA Position Statement

The Freedom to Teach and the Freedom to Learn

NSTA believes that a teacher's freedom to teach involves both the right and the responsibility to use the highest intellectual standards in studying, investigating, presenting, interpreting, and discussing ideas and facts relevant to his or her field of expertise. NSTA has therefore set forth the following standards in regard to the freedom to teach and learn:

As professionals, teachers must be free to examine controversial issues openly in the classroom. The right to examine controversial issues is based on the democratic commitment to open inquiry and on the importance of decision-making involving opposing points of view and the free examination of ideas. The teacher is professionally obligated to maintain a spirit of free inquiry, open-mindedness, and impartiality in the classroom. Informed diversity is a hallmark of democracy to be protected, defended, and valued.

II. Respect the right of any person to learn the history and content of all systems and to decide what can contribute to an individual understanding of our universe and our place in it.

III. In explaining natural phenomena, science instruction should only include those theories that can be called science.

IV. Ascertain whether a particular theory is properly in the realm of science education, apply the criteria stated above, that is 1) the theory can explain what is observed, 2) the theory can predict that which has not been observed, 3) the theory can be tested by further experimentation and be modified as new data are acquired.

V. Oppose any action that attempts to legislate, mandate, or coerce the inclusion in the body of science education, including textbooks, any tenets which cannot meet the above criteria.

Helena Public Schools Safety/Care Statement

Helena School District #1 and the Science Curriculum Committee strongly encourage hands-on science activities. The safety of students and the care of equipment are paramount.

The National Science Teachers Association (NSTA) and other professional science organizations have guidelines, which must be followed for the use, maintenance and storage of laboratory materials, equipment and preserved organisms. These guidelines also address safety and emergency procedures as well as the use and care of living organisms. Each classroom must be supplied with safety equipment and materials appropriate to perform laboratory procedures specific to the grade level and/or course being taught.

A student-to-instructor ratio in laboratory classes must permit safe and effective instruction. Class size (K-12) should be determined by the physical design of the classroom and should not exceed 24 students per teacher in the laboratory setting as published in the National Science Supervisors Association and the National Science Teachers Association guidelines.

SCOPE AND SEQUENCE DEFINITIONS
"IDEA"

The scope and sequence is designed to present guidelines appropriate to proficiency as directed by the Montana Science Standards.

I = Introduce: At this level, the topic is intentionally and strategically mentioned, but without extensive and formal instruction. "Awareness" might be a similar descriptor. Since formal instruction is not the intent, formal evaluation of achievement in this area may not be necessary. Teachers may mention the topic before this level, of course, but the intent of the guide is to point out that a conscious effort be made **to mention and describe the topic.**

D = Develop: Developing skills, attitudes, and knowledge involves using a variety of effective and appropriate strategies and methods available to each teacher and situation. **Learning** and **achievement** is the goal, and therefore must be evaluated by various techniques. Practice and re-teaching becomes an integral part of this important process.

E = Expand: Once a topic has been developed, it becomes necessary to explore it more fully. This may be accomplished by the use of various methods including observation, prediction, conclusion drawing, and problem solving techniques. At this level, the student should have an **understanding of the fundamental concepts** involved in the topic.

A = Apply: Students are encouraged to use what they have learned. This involves:

1. **Use of fundamental concepts to quantitatively evaluate material.**
2. **Creative problem solving, data generation and inference.**
3. **Taking the initiative to develop ideas and to formulate their own questions.**
4. **Ability to consider controversial issues at the interface of science, technology, and society.**

IDEA Scope and Sequence may not always be followed or it may appear to have gaps due to the different benchmarks being taught at the various grade levels:

K – 4 Although specific topics are to be taught at each grade level, they may be reintroduced or further developed at other levels to prepare the students for the fourth grade benchmark.

5 – 8 Fifth and Sixth grades: General Science
Seventh grade: Life Science
Eighth grade: Physical Science

9 – 12 Two of the following are required: Earth Science, Honors Earth Science, Biology and/or Honors Biology. Many other science electives are available to students upon successful completion of these first two courses. These courses include: Biology II, Chemistry I, Physical Science (11th), and Chemistry II, Physics, Chemistry in the Community (11th), Science Seminar (12th), and CSI: Forensics Science (11th).

Standard 1: Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, communicate, scientific investigations

Benchmark		K	1	2	3	4	5	6	7	8	9	10	11	12
1.1	• Establish testable questions	I	I	I	I	I	I	D	E	E/A	D/E	D/E	D/E	E/A
	• Identify variables			I	I	I	I	I/D	D	D	E	E	E/A	A
	• Safely conduct experiments	I	I	I	I	D	D	D	D	D	E	E/A	E/A	E/A
	• Control/Manipulate variables						I	I	I/D	D	D/E	D/E	D/E	A
	• Predict outcomes	I	I	I	I	D	D	D	D	D/E	E	E/A	E/A	E/A
	• Collect data	I	I	I	I	I	I	D	D/E	E	E	E/A	E/A	A
	• Compare/Analyze results					I	I	I	I/D	I/D	E	E/A	E/A	A
	• Identify dependent/independent variables					I	I	I	I/D	I/D	E	E/A	E/A	A
1.2	• Use appropriate tools of measurement accurately	I	I	I	I	I/D	I/D	I/D	D	D	E/A	E/A	E/A	E/A
	• Select appropriate means for representing results					I	I	I	D	D	D/E	D/E	E/A	A
	• Use technology appropriately in conducting research					I	I	I	I/D	D	E/A	E/A	E/A	E/A
1.3	• Provide evidence to support results				I	I	I	I	D	D	E/A	E	E/A	A
	• Defend results						I	I	D	D	D/E	D/E	E/A	A
	• Question results						I	I	D	D	E	E	E	E/A
	• Communicate results	I	I	I	I	I	I	I	D	D	E	E	E/A	A
	• Report results of controlled experiments	I	I	I	I/D	D	D	D	D/E	E	E	A	A	A
	• Recognize differences in controlled/uncontrolled experiments							I/D	D	D	E	A	A	A
1.4	• Construct/create models to illustrate scientific concepts	I	I	I	I	I/D	I/D	D	D	D	E	E	A	A
	• Use models to predict change						I	I	I	D	E	E/A	E/A	A
	• Analyze relationships between models/real world						I	I	I	D	D/E/A	E/A	E/A	A
1.5	• Analyze strengths/weaknesses of experimental design							I	I	I	D	E/A	A	A
1.6	• Compare how observations of nature form an essential base of knowledge among Montana American Indians	I	I	I	I/D	D	D	D	D/E	E	E	A	A	A

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

Benchmark		K	1	2	3	4	5	6	7	8	9	10	11	12
2.1	• Examine and describe physical properties of tangible objects	I	I	I/D	D	D	D	D	D	D/E	E/A		E/A	A
	• Examine and describe physical and chemical properties of objects and substances						I	I/D		D	E/A	E	E/A	E/A
	• Compare and classify physical properties of tangible objects	I	I	I/D	D	D	D	D	D	D	E/A	D	E/A	A
	• Compare and classify physical and chemical properties of objects and substances							I/D	D	D	E	D	E/A	A
	• Predict chemical and physical properties of matter							I		D	E/A	E	E/A	E/A
	• Describe the structure of atoms					I	D	D		D/E	E/A	E/A	EA/	EA/
	• Explain the process of fission, fusion, and radioactive decay									I	D	D	E	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.2	• Separate mixtures based on different properties	I	I	I	I	I	D	D		E		D	EA	A
	• Classify matter in terms of elements, compounds, and mixtures							I/D		D	D/E	D	D	A
	• Model matter in terms of elements, compounds and mixtures							I/D		D	D/E	D	A	A
	• Explain physical interactions of matter using conceptual models									I	D/E/A		E/A	A
	• Explain chemical bonding and molecular geometry as they relate to valance electrons									I	D	D/E	A	A
	• Describe the phases of matter as they relate to the kinetic molecular theory									I	D	D/E	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.3	• Describe the characteristics of light				I	D		I		D	E/A	D	E/A	E/A
	• Describe the characteristics of heat					I/D		I/D		D	E/A		E/A	E/A
	• Describe the characteristics of sound			I	I/D			I/D		D	D/E		D/E	A
	• Describe the characteristics of magnetism	I	I		I/D			I/D		D	D/E			A
	• Describe the characteristics of motion						I	I/D		D	D/E		E	A
	• Describe the characteristics of electricity						I			D	D		E/A	E/A
	• Describe the characteristics of mechanical waves									I/D	E		E/A	A
	• Describe chemical reactions and the factors that influence them							I		I/D	D	D/E	A	A

		K	1	2	3	4	5	6	7	8	9	10	11	12
2.4	• Model states of matter	I	I	I	I/D	D		E		E	E		E/A	A
	• Explain states of matter	I	I	I	I/D	D		D		E	E	D	A	A
	• Explain the effects of energy on the states of matter				I	I		I		I/D	E/A	D	E/A	A
	• Identify what changes and what does not change in matter due to an external force	I	I	I	I	D	D	D		D	D		E/A	A
	• Predict what changes and what does not change in matter due to an external force	I	I	I	I/D	D	D	I/D		D			E/A	A
	• Describe physical and chemical interactions of matter using words and symbolic equations							I	I	D	E/A	D	E/A	A
	• Compare and contrast different forms of energy						I	D	D	D	E	I/D	E/A	E/A
	• Explain the conservation of matter and energy and entropy in a closed system								I	I/D		D	E/A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.5	• Identify the position and motion of an object relative to another			I	I	I	I	D		E	E		A	A
	• Explain the motion of an object as it relates to position, direction, speed and forces acting upon it				I	I	I	D		E	E		A	A
	• Describe the laws of motion of two separate objects				I	I	I	D		E	E		A	A
	• Explain the similarities and differences between gravitational and electromagnetic forces				I	I	I	D		E	E		A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.6	• Identify, build and describe mechanical systems					I	I/D	I/D		D			E	A
	• Measure and analyze mechanical systems									I/D			D/E	E/A
	• Explain how energy is stored, transferred and transformed							I		I/D	I/D	D/E	A	A
	• Explain kinetic and potential energy and their relationship to molecular motion							I		I/D	I/D	D/E	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2.7	• Calculate the quantitative and qualitative relationship between matter and energy									I	D	D	E/A	E/A
	• Analyze the quantitative and qualitative relationship between matter and energy									I	E	D	E/A	A
	• Describe, observe, and measure a form of energy		I	I	D	D	D/E	D/E	E	E	E	E	A	A

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

Benchmark		K	1	2	3	4	5	6	7	8	9	10	11	12
3.1	• Identify structures and systems of plants and animals	I	I	I	I/D	D	D	D	E			E/A	E/A	E/A
	• Compare the structures and functions of prokaryotic (bacteria) cells and eukaryotic cells						I	I	D			E/A	E/A	A
	• Determine and investigate the function of the common building blocks of cells						I		I/D			E/A	E/A	E/A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3.2	• Describe how organisms and systems of organisms obtain and use energy resources						I	D	D/E			E	A	A
	• Explain how organisms and systems of organisms respond to stimuli						I	D	D/E			E/A	A	A
	• Describe and explain energy use in cell maintenance, growth, repair, and development						I		D/E			E/A	A	A
	• Identify and measure basic requirements of energy and nutrition for organisms	I	I	I	I/D	D	D	D/E	D/E			E/A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3.3	• Describe and use models that trace the life cycles of different plants and animals	I	I	I/D	D		D	I	D/E			D/E	A	A
	• Communicate the difference in reproductive processes of plants and animals					I	I	I	D/E			A	A	A
	• Use the principles of genetic modeling						I		D/E			A	A	A
	• Model the structure of DNA and protein synthesis								I/D/E			A	A	A
	• Explain the molecular basis of heredity and its contribution to the diversity of life								I/D/E			A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3.4	• Explain cause and effect relationships of biotic and abiotic components of an ecosystem	I	I/D	D	D	D	D	D	D/E			A	A	A
	• Identify differences between inherited, instinctual an learned behaviors											A	A	A
	• Investigate interdependent nature of biological systems						I	D	D/E			E/A	A	A
	• Explain how biological systems are affected by human interaction	I	I	I	I	I	I	D	D/E			E/A	A	A
	• Predict and model interaction of biotic and abiotic factors with respect to population							I	D/E			E/A	A	A
	• Predict and explain factors which affect the change of a species over time							I/D	D/E			E/A	A	A

		K	1	2	3	4	5	6	7	8	9	10	11	12
3.5	• Classify plants and animals according to their similarities and differences	I	I	I/D	D	D	D	D	D/E			A	A	A
	• Use a basic classification scheme to identify local plants and animals						I	I	D			E/A	A	A
	• Apply a biological classification scheme							I	D			E/A	A	A
	• Infer the degree of species divergence							I	D			E	E	E

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		K	1	2	3	4	5	6	7	8	9	10	11	12
4.1	• Describe the earth's changing features	I	I	I	I/D	D		D			D/E/A			
	• Model the Earth's internal and external structures					I/D		D			D/E/A			
	• Explain the rock cycle in plate tectonics						I	D			D/E/A			
	• Understand and apply the theory of plate tectonics and how it explains the interrelationship between earthquakes, volcanoes, and sea floor spreading.							I/D			D/E/A			
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4.2	• Describe the physical properties of Earth's basic materials	I	I	I	I/D	D		D			D	E/A	D/E	A
	• Classify rocks and minerals						I	I/D			E/A			
	• Explain how different rocks are formed						I	D			E			A
	• Identify the physical and chemical properties of rocks and minerals and the utilization by humans (e.g. building materials, natural resources, coal)						I	I			E/A			A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4.3	• Investigate fossils	I	I	I	I	I/D		D			E	D		
	• Make inferences about life and the environment long ago		I	I	I/D			D			E	D		
	• Discuss scientific theories about the origin of the solar system							I/D			E			
	• Explain scientific theories as applied to the evolution of the earth and solar system							I/D			E		E	E
	• Explain scientific theories about how fossils are used as evidence of changes over time (e.g. climate change)							I/D			E	D		
	• Relate how evidence from technology has impacted our understanding of the universe							I/D			E			A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4.4	• Observe and describe local weather	I	I/D	D	D	D		D			E/A		D/E	D/E
	• Demonstrate how weather conditions are measured	I	I	I/D	D	D		D			E/A		D/E	D/E
	• Describe the water cycle		I	I	D	D		D			E/A	D/E	D/E/A	D/E/A
	• Describe the composition and structure of the atmosphere							I/D			E/A		D/E/A	D/E/A
	• Explain the impact of oceans on weather patterns							I/D			E/A			
	• Describe the impact on earth of fluctuations in weather and climate (e.g. drought, surface and ground water, glacial stability)							I/D			E/A		D/E	D/E
	• Observe, describe, and collect data to make inferences and predictions about weather patterns.	I	I	I	I	I/D	D	E			E/A			

		K	1	2	3	4	5	6	7	8	9	10	11	12
4.5	• Identify and describe seasons	I	D			D		D			E			
	• Explain differences between weather and climate				I	I/D		D			D/E			
	• Describe and model the motion and tilt of the Earth in relation to the Sun					I		D			E/A			
	• Explain the concept of day, night, seasons, and year			I	I	I/D		D			E/A			
	• Explain the factors influencing global weather and climate							I/D			E/A		D/E	D/E
	• Explain the impact of terrestrial, solar oceanic, and atmospheric conditions on global climate patterns							I/D	I/D		E/A			
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4.6	• Describe celestial objects in the sky	I	I	I		I/D		D			E/A			E
	• Explain the relationship between the Sun, moon, and Earth		I	I/D	D	D		D			E/A			E
	• Describe the objects in the solar system in relation to the Sun			I		I/D		D			E/A			
	• Describe and model objects in the solar system in terms of size, structure, and movement					I/D		D			E/A			
	• 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 evolution of the universe.					I		D			E/A			E
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4.7	• Relate how evidence from advanced technology applied to scientific investigations (e.g., telescopes and space-borne observations), has dramatically impacted our understanding of the origin, size, and evolution of the universe.		I	I	I	I		D			E/A			A

Standard 5: Students, through the inquiry process, understand how scientific knowledge and technological developments impact society.

Benchmark		K	1	2	3	4	5	6	7	8	9	10	11	12
5.1	• Give examples of how people use science and technology	I	I	I	I	I/D	D	D	D	D	E	A	A	A
	• Identify fields of science and related occupations					I	I	D	D	D	E	D/E	A	A
	• Describe key factors that affect the development and acceptance of scientific thought							I	D	D	E/A	A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5.2	• Identify a scientific or technological innovation that benefits the community	I	I	ID	D	D	D	D	D	D	D/E	A	A	A
	• Apply scientific knowledge and process skills to understand issues and everyday events						I	I	D	D	E/A	A	A	A
	• Analyze scientific innovations challenging commonly held perceptions								I	D	D/E	A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5.3	• Communicate ideas and solutions in a variety of cooperative settings	I	I	ID	D	D	D	D	D	D	E	A	A	A
	• Model collaborative problem solving		I	I	I	D	I	D	D	D	E	A	A	A
	• Give examples of how scientific knowledge is shaped						I	D	D	D	E	A	A	A
	• Model the ongoing, collaborative scientific process of gathering and evaluating information	I	I	I	I	I	I	I	I	I	D	E/A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5.4	• Use current scientific knowledge to propose solutions for local environmental problems	I	I	I	I	D	D	D	D	D	D/E	D	E/A	E/A
	• Analyze benefits, limitations, and costs of scientific and technological innovations of scientific and technological innovations and decisions							I	I	I	D/E	DE	E/A	E/A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5.5	• Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures	I	I	I	I/D	D	D	D	D	D/E	E	A	A	A
	• Describe how the knowledge of science and technology influences the development of the Montana American Indian cultures	I	I	I	I/D	D	D	D	D	D/E	E	A	A	A
	• Explain how the knowledge of science and technology applies to contemporary Montana American Indian communities (e.g., natural resources development, management and conservation)	I	I	I	I/D	D	D	D	D	D/E	E	A	A	A

Standard 6: **Students understand historical developments in science and technology.**

Benchmark		*K*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
6.1	• Give historical examples of scientific and technological contributions to community, Montana American Indians	I	I	I	I/D	I/D	D	D	D	D	E	A	A	A
	• Explain that scientific knowledge is subject to change with new knowledge					I	I	D	D	D	E	A	A	A
	• Analyze the interrelationship between technological advances and scientific understanding							I	D	D	E	A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
6.2	• Explain how man's quest for knowledge has led to scientific understanding	I	I	I	I/D	I/D	D	D	D	D	E	A	A	A
	• Describe how scientific inquiry produces knowledge of the world						I/D	D	D	D	E	A	A	A
	• Identify major milestones in science						I	D	D	D	E	A	A	A
	• Analyze and evaluate the historical impact of scientific and technological advances							I	I/D	I/D	D/E	E/A	A	A
		K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
6.3	• Describe, explain and analyze science as a human endeavor and an ongoing process	I	I	I	I/D	D	D	D	D	D/E	E	A	A	A

Class/Course Descriptions

Overview for K-5 Science

K-5 science includes topics in the areas of Earth Science, Life Science, Physical Science, Technology, and History. The content is aligned with the Montana Standards for Science. Scientific inquiry and discovery is an essential component of the curriculum at all grade levels. Various teaching and instructional strategies are utilized such as: hands-on investigations and experiments, observations, class discussions, student created projects, guest speakers, fieldtrips, and technology. Science is integrated throughout the curriculum areas. In this way, scientific literacy and appreciation of the science field is promoted.

Middle School Science Courses

6th Grade: The sixth grade science curriculum is designed to provide a transition between elementary and high school that help bridge the gap between childhood and adolescence. There are numerous hands-on-experiences with the scientific processes (i.e., questioning, hypothesizing, predicting, testing, and drawing conclusions). These experiences will enable the student to begin to understand and master the science concepts integrated with technology. The content consists of life, physical, Earth sciences, and ecology with frequent interdisciplinary connections to Social Studies, Math, and Communication Arts.

7th Grade Life Science: In 7th grade science, the focus is on living organisms and their relationship to each other. Basic science concepts are used which involve the Scientific Method, use and application of equipment and the role of science as a problem solving method. It is presented with a "hands on" approach to integrate concepts to application. General overall views of organisms and the comparison of these groups lead students to look at their natural world. It incorporates interdisciplinary units that involve Math, Communication Arts, Social Studies and Science.

8th Grade Physical Science: 8th grade Physical Science is a survey course designed around the study of matter and energy. Approximately one half of the year is devoted to physics topics that include motion, simple machines, light, sound, electricity, magnetism, and computers. The second half of the year covers chemistry topics which include atoms, elements and the periodic table, balancing equations, acids, bases, salts, and soaps. The course is taught and evaluated using various methods such as lecture, demonstration, laboratory, small group projects, class presentations, and portfolios.

High School Science Courses

Applied Earth Science, Earth Science and Honors Earth Science: Earth Science is the study of the Earth and its environment. This includes the study of astronomy, geology, oceanography, paleontology, and meteorology. The content knowledge, methods of presentation and student requirements vary between the three levels offered.

Applied Biology, Biology I, Honors Biology I: Biology is a survey course in the Life Sciences, which will help students to develop an understanding of living things and their relationship to one another. Areas of study include cells, heredity, microbes, plants, invertebrate animals, chordate animals, and ecology. Laboratory work, dissections, lectures, tests, and projects are some of the approaches used to teach the major concepts and evaluate student performance.

Biology II: This is an advanced lab oriented course providing a diversity of experiences in the biological sciences. Units of study include: ecology field studies, genetics, biotechnology and molecular biology, vertebrate anatomy and physiology and plant morphology.

Chemistry I: Chemistry is a laboratory based survey course dealing with the composition, structure, properties, and energy changes of substances through laws that unite these phenomena into a comprehensive system. Topics covered may include atomic structure, gas laws, chemical reactions, elements, compounds, stoichiometry, chemical bonding, electron configuration, acids, bases, thermodynamics and reaction rates.

CHEMCOM (Chemistry in the Community): Chemistry in the Community is designed to show students how chemistry relates to the everyday world. Topics covered may include the chemistry of water, air, metals, foods, and related environmental problems. These are explored through laboratory activities, projects, discussions, field trips, lectures, and problem solving activities.

Physical Science: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry in a conceptual framework. Many of the same topics of the Chemistry I and Physics courses will be covered through the use of local issues and current events. Topics will be covered through the use of laboratory activities, student generated activities, discussion and demonstrations.

Chemistry II: Chemistry II is an opportunity for students who have a desire to continue their study of chemistry and apply their knowledge in a relevant, practical, and useful course while increasing their understanding of fundamental principles, problem solving and laboratory skills and techniques. Topics covered may include analytical analysis, thermodynamics, reaction kinetics, equilibrium, redox, organic, and molecular geometry.

Physics: Physics is the study of the relationships of matter and energy. Laboratory experiences are used to teach such topics as motion, heat, sound, wave mechanics, light, magnetism, and electricity. Lab work, discussions, demonstrations, projects, and text assignments are included in the course.

Science Seminar: This enrichment course is an opportunity for integral study of the various disciplines of science and their social implications. Topics covered may include current trends in science, bioethics, environmental issues, and careers in science. These are explored through literature review, lectures, laboratory activities, student presentations, discussions, guest speakers, and field trips.

CSI: Forensic Science: The cornerstone of criminalistics is science, therefore, basic content knowledge, skills, and laboratory techniques are emphasized. Appropriate evidence collecting skills will be practiced in a realistic context. Students are exposed to the nature of crime scene investigation. Immersion in the various aspects of criminal investigation allows students to focus on the potential career pathways.

Environmental Science: A rapidly changing world with urgent environmental issues calls for a rapidly responsive course in which students can analyze and address those issues. Environmental Studies/Green Group will fill this need. The course "textbook" will be the Internet, newspapers, radio, television, magazines, journals, and other current sources of information. Students and teachers will locate environmental articles, interview local experts, analyze data, design experiments, write and present their findings, make improvements in Helena High systems, help care for Helena High buildings and grounds, and volunteer in the community. The structure of this course will have the flexibility, fluidity, and immediacy that is necessary for responding to today's complex problems.

Guidelines for Placement in High School Courses

Students with diverse needs—those with unique abilities and/or disabilities—will have differentiated opportunities to achieve competencies and standards at rates and by the use of strategies consistent with their needs.

General placement is appropriate for those students who, because of low skills in science, math, reading, and writing, need a class designed to fit their unique abilities. Because enrollment is limited to 15 students per class, it is essential that candidates demonstrate strong effort, excellent attendance, and appropriate classroom behavior. Selection will be based on ITBS scores, current science grade, individual testing, and recommendations by a placement team. The placement team consists of grade level teachers, counselors, and special education teachers.

Honors placement is appropriate for those students who excel. Students will be exposed to more challenging assignments involving rigorous math, additional reading and writing, and independent lab work. **A higher level of commitment and effort is required of honors students.** Because enrollment is limited, selection of students is based on the following: Grades of "B" or better in math, science, and English; scores of 85% or higher on standardized tests in the areas of reading, comprehension, writing, total math, and composite; current science teacher recommendation; completion of the application process and consent of the honors instructor.

Montana K-12 Science Content Standards

<u>Content Standards</u> indicate what all students should know, understand, and be able to do in a specific content area.

<u>Benchmarks</u> define our expectations for students' knowledge, skills, and abilities along a developmental continuum in each content area. That continuum is focused at three points----the end of grades 4, 8, and 12.

Content Standard 1---Students through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.

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

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

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.

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

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

Montana K-12 Science Content Standards and Performance Descriptors--Office of Public Instruction
Linda McCulloch, Superintendent
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Helena Public Schools
Science

Grades K-5
Unifying Themes

Science
Unifying Themes & Critical Competencies - Kindergarten

Problem Solving: • Observe and Report weather/seasons (calendar time and possibly integrate with Indian Education) **1.2** • Ask questions about science in their world. **6.2**	↔	**Vocabulary:**
Measurements/Technology • Nontraditional measurements **1.2** • Identify and demonstrate different uses of technology **5.1**	↔	**Vocabulary:**
Classification/Grouping • Identify solid, liquid, gas (properties of matter) **2.4** • Living and nonliving **3.1**	↔	**Vocabulary:**
Models/Systems • Five senses **3.1** • Model of Earth, sun, moon, stars **4.6** • Explain experiences with magnetism **2.3** • Life cycles, habitats **3.3** • Healthy habits, nutrition **3.2**	↔	**Vocabulary:**
Communication/Vocabulary • Manipulatives **1.2** • Draw **1.2** • Verbal **1.3, 5.3** • Share and listen in a group **5.3**	↔	**Vocabulary:**

Science
Unifying Themes & Critical Competencies for Grade 1

Problem Solving:	↔	**Vocabulary:**
• Collaborate in a group to perform a simple investigation using safe laboratory procedures **1.1**		
Measurements/Technology	↔	**Vocabulary:**
• Identify appropriate measurement tools **1.2** • Identify and explain technologies used in school/community **5.2**		
Classification/Grouping	↔	**Vocabulary:**
• Characteristics of living and non-living) possibly integrate animals with Indian Ed.) **3.1** • Describe properties of matter **2.4** • Demonstrate knowledge of earth, landforms and objects in space **4.1** • Characteristics of magnets **2.3** • Demonstrate experiences with heat **2.7** • Recognize physical properties of Earth **4.2**		
Models/Systems	↔	**Vocabulary:**
• Life cycle of plants and animals/habitats (include prehistoric life) **3.3, 4.3** • Food chain **3.4** • Healthy habits, nutrition **3.2** • Water cycle/weather **4.4**		
Communication/Vocabulary	↔	**Vocabulary:**
• Manipulatives (use to construct simple models) **4.1** • Observe, tell, record scientific investigation **1.1** • Recognizes need for conservation of the environment **5.4** • Draw **1.3** • Share and listen in a group **1.3, 5.3**		

Science
Unifying Themes & Critical Competencies for Grade 2

Problem Solving:	↔	**Vocabulary:**
• Students begin to indentify variables **1.1**		
Measurements/Technology	↔	**Vocabulary:**
• Demonstrate correct use of measurement tools using safe laboratory procedures **1.2**		
Classification/Grouping	↔	**Vocabulary:**
• Classify and record properties of matter/patterns **2.1** • Explore natural resources **4.2** • Basic characteristics of sound **2.3** • Fossils/prehistoric life **4.3** • Describe and illustrate Earth's features (possibly integrate observation of nature with Indian Ed.) **4.1** • Identify seasonal and weather changes **4.5** • Demonstrate experiences with sound **2.7**		
Models/Systems	↔	**Vocabulary:**
• Recognize and identify life cycles of plants and animals **3.3** • Construct a model to illustrate a simple concept **1.4** • Healthy habits, nutrition **3.2** • Identify relationship between sun, moon, stars **4.6**		
Communication/Vocabulary	↔	**Vocabulary:**
• Observe, tell, record scientific investigation **1.1** • Draw **1.3** • Share and listen in a group **1.3, 5.3** • Provides examples of how people use various types of technologies **5.5**		

Science
Unifying Themes and Critical Competencies for Grade 3

Problem Solving:	↔	Vocabulary:
• Conduct a simple experiment, identify the variable and record data (with some teacher direction) **1.1** • Formulate hypothesis and predict outcome **1.1** • Investigate how humans affect the environment in which they live (possibly integrate human/environmental interactions into Indian Ed.) **5.4**		
Measurements/Technology	↔	**Vocabulary:**
• Accurately select and use tools for simple measurement **1.2** • Observe and record weather data, demonstrate how weather conditions are measured **4.4** • Recognizes how technology, science and society are connected **Standard 5**		
Classification/Grouping	↔	**Vocabulary:**
• Identify the characteristics of animals and plants, their functions and relationships to the environment (possibly integrate observations of nature into Indian Ed.) **3.1**		
Models/Systems	↔	**Vocabulary:**
• Identify and describe a simple machine **2.6** • Explain the relationship between the sun, Earth and moon **4.6** • Construct a model to illustrate a simple concept **1.4** • Describe food groups and effects on human body systems **3.2** • Investigate Earth's natural forces, water cycle, soil, fuels, climate **4.4** • Experiment, predict outcomes of mixtures based upon properties **2.1** • Classify objects (properties of matter/patterns/change) **2.2**		
Communication/Vocabulary	↔	**Vocabulary:**
• Communicate scientific data with supporting evidence **1.3** • List occupations that historically use science and inventions that have impacted the world **6.2**		

Science
Unifying Themes & Critical Competencies for Grade 4

Problem Solving: • Given a testable question students plan, design and safely conduct a scientific investigation with identified variables **1.1** • Environment problems, propose solutions **5.4**	↔	**Vocabulary:**
Measurements/Technology • Select and accurately use appropriate equipment and technology to measure and gather data for a scientific investigation **1.2** • Identifies interactions among technology, science and society **Standard 5, 6.3**	↔	**Vocabulary:**
Classification/Grouping • Identify that plants and animals have structures and systems which serve different functions **3.1** • Ecosystems/habitats **3.4** • Examine, measure, describe, compare, classify objects (by properties, mixtures and energy effects) **2.2**	↔	**Vocabulary:**
Models/Systems • Solar system/patterns of movement **4.6** • Simple and complex machines **2.6** • Body systems **3.1** • Describe and give examples of Earth's changing features and properties (including fossils) **4.2, 4.3** • Construct model to illustrate simple concept (compare/contrast/connect) **1.4** • Life cycles of plants and animals **3.3** • Observe and describe water cycle, local weather, seasons and climate **4.4, 4.5**	↔	**Vocabulary:**
Communication/Vocabulary • Represent, communicate and provide supporting evidence of scientific investigation **1.3** • List occupations that historically use science and technological innovations that benefit the community **5.2, 6.3**	↔	**Vocabulary:**

Science
Unifying Themes & Critical Competencies for Grade 5

Problem Solving: • Recognize, select and/or pose a testable question **1.1, 1.3** • Investigate how humans effect the environment in which they live (possibly integrate human/environmental interactions into Indian Ed.) **3.4** • Plan/design an investigation (using variables, control group) **1.1, 1.3** • Use process skills and various scientific methods **1.1, 1.3**	↔	**Vocabulary:**
Measurements/Technology • Metric measurement **1.2**	↔	**Vocabulary:**
Classification/Grouping • Classify rocks and minerals **2.2, 4.1, 4.2** • Compare and contrast different forms of energy **2.3**	↔	**Vocabulary:**
Models/Systems • Build and describe a simple or complex machine • Construct a simple model of an atom **2.1** • Body systems and plant systems **3.2** • Plant cell and animal cell **3.1** • Newton's Laws (motion) **2.3**	↔	**Vocabulary:**
Communication/Vocabulary • Incorporate scientific method and explain scientific experiments based upon gathered evidence **1.3** • List occupations that historically use science and scientific discoveries **6.2**	↔	**Vocabulary:**

Helena Public Schools
Science

Grades K-5
Curriculum

Benchmarks without a bullet are addressed at other grade levels.

Helena Public Schools
Teacher Resource Guide
Kindergarten – Science

Content Standard 1

Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate and communicate the results and form reasonable conclusions of scientific investigations.

Technology Profile PK-2

Benchmark 1.1

Develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied) (a) asking questions about objects, events, and organisms in the environment, (b) planning and concluding simple investigations.

 7 and 8

- Observe/report teacher-directed scientific investigations
- Develop respect for classroom equipment and safe laboratory procedures.

Benchmark 1.2

Select and accurately use appropriate tools to measure in SI units (metric), process and analyze results of a basic scientific investigation.

 2 and 8

- Explore types of measurement using different manipulatives

Benchmark 1.3

Represent, communicate and provide supporting evidence of scientific investigations.

 1, 3, and 9

- Participate in discussions of scientific investigations

Benchmark 1.4

Construct models that illustrate simple concepts and compare those models to what they represent.

 1 and 6

- Construct a model to illustrate a simple concept (at developmentally appropriate level).

Benchmark 1.5

Identify a valid test in an investigation

 4

- Report the results from a controlled experiments

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Kindergarten – Science

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

Technology Profile PK-2

Benchmark 2.1

Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).

- Observe mixtures with different properties

Benchmark 2.2

Examine, measure, describe, compare and classify tangible objects in terms of common physical properties.

- Sort tangible objects

Benchmark 2.3

Describe the basic characteristics of light, heat, magnetism and sound.

- Explore magnets

Benchmark 2.4

Model and explain that matter exists as solids, liquids and gases and can change from one form to another.

- Develop awareness of matter in its different forms

Benchmark 2.5


8

Identify and predict what changes and what remain unchanged when matter experiences an external influence.

- Observe, identify, and predict changes in matter resulting from external forces (e.g. pressure, heat, cold)

Benchmark 2.6

Identify, build, and describe mechanical systems (e.g. simple and complex machines).

Benchmark 2.7

Observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic.

Helena Public Schools
Teacher Resource Guide
Kindergarten – Science

Content Standard 3

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

Technology Profile PK-2

Benchmark 3.1

Identify that plants and animals have structures and systems, which serve different functions

- Observe and discuss similarities/differences of living and non-living things

8

Benchmark 3.2

Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism.

- Develop an awareness of the food groups and proper nutrition

Benchmark 3.3

Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.

- Observe models of the life cycles of an insect and plants

6 and 8

Benchmark 3.4

Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including identifying differences between inherited, instinctual, and learned behaviors

- Explore different types of habitats

3

Benchmark 3.5

Create and use a classification system to group a variety of plants and animals according to their similarities and differences.

- Develop interests, respect, and appreciation for all living things
- Sort according to plants/animals/non-living

Helena Public Schools
Teacher Resource Guide
Kindergarten – Science

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

Technology Profile PK-2

Benchmark 4.1
Describe and give examples of Earth's changing features.
- Develop an awareness of planet Earth

 10

Benchmark 4.2
Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)
- Discuss the physical properties of the Earth and show examples

 10

Benchmark 4.3
Investigate fossils and make inferences about life and the environment long ago.
- Discuss prehistoric life

 5

Benchmark 4.4
Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured.
- Observe daily weather

 8

Benchmark 4.5
Identify seasons and explain the differences between weather and climate.
- Observe seasonal changes

 8

Benchmark 4.6
Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the sun.
- Name the sun, Moon and stars
- Discuss what the Sun does for the Earth

 10

Benchmark 4.7
Identify technology and methods used for space exploration (e.g. star patterns, space shuttles, telescopes)

Helena Public Schools
Teacher Resource Guide
Kindergarten – Science

Content Standard 5

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

Technology Profile PK-2

Benchmark 5.1

Describe and discuss examples of how people use science and technology

- Explore how science and technology are used within the community

9

Benchmark 5.2

Identify a scientific or technological innovation that benefits the community.

- Participate in discussions about innovations that make our life easier

9

Benchmark 5.3

Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.

- Share and listen in a group

Benchmark 5.4

Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management).

- Introduce concept of recycling, reduce, reuse

2

Benchmark 5.5

Identify how the knowledge of science and technology influences the development of the Montana American Indian Cultures.

- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures,

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Kindergarten – Science

Content Standard 6 — **Technology Profile PK-2**

Students understand historical developments in science and technology.

Benchmark 6.1

Give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples

Benchmark 6.2

Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe

- Ask questions relating about science in their world

Benchmark 6.3

Describe science as a human endeavor and an ongoing process.

- Explore science as a human endeavor and an ongoing process

Helena Public Schools
Teacher Resource Guide
Grade 1 – Science

Content Standard 1
Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate and communicate the results and form reasonable conclusions of scientific investigations.

Technology Profile PK-2

Benchmark 1.1
Develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied) (a) asking questions about objects, events, and organisms in the environment, (b) planning and concluding simple investigations.
- Observe/tell and record scientific investigations.
- Develop respect for classroom equipment and safe laboratory procedures.

 7 and 8

Benchmark 1.2
Select and accurately use appropriate tools to measure in SI units (metric), process and analyze results of a basic scientific investigation.
- Identify appropriate measurement tools

 2 and 8

Benchmark 1.3
Represent, communicate and provide supporting evidence of scientific investigations.
- Participate in discussions of scientific investigations (e.g., class graphs, charts, tables)

 1, 3, and 9

Benchmark 1.4
Construct models that illustrate simple concepts and compare those models to what they represent.
- Construct a model to illustrate a simple concept (at developmentally appropriate level.

 1 and 6

Benchmark 1.5
Identify a valid test in an investigation
- Report the results from a controlled experiments

 4

Benchmark 1.6
Identify how observations of nature form an essential base of knowledge among the Montana American Indians
- Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 1 – Science

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

Technology Profile PK-2

Benchmark 2.1
Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).
- Observe mixtures with different properties

Benchmark 2.2
Examine, measure, describe, compare and classify tangible objects in terms of common physical properties.
- Sort tangible objects

Benchmark 2.3
Describe the basic characteristics of light, heat, magnetism and sound.
- Explore magnets

Benchmark 2.4
Model and explain that matter exists as solids, liquids and gases and can change from one form to another.
- Develop awareness of matter in its different forms

Benchmark 2.5
Identify and predict what changes and what remain unchanged when matter experiences an external influence.
- Observe, identify, and predict changes in matter resulting from external forces (e.g. pressure, heat, cold)

 8

Benchmark 2.7
Observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic.
- Observe, measure and manipulate heat energy. (e.g., temperature higher/lower, thermometer)

 8

Helena Public Schools
Teacher Resource Guide
Grade 1 – Science

Content Standard 3

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

Technology Profile PK-2

Benchmark 3.1

Identify that plants and animals have structures and systems, which serve different functions

- Observe and discuss similarities/differences of living and non-living things

8

Benchmark 3.2

Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism.

- Develop an awareness of the food groups and proper nutrition

Benchmark 3.3

Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.

- Observe models of the life cycles of an insect and plants

6 and 8

Benchmark 3.4

Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including identifying differences between inherited, instinctual, and learned behaviors

- Explore different types of habitats

3

Benchmark 3.5

Create and use a classification system to group a variety of plants and animals according to their similarities and differences.

- Compare and identify plants and animals into groups by size, shape, needs and uses.

6

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Teacher Resource Guide
Grade 1 – Science

Content Standard 4

Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of the Earth's systems and other objects in space.

Technology Profile PK-2

Benchmark 4.1

Describe and give examples of Earth's changing features.

- Identify basic landforms (e.g., mountain, river, hill, ocean, lake, valley, volcano)

 10

Benchmark 4.2

Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)

- Recognize the importance of air and water to living things

 10

Benchmark 4.3

Investigate fossils and make inferences about life and the environment long ago.

- Introduce prehistoric life through investigation of fossils.

Benchmark 4.4

Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured.

- Observe, discuss and record weather
- Observe the water cycle

 8 and 10

Benchmark 4.5

Identify seasons and explain the differences between weather and climate.

- Observe and record physical changes due to the seasons

 8

Benchmark 4.6

Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the sun.

- Explore the relationship between the Sun, Moon and Earth and include evidence of the Sun as a source of light and heat.
- Explore the differences between night and day.

 10

Benchmark 4.7

Identify technology and methods used for space exploration (e.g. star patterns, space shuttles, telescopes)

- Identify types of technology to observe objects in space (e.g., telescopes)

 9

Helena Public Schools
Teacher Resource Guide
Grade 1 – Science

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

Technology Profile PK-2

Benchmark 5.1 9
Describe and discuss examples of how people use science and technology
- Explore how science and technology are used within the community

Benchmark 5.2 9
Identify a scientific or technological innovation that benefits the community.
- Discuss a scientific or technological innovation that has benefited the community

Benchmark 5.3 4
Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.
- Collaborate in a group to perform a simple investigation.

Benchmark 5.4 2
Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management).
- Describe the need for conservation of the environment.

Benchmark 5.5 5
Identify how the knowledge of science and technology influences the development of the Montana American Indian Cultures.
- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.

Helena Public Schools
Teacher Resource Guide
Grade 1 – Science

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

Technology Profile PK-2

Benchmark 6.1

Give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples

Benchmark 6.2

Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe

- Ask questions relating to specific scientific knowledge.

Benchmark 6.3

Describe science as a human endeavor and an ongoing process.

- Identify that everyone can do science.

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

Content Standard 1

Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate and communicate the results and form reasonable conclusions of scientific investigations.

Technology Profile PK-2

Benchmark 1.1

Develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied) (a) asking questions about objects, events, and organisms in the environment, (b) planning and concluding simple investigations.

 7 and 8

- Through teacher-directed scientific investigations, students begin to identify variables.
- Develop respect for classroom equipment and safe laboratory procedures.

Benchmark 1.2

Select and accurately use appropriate tools to measure in SI units (metric), process and analyze results of a basic scientific investigation.

 2 and 8

- Demonstrate correct use of measurement tools.

Benchmark 1.3

Represent, communicate and provide supporting evidence of scientific investigations.

 1, 3, and 9

- Communicate scientific data via illustrations, verbal discussions and written form.

Benchmark 1.4

Construct models that illustrate simple concepts and compare those models to what they represent.

 1 and 6

- Construct a model to illustrate a simple concept (at developmentally appropriate level)

Benchmark 1.5

Identify a valid test in an investigation

 4

- Discuss and illustrate the results from a controlled experiment.

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

Content Standard 2

Students through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical systems.

Technology Profile PK-2

Benchmark 2.1

Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).

- Identify patterns of mixtures based on different properties.

Benchmark 2.2

Examine, measure, describe, compare and classify tangible objects in terms of common physical properties.

- Compare tangible objects in terms of common physical properties.

Benchmark 2.3

 8

Describe the basic characteristics of light, heat, magnetism and sound.

- Observe and describe basic characteristics of sound.

Benchmark 2.4

 8

Model and explain that matter exists as solids, liquids and gases and can change from one form to another.

- Classify and record properties of matter.

Benchmark 2.5

Identify and predict what changes and what remain unchanged when matter experiences an external influence.

- Identify patterns that occur when external forces are applied to matter.

Benchmark 2.6

Identify, build, and describe mechanical systems (e.g. simple and complex machines).

Benchmark 2.7

 8

Observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic.

- Observe, measure and manipulate sound energy (e.g., louder, softer, pitch-level)

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

Content Standard 3

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

Technology Profile PK-2

Benchmark 3.1 — 8

Identify that plants and animals have structures and systems, which serve different functions

- Distinguish the differences between plants and animals.
- Investigate the structure of plants.

Benchmark 3.2 — 10

Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism.

- Discuss the need of proper nutrition for energy and growth.

Benchmark 3.3 — 6 and 8

Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.

- Recognize and identify the different stages of development in the life cycles of plants and animals.

Benchmark 3.4 — 8

Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including indentifying differences between inherited, instinctual, and learned behaviors

- Observe, identify and classify selected animals with respect to characteristics and habits.

Benchmark 3.5 — 8

Create and use a classification system to groups a variety of plants and animals according to their similarities and differences.

- Observe, identify and classify selected plants with respect to characteristics and habitat.

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

Content Standard 4 Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of the Earth's systems ad other objects in space.	Technology Profile PK-2
Benchmark 4.1 **Describe and give examples of Earth's changing features.** • Explore and compare features of Earth.	 10
Benchmark 4.2 **Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)** • Explore natural resources	 10
Benchmark 4.3 **Investigate fossils and make inferences about life and the environment long ago.** • Develop an understanding of prehistoric life.	 5
Benchmark 4.4 **Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured.** • Explore influences of weather on the environment.	 8 and 10
Benchmark 4.5 **Identify seasons and explain the differences between weather and climate.** • Identify and describe weather conditions typical of various seasons across the country.	 10
Benchmark 4.6 **Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the sun.** • Identify relationships of the Sun, Moon and planets.	 10
Benchmark 4.7 **Identify technology and methods used for space exploration (e.g. star patterns, space shuttles, telescopes)** • Discuss current technology for space exploration (e.g., space shuttle, telescope)	 9 and 10

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

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

Technology Profile PK-2

Benchmark 5.1
Describe and discuss examples of how people use science and technology
- Discuss the benefits of using science and technology.

9

Benchmark 5.2
Identify a scientific or technological innovation that benefits the community.
- Explain how technological innovations impact their lives.

9

Benchmark 5.3
Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.
- Begin to record and share scientific investigations in cooperative groups.

4

Benchmark 5.4
Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management).
- Develop ideas for conservation of the environment.

2

Benchmark 5.5
Identify how the knowledge of science and technology influences the development of the Montana American Indian Cultures.
- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.

5

Helena Public Schools
Teacher Resource Guide
Grade 2 – Science

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

Technology Profile PK-2

Benchmark 6.1

Give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples

- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.

5

Benchmark 6.2

Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe

- Explore the development of inventions over time.

5 and 10

Benchmark 6.3

Describe science as a human endeavor and an ongoing process.

- Identify examples as a human process.

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

Content Standard 1

Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate and communicate the results and form reasonable conclusions of scientific investigations.

Technology Profile PK-2

Benchmark 1.1

Develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied) (a) asking questions about objects, events, and organisms in the environment, (b) planning and concluding simple investigations.

 6 and 8

- Conduct a simple experiment, identify the variables, and record data (with some teacher direction)
- Develop respect for classroom equipment and safe laboratory procedures.

Benchmark 1.2

Select and accurately use appropriate tools to measure in SI units (metric), process and analyze results of a basic scientific investigation.

 4

- Accurately select and use tools for simple measurement.

Benchmark 1.3

Represent, communicate and provide supporting evidence of scientific investigations.

- Communicate scientific data with supporting evidence.

Benchmark 1.4

Construct models that illustrate simple concepts and compare those models to what they represent.

 6

- Construct a model to illustrate a simple concept (at developmentally appropriate level)

Benchmark 1.5

Identify a valid test in an investigation

 2

- Discuss, illustrate and use written form to communicate results form a controlled experiment.

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

 9

- Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

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

Technology Profile PK-2

Benchmark 2.1 — 6

Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).

- Experiment and predict outcomes of mixtures based on different properties.

Benchmark 2.2 — 4

Examine, measure, describe, compare and classify tangible objects in terms of common physical properties.

- Classify tangible objects in terms of common physical properties.

Benchmark 2.3 — 4

Describe the basic characteristics of light, heat, magnetism and sound.

- Investigate sound vibrations and pitch.
- Investigate properties of light.
- Investigate characteristics of magnets.

Benchmark 2.4 — 4

Model and explain that matter exists as solids, liquids and gases and can change from one form to another.

- Analyze differences of matter, and explain how matter changes.

Benchmark 2.5 — 4

Identify and predict what changes and what remain unchanged when matter experiences an external influence.

- Analyze the effects of external forces on matter and interpret the data.

Benchmark 2.6 — 7

Identify, build, and describe mechanical systems (e.g. simple and complex machines).

- Identify and describe a simple machine.

Benchmark 2.7

Observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic.

- See benchmark 2.3

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

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

Technology Profile PK-2

Benchmark 3.1
Identify that plants and animals have structures and systems, which serve different functions
- Identify the parts of plants and the function of each of the parts.

2 and 7

Benchmark 3.2
Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism.
- Describe food groups and their effect on human body systems.

7

Benchmark 3.3
Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.
- Analyze and discuss the different stages of development in the life cycle of plants.

6

Benchmark 3.4
Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including indentifying differences between inherited, instinctual, and learned behaviors
- Explore the characteristics and adaptations of plants and animals in relationship to their environments.

6 and 7

Benchmark 3.5
Create and use a classification system to groups a variety of plants and animals according to their similarities and differences.
- Observe, identify and classify selected plants with respect to characteristics and habitat.

2 and 7

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

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

Technology Profile PK-2

Benchmark 4.1
Describe and give examples of Earth's changing features.
- Investigate the effects of natural forces on the Earth's surface.

 7

Benchmark 4.2
Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)
- Discuss the properties of water and soil.

 6

Benchmark 4.3
Investigate fossils and make inferences about life and the environment long ago.
- Investigate the importance of conserving fossil fuels.

 3 and 5

Benchmark 4.4
Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured.
- Observe and record weather data.
- Investigate the components of the water cycle.

 6 and 7

Benchmark 4.5
Identify seasons and explain the differences between weather and climate.
- Explain the difference between weather and climate.
- Discuss seasonal changes.

Benchmark 4.6
Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the sun.
- Investigate the relationship between the Earth, Moon, and Sun.

 7

Benchmark 4.7
Identify technology and methods used for space exploration (e.g. star patterns, space shuttles, telescopes)
- Identify current technology for space exploration and its impact.

 5

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

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

Technology Profile PK-2

Benchmark 5.1
Describe and discuss examples of how people use science and technology
- Research the benefit of using science and technology.

9

Benchmark 5.2
Identify a scientific or technological innovation that benefits the community.
- Identify a scientific or technological innovation that benefits the community.

9

Benchmark 5.3
Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.
- Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.

6

Benchmark 5.4
Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management).
- Investigate how humans affect the environment in which the live.

3

Benchmark 5.5
Identify how the knowledge of science and technology influences the development of the Montana American Indian Cultures.
- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.

9

Helena Public Schools
Teacher Resource Guide
Grade 3 – Science

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

Technology Profile PK-2

Benchmark 6.1

Give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples

 9

- Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.

Benchmark 6.2

Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe

 9

- Identify how inventions have impacted the world.

Benchmark 6.3

Describe science as a human endeavor and an ongoing process.

- Identify examples of science as an on-going process.

Helena Public Schools
Teacher Resource Guide
Grade 4 – Science

Content Standard 1

Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate and communicate the results and form reasonable conclusions of scientific investigations.

Technology Standards / Benchmarks

Benchmark 1.1

Develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied) (a) asking questions about objects, events, and organisms in the environment, (b) planning and concluding simple investigations.

- Develop the abilities to safely conduct scientific inquiry, including (a step-by-step sequence in not implies) (a) asking questions about objects, events and organisms in the environment, (b) planning and conducting simple investigations.

 6

Benchmark 1.2

Select and accurately use appropriate tools to measure in SI units (metric), process and analyze results of a basic scientific investigation.

- Select and accurately use appropriate equipment and technology to measure SI units, gather process and analyze data from a scientific investigation (e.g., rulers, scales, thermometer, stop watch etc.)

 6

Benchmark 1.3

Represent, communicate and provide supporting evidence of scientific investigations.

- Represent (with graphs, charts, and diagrams), communicate, and provide supporting evidence of scientific investigations.

 4 and 5

Benchmark 1.4

Construct models that illustrate simple concepts and compare those models to what they represent.

- Construct models to illustrate simple concepts and compare those models to what they represent (scale, legend, key)

 7

Benchmark 1.5

Identify a valid test in an investigation

- Identify a valid test in an investigation

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 4 – Science

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

Technology Standards / Benchmarks

Benchmark 2.1
Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).
- Create mixtures and separate them based on different properties (e.g. salt and sand, iron filings and soil, oil and water).

Benchmark 2.2
Examine, measure, describe, compare and classify tangible objects in terms of common physical properties.
- Examine, measure, describe, compare, and classify tangible objects in terms of common physical properties.

4 and 6

Benchmark 2.3
Describe the basic characteristics of light, heat, magnetism and sound.
- Describe, compare / contrast, model basic characteristics of light, heat, magnetism and sound

7

Benchmark 2.4
Model and explain that matter exists as solids, liquids and gases and can change from one form to another.
- Model and explain that matter exists as solids, liquids, and gases and can change from one form to another

2 and 7

Benchmark 2.5
Identify and predict what changes and what remain unchanged when matter experiences an external influence.
- Identify and predict what changes and what remains unchanged when matter experiences an external influence

Benchmark 2.6
Identify, build, and describe mechanical systems (e.g. simple and complex machines).

- Identify, build and describe mechanical systems (e.g., simple and complex machines)

Benchmark 2.7
Observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic.
- Observe, measure and manipulate forms of energy: sound, light, heat, magnetic.

6

Helena Public Schools
Teacher Resource Guide
Grade 4 – Science

Content Standard 3 Students, through the inquiry process, demonstrate knowledge of characteristics, structures and functions of living things, the process and diversity of life, and how living organisms interact with each other and their environment.	Technology Standards / Benchmarks
Benchmark 3.1 **Identify that plants and animals have structures and systems, which serve different functions** • Identify that plants and animals have structures and systems, which serve different functions.	 2
Benchmark 3.2 **Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism.** • Identify, measure and describe basic requirements of energy needed and nutritional needs for an organism. • Compare / contrast food webs and food chains.	 5 and 7
Benchmark 3.3 **Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.** • Describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species.	
Benchmark 3.4 **Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including identifying differences between inherited, instinctual, and learned behaviors** • Explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including identifying differences between inherited, instinctual, and learned behaviors.	 4, 6, and 7
Benchmark 3.5 **Create and use a classification system to groups a variety of plants and animals according to their similarities and differences.** • Create and use a classification system to group a variety of plants and animals according to their similarities and differences.	 4

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Teacher Resource Guide
Grade 4 – Science

Content Standard 4 Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of the Earth's systems and other objects in space.	Technology Standards / Benchmarks
Benchmark 4.1 **Describe and give examples of Earth's changing features.** • Describe and give examples of Earth's changing features (e.g., erosion, weathering, volcanoes, glaciers etc.)	 2 and 4
Benchmark 4.2 **Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)** • Describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases)	 6 and 7
Benchmark 4.3 **Investigate fossils and make inferences about life and the environment long ago.** • Investigate fossils and make inferences about life and the environment long ago.	
Benchmark 4.4 **Observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured.** • Observe record and describe the water cycle and the local weather and demonstrate how weather conditions are measured.	 6 and 7
Benchmark 4.5 **Identify seasons and explain the differences between weather and climate.** • Identify seasons and explain the differences between weather and climate.	
Benchmark 4.6 **Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the sun.** • Describe objects in the sky and their pattern of movement and explain that light and heat come from a star called the Sun.	 2 and 7
Benchmark 4.7 **Identify technology and methods used for space exploration (e.g. star patterns, space shuttles, telescopes)**	

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Grade 4 – Science

Content Standard 5 **Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.**	Technology Standards / Benchmarks
Benchmark 5.1 **Describe and discuss examples of how people use science and technology** • Describe and discuss examples of how people use science and technology.	9
Benchmark 5.2 **Identify a scientific or technological innovation that benefits the community.** • Identify a scientific or technological innovation that benefits the community.	9
Benchmark 5.3 **Model scientific collaboration by sharing and communicating ideas and solutions in a variety of cooperative settings.** • Model scientific collaboration by sharing and communicating ideas and solutions about a local current event / problem in a variety of cooperative settings.	1
Benchmark 5.4 **Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management).** • Use current scientific knowledge to make inferences and propose solutions for local environmental problems (recycling, waste management)	5
Benchmark 5.5 **Identify how the knowledge of science and technology influences the development of the Montana American Indian Cultures.** • Identify how the knowledge of science and technology influences the development of the Montana American Indian cultures.	

Helena Public Schools
Teacher Resource Guide
Grade 4 – Science

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

Technology Standards / Benchmarks


9

Benchmark 6.1

Give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples

- Give historical examples of scientific and technological contributions to communities, cultures, and societies, including Montana American Indian examples.

Benchmark 6.2

Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe

- Describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe.

Benchmark 6.3

Describe science as a human endeavor and an ongoing process.

- Describe science occupations and the benefits.

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

Content Standard 1
Students, through the inquiry process, design, conduct, evaluate and communicate scientific investigations

Technology Profiles 3-5

Benchmark 1.1

Identify a question, formulate hypothesis, control and manipulate variables, devise and safely conduct experiments, predict outcomes and analyze results.

 6

- Recognize and select a testable question to plan and design an investigation
- Identify manipulated variables, dependent and independent
- Identify relationship between a testable question and hypothesis
- Develop respect for classroom equipment and use safe laboratory procedures

Benchmark 1.2

Select and accurately use appropriate equipment and technology to measure in (SI units), gather, process and analyze data from a scientific investigation

 4

- Use the metric system to measure length, mass, volume, density, weight, and temperature
- Use SI units to collect data measure, and draw conclusion

Benchmark 1.3

Communicate and defend results of investigations; question results of investigations if different from predicted

 4

- Incorporate process skills and scientific methods to explain scientific investigations based upon gathered evidence.

Benchmark 1.4

Create models to illustrate scientific concepts and use the model to predict change (e.g., computer simulation, a stream table graphic representation)

 2

- Construct models to illustrate simple concepts and discover relationships

Benchmark 1.5

Distinguish between controlled and uncontrolled experiments by consistency of results.

- Identify and communicate results of controlled experiments

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Identify how observations of nature form an essential base of knowledge among Montana American Indians.

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

Content Standard 2

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

Technology Profiles 3-5

Benchmark 2.1

Classify, describe, and model matter in terms of elements, compounds, mixtures, atoms and molecules

 2, 4 and 7

- Construct a simple model of an atom
- Examine the parts of an atom (protons, neutrons and electrons) and their respective electrical charge.
- Investigate properties of molecules and compounds

Benchmark 2.2

Examine, measure, describe, compare and classify objects and substances based on common physical properties and simple chemical properties

 4 and 7

- Classify rocks and mineral according to the characteristic properties of the substance
- Examine chemical properties of minerals and crystals

Benchmark 2.3

Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves

 4 and 6

- Define energy and apply Newton's Laws of Motion
- Compare and contrast different forms of energy

Benchmark 2.4

Model and explain that states of matter, solids, liquids and gases, are dependent upon the quantity of energy present in the system.

- Identify solids, liquids and gases using simple atoms and compounds

Benchmark 2.5

Describe and explain the motion of an object in terms of its position, direction, and speed as well as the forces acting within those systems

 6

- Identify how objects move relative to their position

Benchmark 2.6

Identify, build, and describe, measure, and analyze mechanical systems (e.g. simple and complex machines).

- Build and describe a simple or complex machine

Benchmark 2.7

Give examples and describe how energy is conserved (e.g., electric to light and heat (fuel to propulsion))

 2 and 6

- Show how energy can change forms

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

Content Standard 3

Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact wit each other and their environment

Technology Profiles 3-5

Benchmark 3.1

Compare 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

 2

- Investigate the structure of plant and animal cells
- Describe structures and functions of plant and animal cells and their components

Benchmark 3.2

Explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions and how they respond to stimuli (e.g., food webs, photosynthesis, respiration)

 2

- Investigate plant systems (e.g., photosynthesis)
- Investigate body systems (e.g., sensory, skeletal, circulatory, digestive, respiratory, nervous or muscular)

Benchmark 3.3

Communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., punnett squares)

 2 and 6

- Investigate differences between reproductive processes in plants
- Discuss the reproductive principles in animals

Benchmark 3.4

Investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving

 2 and 6

- Identify the structure and function of various systems of living organisms
- Discuss human impact on the environment

Benchmark 3.5

Use a basic classification scheme to identify plants and animals

 2 and 6

- Describe differences between one-celled and multi-celled organisms.

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

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.

Technology Profiles 3-5

Benchmark 4.1

Model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics and constructive and destructive forces

- Classify rocks and minerals according to the characteristics of the substance
- Examine chemical properties of minerals and crystals

Benchmark 4.2

 2

Differentiate between rock types and mineral types and classify both by how they are formed and the utilization by humans

- Classify rocks and minerals according to the characteristic properties of the substance

Benchmark 4.3

 7

Use fossils to describe the geological timeline

- Use fossils to describe the geological timeline
- Describe how relative age of fossils can be determined from their position in sedimentary rock layers.

Benchmark 4.4

 7

Describe the water cycle, the composition and structure of the atmosphere and the impact of oceans on large-scale weather patterns.

- Describe the water cycle, the composition and structure of the atmosphere and the impact of oceans on large-scale weather patterns.

Benchmark 4.5

Describe and model the motion and tilt of Earth in relation to the Sun, and explain the concept of day, night, seasons, year, and climatic change

Benchmark 4.6

Describe the Earth, Moon, planets and other objects in space in terms of size, structure, and movements in relation to the Sun.

Benchmark 4.7

Identify scientific theories about the origin and evolution of the Earth and solar system.

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

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

Technology Profiles 3-5

Benchmark 5.1 — 1 and 2

Identify the specific fields of scientific endeavor and related occupations within those fields.

- Explore scientific careers and opportunities in science.

Benchmark 5.2 — 3, 5, and 9

Apply Scientific knowledge and process skills to understand issues and everyday events.

- Use scientific knowledge to discuss issues (e.g., air, land, and water pollution, recycling to conserve resources, reusing, reducing waste, etc.)

Benchmark 5.3 — 7

Model collaborative problem solving and give examples of how scientific knowledge is shared, critiqued, and scrutinized by other scientists and the public

- Use group process to conduct scientific investigations

Benchmark 5.4 — 5 and 9

Investigate local problems and / or issues and propose solutions or products that address a need, which considers variables (e.g., environmental risks)

- Identify community connections with scientific investigations

Benchmark 5.5 — 9

Describe how the knowledge of science and technology influences the development of the Montana American Indian Cultures.

- Describe how the knowledge of science and technology influences the development of the Montana Indian cultures

Helena Public Schools
Teacher Resource Guide
Grade 5 – Science

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

Technology Profiles 3-5

Benchmark 6.1

Give examples of scientific discoveries and describe the interrelationship between technological advances and scientific understanding, including Montana American Indian examples

 1 and 9

- Give examples of scientific discoveries and describe the interrelationship between technological contributions to communities, cultures, and societies, including Montana American Indian examples.

Benchmark 6.2

Identify major milestones in science that have impacted science, technology and society

 9

- Recognize scientific discoveries and their impact on society

Benchmark 6.3

Describe and explain science as a human endeavor and an ongoing process

 9

- Recognize scientific discoveries and their impact on society

Helena Public Schools
Science

Grades 6-8
Curriculum

Benchmarks without a bullet are addressed at other grade levels.

Helena Public Schools
Teacher Resource Guide
Grade 6 – Science

Content Standard 1
Students, through the inquiry process, design, conduct, evaluate and communicate scientific investigations

Technology Profile 6-8

Benchmark 1.1

Identify a question, formulate hypothesis, control and manipulate variables, devise and safely conduct experiments, predict outcomes and analyze results.

 3

- Explain the goal and use scientific method
- List important safety precautions to follow in a science laboratory

Benchmark 1.2

Select and accurately use appropriate equipment and technology to measure in (SI units), gather, process and analyze data from a scientific investigation

 3, 6 and 9

- Identify and compare the metric units used to measure length, mass, volume, density, weight, and temperature
- Explain the role of scientific tools in the study of science
- Use information to prepare data sheets, charts, and graphs

Benchmark 1.3

Communicate and defend results of investigations; question results of investigations if different from predicted

- Incorporate scientific method and explain scientific experiments based upon gathered evidence.

Benchmark 1.4

 1 and 9

Create models to illustrate scientific concepts and use the model to predict change (e.g., computer simulation, a stream table graphic representation)

- Create visuals to identify fossil fuels and their uses
- Discuss other forms of energy resources, including alternative sources of energy

Benchmark 1.5

Distinguish between controlled and uncontrolled experiments by consistency of results.

- Identify a variable in setting up a controlled and uncontrolled experiment

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Compare natural observations made by scientists to those made by Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 6 – Science

Content Standard 2

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

Technology Profile 6-8

Benchmark 2.1

Classify, describe, and model matter in terms of elements, compounds, mixtures, atoms and molecules

 1

- Classify matter as elements, compounds, solutions, or mixtures
- Describe the structure of the atom

Benchmark 2.2

Examine, measure, describe, compare and classify objects and substances based on common physical properties and simple chemical properties

- Explain the role of chemical cycles in nature
- Explain and give examples of chemical properties and chemical changes

Benchmark 2.3

 7

Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves

- Describe the forces between electric charges and the atomic basis of electric charges
- Identify the effects of static electricity
- Define voltage, current and resistance, and apply these concepts to circuit situations
- Identify the development and operations of technology in our society

Benchmark 2.4

 1

Model and explain that states of matter, solids, liquids and gases, are dependent upon the quantity of energy present in the system.

- Explain and give examples of physical properties, and physical and chemical changes

Benchmark 2.5

 9

Describe and explain the motion of an object in terms of its position, direction, and speed as well as the forces acting within those systems

- Identify Newton's Laws of Motion

Benchmark 2.6

 1

Identify, build, and describe, measure, and analyze mechanical systems (e.g. simple and complex machines).

- Build a complex machine and explain how it works

Benchmark 2.7

 1

Give examples and describe how energy is conserved (e.g., electric to light and heat (fuel to propulsion))

- Describe the Law of Conservation of Energy
- Demonstrate how energy is transferred

Helena Public Schools
Teacher Resource Guide
Grade 6 – Science

Content Standard 3 Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact wit each other and their environment	Technology Profile 6-8
Benchmark 3.1 **Compare 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** • Describe the basic characteristics of l living things • Describe the structures and functions of plant and animal cells and their parts	1
Benchmark 3.2 **Explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions and how they respond to stimuli (e.g., food webs, photosynthesis, respiration)** • Investigate plant and animal systems (e.g., photosynthesis, respiration) • Identify the characteristics of the six land biomes and the two water biomes • Describe food chains, food webs, and energy pyramids	1 and 9
Benchmark 3.3 **Communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., punnett squares)** • Describe interactions and relationships between living things • Discuss the reasons for the extinction of organisms	1 and 9
Benchmark 3.4 **Investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving** • Identify the structure and function of various systems of living organisms • Relate land biomes of the western hemisphere to their climates	7
Benchmark 3.5 **Use a basic classification scheme to identify plants and animals** • Identify the ecological relationships of plants and animals in their local biome	7

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Grade 6 – Science

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.

Technology Profile 6-8

Benchmark 4.1


1, 2 and 9

Model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics and constructive and destructive forces

- Describe and explain the motion of the Earth's crust
- Describe the formation of mountains, plateaus, and domes
- Describe what occurs during earthquakes
- Describe the types of volcanoes and state the location of major zones of volcanic activity
- List the major lithopheric plates
- Discuss the theory of continental drift, ocean floor spreading, and plate tectonics

Benchmark 4.2


1 and 9

Differentiate between rock types and mineral types and classify both by how they are formed and the utilization by humans

- Identify and describe minerals
- Describe the uses of minerals
- Describe rocks and the three basic types of rock
- Explain the rock cycle
- Identify the factors that cause erosion and deposition

Benchmark 4.3


1 and 9

Use fossils to describe the geological timeline

- List the major lithopheric plates
- Discuss the theory of continental drift, ocean floor spreading, and plate tectonics

Benchmark 4.4


1, 7 and 9

Describe the water cycle, the composition and structure of the atmosphere and the impact of oceans on large-scale weather patterns.

- Describe the impact of air pressure, wind, and humidity on the weather
- Describe how fronts affect weather patterns
- Explain the process of predicting weather
- Differentiate between weather and climate
- Identify characteristics of Earth's climate zones
- Detail the impact of climate change on organisms
- Describe the varying climates of regions in the western hemisphere

Content Standard 4 - Continued

Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space.

Technology Profile 6-8

Benchmark 4.5

 1 and 9

Describe and model the motion and tilt of Earth in relation to the Sun, and explain the concept of day, night, seasons, year, and climatic change

- Relate the tilt of the Earth's axis and its position in reference to the Sun, Earth's seasons, and the length of days

Benchmark 4.6

 1, 7 and 9

Describe the Earth, Moon, planets and other objects in space in terms of size, structure, and movements in relation to the Sun.

- Describe the characteristics of stars, star systems, and galaxies
- Relates the starting mass of a star to its life cycle
- Apply theories regarding the formation of the solar system to the characteristics of the planets and other objects in the solar system
- Discuss the characteristics of the Earth and its moon
- Identify the interactions that occur among the Earth, its Moon, and the Sun

Benchmark 4.7

 8

Identify scientific theories about the origin and evolution of the Earth and solar system.

- Identify theories about the origin of the universe.

Helena Public Schools
Teacher Resource Guide
Grade 6 – Science

Content Standard 5
Students understand how scientific knowledge and technological developments impact society.

Technology Profile 6-8

Benchmark 5.1
Identify the specific fields of scientific endeavor and related occupations within those fields.
- Explore scientific careers

4

Benchmark 5.2
Apply scientific knowledge and process skills to understand issues and everyday events.
- Investigate ways of preventing air and water pollution
- Recognize the need for recycling to conserve resources and to help prevent pollution
- Name non-living natural resources of land, soil, water, and minerals and label them as renewable or nonrenewable resources

1 and 2

Benchmark 5.3
Model collaborative problem solving and give examples of how scientific knowledge is shared, critiqued, and scrutinized by other scientists and the public
- Consider methods for managing land resources

2 and 3

Benchmark 5.4
Investigate local problems and / or issues and propose solutions or products that address a need, which considers variables (e.g., environmental risks)
- Identify sources of air, land, and water pollution
- Identify fossil fuels and their uses

2

Benchmark 5.5
Describe how the knowledge of science and technology influences the development of the Montana American Indian Cultures.
- Describe how the knowledge of science and technology influences the development of the Montana Indian cultures

Helena Public Schools
Teacher Resource Guide
Grade 6 – Science

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

Technology Profile 6-8

Benchmark 6.1

Give examples of scientific discoveries and describe the interrelationship between technological advances and scientific understanding, including Montana American Indian examples

 8

- Give examples of scientific discoveries and describe the interrelationship between technological contributions to communities, cultures, and societies, including Montana American Indian examples.

Benchmark 6.2

Identify major milestones in science that have impacted science, technology and society

 1 and 9

- Trace the development of mankind's quest for space exploration
- Recognize the need for recycling to conserve resources to help prevent pollution

Benchmark 6.3

Describe and explain science as a human endeavor and an ongoing process

- Trace the development of mankind's quest for space exploration

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

Content Standard 1
Students, through the inquiry process, design, conduct, evaluate and communicate scientific investigations

Technology Profile 6-8

Benchmark 1.1

Identify a question, formulate hypothesis, control and manipulate variables, devise and safely conduct experiments, predict outcomes and analyze results.

- Explain the goal and use scientific method and use the steps in the scientific method
- Demonstrate the use of proper laboratory safety procedures
- Apply the scientific method to problem solving situations

6 and 3

Benchmark 1.2

Select and accurately use appropriate equipment and technology to measure in (SI units), gather, process and analyze data from a scientific investigation

- Use the metric system to measure length, mass, volume, density, weight, and temperature
- Use scientific tools and techniques in the study of science (e.g., microscope)
- Integrate math and science by using probability, the metric system, and graphing to solve science problems

7

Benchmark 1.3

Communicate and defend results of investigations; question results of investigations if different from predicted

- Analyze scientific results suing various methods of scientific research

3 and 6

Benchmark 1.4

Create models to illustrate scientific concepts and use the model to predict change (e.g., computer simulation, a stream table graphic representation)

- Use probability problems to predict genetic outcomes

1

Benchmark 1.5

Distinguish between controlled and uncontrolled experiments by consistency of results.

- Develop controls and variable in experiments

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

- Using literature from Montana American Indians apply information to nature

8

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

Content Standard 2

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

Technology Profile 6-8

Benchmark 2.1

Classify, describe, and model matter in terms of elements, compounds, mixtures, atoms and molecules

 1 and 9

- Relate organic compounds to biological systems

Benchmark 2.2

Examine, measure, describe, compare and classify objects and substances based on common physical properties and simple chemical properties

Benchmark 2.3

Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves

Benchmark 2.4

 1, 7 and 9

Model and explain that states of matter, solids, liquids and gases, are dependent upon the quantity of energy present in the system.

- Explain the role of photosynthesis and respiration as related to energy in natural systems

Benchmark 2.5

Describe and explain the motion of an object in terms of its position, direction, and speed as well as the forces acting within those systems

Benchmark 2.6

Identify, build, and describe, measure, and analyze mechanical systems (e.g. simple and complex machines)

Benchmark 2.7

 1

Give examples and describe how energy is conserved (e.g., electric to light and heat (fuel to propulsion))

- Describe how energy is transformed in the human body
- Describe how energy is used and transferred in plant and animal cells

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

Content Standard 3

Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact wit each other and their environment

Technology Profile 6-8

Benchmark 3.1

 1 and 9

Compare 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

- Explain the cell theory
- Describe the structures and activities of cells
- Identify the parts of a virus, protists, fungi, plants, and animal cells
- Identify the forms and functions of micro-organisms
- Identify the parts of bacterium and classify bacteria
- List the characteristics of protists fungi, plants and animal cells
- Classify cells by using examples of cells structures and give examples of sarcodines, ciliates, flagellates, and sporozoans

Benchmark 3.2

 1, 3, and 9

Explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions and how they respond to stimuli (e.g., food webs, photosynthesis, respiration)

- Compare vascular and nonvascular plants
- Describe the characteristics and structures of plants and animals
- Identify the factors that affect plant growth
- Describe photosynthesis and compare to respiration
- Compare invertebrates and vertebrates
- Describe the characteristics of six groups of invertebrates and classify organisms using those characteristics
- Compare cold-blooded and warm-blooded vertebrates
- Identify the characteristics and needs of living things
- Describe the processes and basic chemistry of organisms
- Use comparative anatomy in a laboratory setting to examine representative organisms, i.e., earthworm, crayfish, grasshopper, perch, frog, and fetal pig
- Identify and classify the levels of organization found in living systems
- Describe the features and functions of the human body

Benchmark 3.3

 1 and 9

Communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., punnett squares)

- Explain how traits are inherited on the basis of genetics, cell structure and probability theory
- Describe DNA structure and replication
- Identify certain genetic traits found in living systems
- Explain practical application of genetics
- Describe mutations and their contributions to the process of natural selection

Content Standard 3 - Continued

Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact wit each other and their environment

Technology Profile 6-8

Benchmark 3.4

 1, 3 and 9

Investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving

- Analyze the reasons for the extinction of organisms
- Define ecology and explain various components of ecosystems
- Describe the interactions and relationships between living things
- Describe and analyze the process of ecological succession
- Investigate nonliving natural resource of land, soil, water, and minerals and label them as renewable or nonrenewable resources as how they are affected by human interaction

Benchmark 3.5

 1 and 9

Use a basic classification scheme to identify plants and animals

- Describe the five levels of organization of living things
- Explain how living things are classified
- Classify plants and animals into groups and compare their characteristics
- Identify samples of local flora and fauna

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

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.

Technology Profile 6-8

Benchmark 4.1

Model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics and constructive and destructive forces

Benchmark 4.2

Differentiate between rock types and mineral types and classify both by how they are formed and the utilization by humans

 1 and 9

Benchmark 4.3

Use fossils to describe the geological timeline

- Identify fossils

Benchmark 4.4

Describe the water cycle, the composition and structure of the atmosphere and the impact of oceans on large-scale weather patterns.

 5

- Identify man-made chemicals that display an adverse effect upon natural cycles
- Describe the importance of the water-cycle as it applies to living systems

Benchmark 4.5

Describe and model the motion and tilt of Earth in relation to the Sun, and explain the concept of day, night, seasons, year, and climatic change

 4

- Discuss the effects of seasonal changes in relationship to biological systems

Benchmark 4.6

Describe the Earth, Moon, planets and other objects in space in terms of size, structure, and movements in relation to the Sun.

Benchmark 4.7

Identify scientific theories about the origin and evolution of the Earth and solar system.

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

Content Standard 5
Students understand how scientific knowledge and technological developments impact society.

Technology Profile 6-8

Benchmark 5.1
Identify the specific fields of scientific endeavor and related occupations within those fields.
- Explore contributions of scientist and career opportunities in science

4

Benchmark 5.2
Apply Scientific knowledge and process skills to understand issues and everyday events.
- Identify source of air, land, and water pollution and ways of preventing or remediating
- Recognize the need for recycling to conserve resources
- Discuss the reason for the extinction of organisms

3, 7 and 8

Benchmark 5.3
Model collaborative problem solving and give examples of how scientific knowledge is shared, critiqued, and scrutinized by other scientists and the public

Benchmark 5.4
Investigate local problems and / or issues and propose solutions or products that address a need, which considers variables (e.g., environmental risks)
- Define ecology and explain various components of ecosystems
- Describe food chains, food webs, and energy pyramids
- Identify fossil fuels and their uses
- Analyze recycling to conserve resources as it impacts society

3

Benchmark 5.5
Describe how the knowledge of science and technology influences the development of the Montana American Indian Cultures.
- Describe how the knowledge of science and technology influences the development of the Montana Indian cultures

Helena Public Schools
Teacher Resource Guide
Grade 7 – Science

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

Technology Profile 6-8

Benchmark 6.1

Give examples of scientific discoveries and describe the interrelationship between technological advances and scientific understanding, including Montana American Indian examples

- Give examples of scientific discoveries and describe the interrelationship between technological contributions to communities, cultures, and societies, including Montana American Indian examples.

5 and 7

Benchmark 6.2

Identify major milestones in science that have impacted science, technology and society

- Identify major contributions, theories, equipment and events in the advancement of biological sciences (i.e., cell theory, disease medicine)

9

Benchmark 6.3

Describe and explain science as a human endeavor and an ongoing process

- Identify the major contributions and events in the advancement of life science

9

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

Content Standard 1
Students, through the inquiry process, design, conduct, evaluate and communicate scientific investigations

Technology Profile 6-8

Benchmark 1.1

Identify a question, formulate hypothesis, control and manipulate variables, devise and safely conduct experiments, predict outcomes and analyze results.

- Demonstrate the use of proper laboratory safety procedures
- Apply the scientific method to problem-solving situations
- Design and conduct a scientific investigation

3, 6 and 7

Benchmark 1.2

Select and accurately use appropriate equipment and technology to measure in (SI units), gather, process and analyze data from a scientific investigation

- Utilize basic metric measurements in science and its relationship to the English system
- Distinguish between the concepts of weight, mass, volume, density, linear measurement and temperature
- Compare measurement systems

7

Benchmark 1.3

Communicate and defend results of investigations; question results of investigations if different from predicted

- Use critical thinking skills to present and defend the results of scientific investigations

3 and 5

Benchmark 1.4

Create models to illustrate scientific concepts and use the model to predict change (e.g., computer simulation, a stream table graphic representation)

- Create and analyze graphs and tables for collecting data

1, 3 and 6

Benchmark 1.5

Distinguish between controlled and uncontrolled experiments by consistency of results.

- Apply and relate controls and variables in scientific investigations

Benchmark 1.6

Identify how observations of nature form an essential base of knowledge among the Montana American Indians

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

Content Standard 2

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

Technology Profile 6-8

Benchmark 2.1  1

Classify, describe, and model matter in terms of elements, compounds, mixtures, atoms and molecules

- Interpret the atomic theory of atoms and molecules
- Distinguish between atoms and molecules
- Differentiate among protons, neutrons, and electrons
- Construct models of atoms using structural and empirical formulas i.e. electron dot etc.
- Interpret the periodic table of elements
- Demonstrate the use of the pH scale and a variety of indicators
- Identify the properties of acids, bases and salts
- Distinguish between organic and inorganic compounds

Benchmark 2.2  3

Examine, measure, describe, compare and classify objects and substances based on common physical properties and simple chemical properties

- Distinguish between physical and chemical properties of matter
- Compare and contrast physical and chemical changes
- Describe the physical and chemical properties of common elements

Benchmark 2.3  3 and 6

Define energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves

- Describe and measure static electricity and electric currents
- Demonstrate the difference between series and parallel circuits
- Relate the principles of light and sound
- Relate electricity and magnetism to the production of electricity

Benchmark 2.4  1

Model and explain that states of matter, solids, liquids and gases, are dependent upon the quantity of energy present in the system.

- Explain the law of Conservation of Matter and Energy

Content Standard 2 - Continued

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

Technology Profile 6-8

Benchmark 2.5 — 1 and 7

Describe and explain the motion of an object in terms of its position, direction, and speed as well as the forces acting within those systems

- Describe the nature of measurement of forces
- Apply Newton's three Laws of Motion to practical situations
- Differentiate between kinetic and potential energy
- Demonstrate the application of forces involved in the principles of pressure, buoyancy, and flight

Benchmark 2.6 — 1

Identify, build, and describe, measure, and analyze mechanical systems (e.g. simple and complex machines).

- Describe energy transformations through the application of simple and compound machines
- Differentiate between kinetic and potential energy

Benchmark 2.7 — 1

Give examples and describe how energy is conserved (e.g., electric to light and heat (fuel to propulsion))

- Describe the Law of Conservation of Energy
- Demonstrate how energy is transferred

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

Content Standard 3

Technology Profile 6-8

Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact wit each other and their environment

Benchmark 3.1

Compare 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

Benchmark 3.2

Explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions and how they respond to stimuli (e.g., food webs, photosynthesis, respiration)

Benchmark 3.3

Communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., punnett squares)

Benchmark 3.4

Investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving

Benchmark 3.5

Use a basic classification scheme to identify plants and animals

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

Content Standard 4

Technology Profile 6-8

Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space.

Benchmark 4.1

Model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics and constructive and destructive forces

Benchmark 4.2

Differentiate between rock types and mineral types and classify both by how they are formed and the utilization by humans

Benchmark 4.3

Use fossils to describe the geological timeline

Benchmark 4.4

Describe the water cycle, the composition and structure of the atmosphere and the impact of oceans on large-scale weather patterns.

Benchmark 4.5

Describe and model the motion and tilt of Earth in relation to the Sun, and explain the concept of day, night, seasons, year, and climatic change

Benchmark 4.6

Describe the Earth, Moon, planets and other objects in space in terms of size, structure, and movements in relation to the Sun.

Benchmark 4.7

Identify scientific theories about the origin and evolution of the Earth and solar system.

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

Content Standard 5
Students understand how scientific knowledge and technological developments impact society.

Technology Profile 6-8

Benchmark 5.1
Identify the specific fields of scientific endeavor and related occupations within those fields.

- Investigate the career opportunities in the physical sciences

4

Benchmark 5.2
Apply Scientific knowledge and process skills to understand issues and everyday events.

- Apply technology to the physical sciences, and understand how science and technology affect society
- Recognize the integration of the physical sciences with the other sciences (e.g., life sciences, etc) and other disciplines (e.g., P.E., Art, English, Math, etc)

Benchmark 5.3
Model collaborative problem solving and give examples of how scientific knowledge is shared, critiqued, and scrutinized by other scientists and the public

- Recognize scientific views on energy topics that connect with physical science

2 and 5

Benchmark 5.4
Investigate local problems and / or issues and propose solutions or products that address a need, which considers variables (e.g., environmental risks)

- Analyze local environmental problems and identify variables as they relate to physical science

2

Benchmark 5.5
Describe how the knowledge of science and technology influences the development of the Montana American Indian Cultures.

- Describe how the knowledge of science and technology influences the development of the Montana Indian cultures

Helena Public Schools
Teacher Resource Guide
Grade 8 – Science

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

Technology Profile 6-8

Benchmark 6.1

Give examples of scientific discoveries and describe the interrelationship between technological advances and scientific understanding, including Montana American Indian examples

- Give examples of scientific discoveries and describe the interrelationship between technological contributions to communities, cultures, and societies, including Montana American Indian examples.

5

Benchmark 6.2

Identify major milestones in science that have impacted science, technology and society

- Identify major contributions, theories, equipment and events in the advancement of biological sciences (i.e., cell theory, disease medicine)

9

Benchmark 6.3

Describe and explain science as a human endeavor and an ongoing process

- Appraise major contributions and events in the advancement of physical science

5 and 9

Helena Public Schools
Science

Grades 9-12
Curriculum

Benchmarks without a bullet are addressed at other grade levels.

APPLIED EARTH SCIENCE, EARTH SCIENCE and/or HONORS EARTH SCIENCE

Grade Level: 9 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Earth Science is designed to cover Astronomy, Geology, Oceanography, and Meteorology with emphasis on hands-on learning. Because it covers the essentials of the abiotic environment, it is recommended that this course be taken as one of the two required laboratory science courses for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
Astronomy	• determine the location of earth in space and understand and describe movements of astronomical objects	1.1, 1.2, 1.5, 4.6	
	• list and compare physical and chemical data for the Sun, planets, the Moon and stars	1.1, 1.4, 2.2, 2.3, 4.6	1, 2, 3, 4, 5, 6, 7, 8, 9
	• explain how the position and motion of the earth to cause seasons, daylight, darkness, and the apparent motion of celestial objects	1.1, 1.2, 1.5, 4.6	
	• investigate lunar history, lunar motions and the Earth/Moon system	1.1-1.5, 4.6, 5.5	
	• investigate wave theory as it applies to electromagnetic radiation	2.3, 2.7	
	• explore the forces involved with stellar evolution	2.1, 2.5, 2.7, 4.6, 4.7	
	• explore planetary magnetism while investigating magnetic declination and magnetic polarity and auroras	2.3, 2.5, 4.1, 4.6	
	• relate how evidence from advanced technology, applied to scientific investigations has dramatically impacted our understanding of the origin, size, and evolution of the Universe.	4.3, 4.7, 5.2, 5.5	
	• explain the impact of astronomical events and conditions on Earth's climate	1.6, 4.5, 4.6, 6.1-6.3	
	• 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.	4.6, 5.1-5.5, 6.1-6.3	
	• examine the historical developments of man's study of the heavens, including scientific theories regarding the origin of the universe.	1.6, 5.1-5.5, 6.1-6.3	
	• examine the history of space exploration and advances in space technology	4.3, 4.7, 5.3, 5.4, 6.1-6.3	

APPLIED EARTH SCIENCE, EARTH SCIENCE and/or HONORS EARTH SCIENCE

Grade Level: 9 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Earth Science is designed to cover Astronomy, Geology, Oceanography, and Meteorology with emphasis on hands-on learning. Because it covers the essentials of the abiotic environment, it is recommended that this course be taken as one of the two required laboratory science courses for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
Geology	• examine and explore the processes and effects of volcanism, earthquakes and mountain building.	1.1-1.5, 2.3, 2.7, 4.1-4.4, 5.1-5.5, 6.1-6.3	
	• explore and apply the concepts of plate tectonics and the evidence that supports it	1.1-1.5, 2.6, 4.1, 4.3, 5.1-5.3, 6.2, 6.3	
	• use the theory of plate tectonics to explain earthquakes, volcanoes and sea floor spreading	1.1-1.5, 2.6, 2.7, 4.1, 4.3, 5.1-5.3, 6.2, 6.3	
	• investigate the dynamic nature of the Earth's crust and internal structure	4.1-4.3	
	• investigate weathering and erosion as caused by wind, water and ice and their effects upon the Earth's surface	4.1, 4.2, 4.4	1, 2, 4, 5, 6
	• examine the utilization of natural resources and the importance of planetary stewardship	4.2, 5.1, 5.3, 5.4, 6.1-6.3	
	• examine and describe rock cycle	2.4, 2.6, 4.2, 4.3	
	• use maps and other models of the Earth to interpret and understand crustal, oceanic, and atmospheric conditions	4.2, 4.3, 4.4, 4.5, 4.7, 6.2	
	• identify and classify the common rocks and minerals using chemical and physical properties	1.2, 2.1, 2.2-2.4, 4.2	
	• examine the role of convection currents in the plate tectonics	4.1	
	• explore wave theory as it applies to seismic waves and tsunamis	2.3, 2.6, 2.7, 6.3	
	• investigate density as it applies to Earth structure and Earth materials	2.2, 2.3, 4.2	

APPLIED EARTH SCIENCE, EARTH SCIENCE and/or HONORS EARTH SCIENCE

Grade Level: 9 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Earth Science is designed to cover Astronomy, Geology, Oceanography, and Meteorology with emphasis on hands-on learning. Because it covers the essentials of the abiotic environment, it is recommended that this course be taken as one of the two required laboratory science courses for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
Geology Continued	• explore the impact of terrestrial conditions and changes on Earth's climate	4.4, 4.5	
	• trace the diversity and complexity of life through geologic time	4.3, 5.1	
	• examine / discuss benefits, limitations, costs, consequences and ethics involved in using scientific and technological innovations to make reasoned decisions through the study of natural resources and environmental pollution.	5.1-5.4, 6.1-6.3	4, 5, 6
	• investigate the roles and processes of ground and surface water in the hydrologic cycle	1.1-1.5, 2.2, 2.3, 4.4	
Oceanography	• investigate chemical, physical and biological characteristics of the oceans	1.1-1.6, 2.1, 2.2, 4.1, 4.5, 5.1-5.5, 6.1-6.3	
	• explore geologic features of ocean basins and continental margins	1.3, 1.4, 1.6, 2.7, 4.1, 4.5, 6.1-6.3	
	• investigate processes which create waves and currents explore the wave theory as it applies to oceanic waves	1.3, 1.4, 1.6, 2.7, 4.1, 4.5	
	• explore the relationship between oceanic circulation and Earth's climate	1.3, 1.4, 1.6, 4.1, 4.4, 4.5, 5.1-5.5, 6.1-6.3	
	• investigate historical discoveries in oceanography	5.1-5.3	4, 5, 6, 7, 8, 9
Meteorology	• utilize raw data to develop weather maps and predict weather	1.1-1.2, 1.4, 4.4, 4.5	
	• discuss and investigate evaporation, condensation, precipitation and humidity	1.1-1.6, 2.7, 4.4, 5.5, 6.1	
	• measure and evaluate the effects of pressure, temperature, humidity and atmospheric composition on weather	1.2, 1.4, 4.4, 4.5	
	• investigate climate factors and climate change	1.2, 1.4, 4.4,4.5, 5.1	1, 2, 3, 8, 9

APPLIED EARTH SCIENCE, EARTH SCIENCE and/or HONORS EARTH SCIENCE

Grade Level: 9 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Earth Science is designed to cover Astronomy, Geology, Oceanography, and Meteorology with emphasis on hands-on learning. Because it covers the essentials of the abiotic environment, it is recommended that this course be taken as one of the two required laboratory science courses for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
Meteorology Continued	• investigate the effects of man's activities on the atmosphere	1.4, 2.7, 4.2, 4.4, 4.5, 5.1- 5.5, 6.1-6.3	
	• investigate the composition of the atmosphere and its dynamic nature	1.2, 1.6, 2.4, 2.7, 4.4, 4.5, 5.4, 5.5, 6.1-6.3	
	• explore the cyclic nature and balances that exist in the atmosphere	1.1-1.6, 2.4, 4.4, 4.5	
	• examine the role of convection in atmospheric circulation	2.5, 2.6, 4.4, 4.5	
	• examine and explore the processes and effects of plate tectonics as they relate to climate change	1.1-1.6, 4.1, 4.5	
	• explain the relationship of the hydrologic cycle to weather.	1.1-1.6, 4.1, 4.5	
	• explain the Greenhouse Effect and discuss its connection to Global Warming	2.6, 4.4, 4.5	
	• collect and analyze local, regional, and global weather-related data in order to make inferences and predictions about weather patterns.	1.1-1.6, 4.4, 4.5	
	• explain the impact of terrestrial, solar, oceanic, and atmospheric conditions on global climatic patterns	4.5	

GENERAL BIOLOGY I, BIOLOGY I and/or HONORS BIOLOGY I

Grade Level: 10 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Biology I is a survey course in the Life Sciences which includes inquiry-based laboratory experiences. The purpose of this course is to develop an understanding of living things and their relationship to one another. It is recommended that this course be taken as one of the two required laboratory science courses needed for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
General	• learn and exhibit safety, proper handling, and care of laboratory equipment, specimens, and organisms	1.1, 1.2	2, 7, and 9
	• understand and conduct investigations using the scientific method and appropriate technologies	1.1-1.3, 1.6	
	• learn how to use the System International (SI) measurement	1.2	
	• demonstrate awareness of career opportunities in the biological field	6.3	
	• understand the chronological order of scientific events and discoveries	6.1, 6.3	
	• demonstrate proficiency in using the microscope, balance, and other tools associated with science	1.2, 3.1	
	• integrate basic skills such as reading, writing, speaking, listening, and mathematics into the study of biology	1.1–1.6, 3.2, 5.1-5.5, 6.1-6.3	
Cell	• know the basic principles and characteristics that govern living things	3.1, 3.2, 6.2	4, 7, and 9
	• understand the basic principles involving matter, inorganic chemistry, and biochemistry	2.1-2.4, 2.6, 3.1, 3.2, 6.2	
	• understand the structure and functions of cells	3.1, 3.2, 5.3, 6.1-6.3	
	• know the basic chemical processes which enable organisms to meet their metabolic and developmental needs	2.1-2.4, 2.6, 3.1-3.2	
	• know the processes of cell division, mitosis, and meiosis	1.1-1.6, 3.2	
Heredity	• describe the structure and function of nucleic acids and relate them to protein synthesis and the molecular basis of heredity	3.1, 3.3	3, 7, and 9
	• know the principles of heredity and how they apply in living organisms	3.3, 5.5, 6.1, 6.2	
	• understand genetic variations and how they affect organisms and populations	3.3-3.5, 5.1-5.5, 6.1-6.3	
	• understand the methods and technology used in the study of genetics	3.1, 3.3-3.5, 5.1-5.5, 6.1-6.3	
	• understand both the current and historical scientific theories on the origin of life and organic variation	3.3, 3.4, 3.5, 5.1-5.5, 6.1-6.3	
	• describe and understand current classification systems to include Domains	3.5	

GENERAL BIOLOGY I, BIOLOGY I and/or HONORS BIOLOGY I

Grade Level: 10 **Course Duration:** Full Year
Prerequisite: Taken Earth Science
Course Description: Biology I is a survey course in the Life Sciences which includes inquiry-based laboratory experiences. The purpose of this course is to develop an understanding of living things and their relationship to one another. It is recommended that this course be taken as one of the two required laboratory science courses needed for high school graduation.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes – At the proficiency level, students will:	MT Standard	Technology Stand/Bench.
Microbes	• describe and understand the characteristics of microbes (viruses, archea and bacteria, protists), methods by which they are studied, and their role in the environment	3.1-3.5, 5.1-5.5, 6.1-6.2	7, 8, and 9
Fungi	• describe and understand the characteristics of fungi and their ecological significance	1.2-1.6, 3.1-3.5, 5.1-5.5, 6.1- 6.3	3, 7, and 9
Plants	• describe and understand the characteristics of plants and their ecological significance	1.2-1.6, 3.1-3.5,5.1-5.5, 6.1-6.3	3, 7, and 9
Animals	• describe and understand the characteristics of animals (invertebrates and vertebrates) and of animals (invertebrates and vertebrates) and their ecological significance	1.2-1.6, 3.1-3.5, 5.1-5.5, 6.1-6.3	3, 7, and 9
Ecology	• understand, interpret, and analyze ecological interrelationships within the biosphere and the role humans play in these processes	1.2-1.6, 3.1-3.5, 4.4, 4.5,5.1-5.5, 6.1- 6.3	5, 7, and 9

BIOLOGY II

Grade Level: 11 or 12 **Course Duration:** Full Year
Prerequisite: "B" or better in Biology I, recommendation of Biology I instructor
Recommended for: College Preparatory
Course Description:
Biology II is a college preparatory course offered to juniors or seniors who have received a "B" or better in Biology I. This course is designed for students who are interested in the biological fields or in studies beyond the scope of Biology.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes: The student will be proficient in solving problems and demonstrating skills with:	MT Standard	Technology Stand/Bench.
General	• learn and exhibit safety, proper handling, and care of laboratory equipment, specimens, and organisms	1.1, 5.1, 5.2	3, 2, 7, 9, and 10
	• understand and conduct investigations using the scientific method and appropriate technologies	1.1-1.6, 3.1-3.4, 5.1, 6.1-6.3	
	• learn how to use the SI system of measurement	1.1, 1.2	
	• demonstrate awareness of career opportunities in the biological field	5.1, 5.3-5.5, 6.1-6.3	
	• understand the chronological order of scientific events and discoveries	1.6, 5.1, 5.2, 5.4, 6.1-6.3	
	• demonstrate proficiency in using the tools and technology associated with biology	1.1, 1.2, 1.6, 3.1-3.4, 5.1, 5.2, 5.4	
	• integrate basic skills such as reading, writing, speaking, listening, and mathematics into the study of biology	1.1-1.6, 3.1-3.5, 5.1-5.4, 6.1-6.3	
Cell and Tissues	• know the basic principles and characteristics that govern living things	2.3, 3.1-3.5, 6.1-6.3	4, 7, and 9
	• understand the basic principles involving matter, inorganic chemistry, and biochemistry	1.3-1.6, 2.1-2.4, 2.6, 3.1-3.4, 6.1-6.3	
	• understand the structure and functions of cells	1.3, 2.1-2.4, 2.6, 3.1-3.5, 5.1, 5.2, 5.4, 6.1-6.3	
	• know the basic chemical processes which enable organisms to meet their metabolic and developmental needs	1.3, 2.1-2.4, 2.6, 3.1-3.4	
	• know the processes of cell division, mitosis, and meiosis	1.3-1.6, 3.1-3.4	
	• recognize different tissues and their abnormalities	1.2-1.6, 3.1-3.5, 6.1-6.3	

BIOLOGY II

Grade Level: 11 or 12 **Course Duration:** Full Year
Prerequisite: "B" or better in Biology I, recommendation of Biology I instructor
Recommended for: College Preparatory
Course Description:
Biology II is a college preparatory course offered to juniors or seniors who have received a "B" or better in Biology I. This course is designed for students who are interested in the biological fields or in studies beyond the scope of Biology.

Scientific Processes ***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***

Course content	Learner outcomes: The student will be proficient in solving problems and demonstrating skills with:	MT Standard	Technology Stand/Bench.
Heredity	• describe the structure and function of nucleic acids and relate them to protein acids and relate them to protein synthesis and the molecular basis of heredity	2.1, 2.2, 2.5, 3.1, 3.2, 3.3, 3.5	3, 7, and 9
	• know the principles of heredity and how they apply in living organisms they apply in living organisms	3.1, 3.3-3.5, 5.1-5.4, 6.1-6.3	
	• understand genetic variations and how they affect organisms and populations	1.5, 3.1, 3.3, 3.4, 3.5, 5.1-5.4, 6.1-6.3	
	• understand the methods and technology used in the study of genetics and their applications	1.5, 1.6, 3.1, 3.3, 3.4, 3.5, 5.1-5.4, 6.1-6.3	
	• understand gene regulation and mutations	3.1, 3.3, 3.4, 3.5,	
	• understand the mechanisms involved in evolutionary biology	1.3-1.6, 3.4, 3.5, 4.1, 4.3-4.5, 5.1, 5.2, 5.4, 6.1-6.3	
Microbes	• describe and understand the characteristics of microbes (viruses, archea and bacteria, protists), methods by which they are studied, and their role in the environment	1.3-1.6, 2.1-2.4, 2.6, 3.1-3.5, 5.1-5.5, 6.1-6.3	7, 8, and 9
Fungi	• describe and understand the characteristics of fungi and their ecological significance	1.3-1.6, 2.1-2.4, 2.6, 3.1-3.5, 5.1-5.5, 6.1-6.3	3, 7, and 9
Plants	• understand the reproduction, growth, development structure, physiology and behavioral adaptations	2.6, 3.1-3.5, 5.1-5.5, 6.1-6.3	3, 7, and 9
Animals	• understand the reproduction, growth, development structure, physiology and behavioral adaptations	3.1-3.5, 5.1-5.5, 6.1-6.3	
	• compare and contrast the anatomy of vertebrate organisms	1.3-1.6, 3.1-3.5, 5.1-5.4, 6.1-6.3	
	• learn the processes and complexities of the organ systems of the human body	1.2, 3.1-3.5,5.1-5.4,6.1-6.3	
	• analyze, compare, measure and test human exercise physiology and body processes	1.1,3.1-3.5, 5.1-5.4,6.1-6.3	
Ecology	• understand, interpret, and analyze ecological interrelationships within the biosphere and the role humans play in these processes	1.1-1.6,2.1-2.4,2.6,3.1-3.5, 5.1-5.5,6.1-6.3	
	• understand how to conduct field studies involving management of natural resources		

CHEMISTRY

Grade Level: 11 and 12 **Course Duration:** Full Year
Prerequisite: Concurrent enrollment of completion of Math III
Course Description: Chemistry I is a survey course dealing with the compositions of substances and the changes they undergo. The basic principles and concepts of chemistry are developed through extensive laboratory investigations.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes -** The student will be proficient in solving problems and demonstrating skills in the following areas.	**MT Standard**	**Technology Stand/Bench.**
Measurement and Math Skills	• Gain a perspective of the history of chemistry.	5.1-5.5, 6.1-6.3	
	• Discuss the significance of chemistry today.	5.1-5.5, 6.1-6.3	2
	• Measure and convert within the SI and other standard systems.	1.2	3
	• Demonstrate an ability to solve appropriate problems involving basic algebra.	1.2, 2.3-2.7	
	• Explain the significance of numbers and uncertainty of measurements.	1.2, 2.3, 2.4	9
	• Apply dimensional analysis to problem solving.	1.2	4 and 5
	• Solve problems involving ratio, proportion and percentages.	1.2	
	• Write numbers in scientific notation.	1.2	
	• Relate scientific method to problem solving.	1.1-1.6, 2.1-2.7, 5.1-5.5	
Laboratory	• Demonstrate appropriate laboratory techniques and safe use of equipment while working individually and in small groups.	1.1-1.6	
	• Evaluate critical experiments in which independent and dependent variables are measured, analyzed and controlled, using tools such as accuracy and precision.	1.1-1.6, 2.3-2.5	3
	• Graph correctly and interpret experimental data.	1.1-1.6	3
	• Gain experience and develop skills in laboratory techniques which are emphasized in experimental procedures.	1.1-1.6, 2.1-2.7	
Atomic Structure and Periodic Properties of Atoms	• Describe the formation of isotopes through the use of nuclear equations	2.1	
	• Relate periodic trends, such as electro negativity, affinity, ionization energy and atomic size to ion formation and bonding.	2.1-2.3, 2.7	
	• Illustrate the formation of ions.	2.1	1 and 9
	• Explain the fundamental structure of the atom.	2.1-2.3, 5.1-5.4, 6.2,6.3	
	• Relate radioactivity to atomic structure.	2.1, 2.4, 2.7, 5.1-5.4	
	• Sketch appropriate Bohr shell diagrams	2.1-2.3	
	• Relate chemical properties to atomic structure.	2.1-2.4, 2.6	
	• Describe the development and arrangement of the modern periodic table.	2.1-2.3, 6.1-6.3	2
	• State the Periodic Law and give several examples of periodicity.	2.1-2.3, 6.2, 6.3	
	• Relate elemental position on the periodic table to atomic structure.	2.1-2.3	
	• Illustrate behavior of elements in a family and in a period.	2.1-2.3	
	• Apply basic bonding theory to compounds involving representative elements including ionic and covalent bonding and Van der Waal forces.	2.1-2.3, 2.6, 6.2,6.3	

CHEMISTRY

Grade Level: 11 and 12 **Course Duration:** Full Year
Prerequisite: Concurrent enrollment of completion of Math III
Course Description: Chemistry I is a survey course dealing with the compositions of substances and the changes they undergo. The basic principles and concepts of chemistry are developed through extensive laboratory investigations.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes - The student will be proficient in solving problems and demonstrating skills in the following areas.**	**MT Standard**	**Technology Stand/Bench.**
	• Describe general metal properties and use both systems of nomenclature to name and write formulas of transitional metal compounds.	2.1-2.3	
	• Describe the significance of the four quantum numbers and write appropriate electron notations.	2.1-2.3, 6.1-6.3	
Properties of Matter	• Distinguish between matter and energy.	2.1, 2.2, 2.4-2.7	
	• Describe elements, compounds, and mixtures.	2.1, 2.2, 6.2, 6.3	
	• Differentiate between chemical and physical properties and changes.	2.1, 2.2	
	• Solve appropriate problems involving density and specific gravity.	2.1,2.2, 2.4	3
	• Write and interpret elemental symbols and compound formulas.	2.1, 2.2	
	• Summarize the basic concepts of modern atomic theory.	1.3, 1.5, 2.1-2.7, 5.1-5.4, 6.2, 6.3	1 and 9
	• Differentiate phases of matter and their relationship to the kinetic molecular theory.	2.2, 2.6	
Mole Concept	• Calculate formula weights and solve problems utilizing formulas.	1.2, 2.1, 2.2	3
	• Apply Avogadro's number to the mole concept.	2.3, 2.4, 5.1, 5.2, 5.4, 6.2,6.3	3
	• Explain the significance and calculate molar mass and molar volume.	1.2, 2.1, 2.3	3
	• Calculate gram-formula weights.	1.2, 2.1, 2.3	3
Chemical Bonding	• Recognize crystal systems and crystal types and relate them to chemical bonding.	2.2, 2.3	
	• Identify the geometry of molecules and relate to electro negativity and bond polarity.	2.2, 2.3, 2.7	
	• Explain hybridization and the octet rule.	2.1-2.3	1 and 9
	• Relate chemical activity to electron gain or loss.	2.1-2.3	
	• Differentiate ionic bonding from covalent bonding.	2.1-2.3	
	• Illustrate covalent bonding.	2.1-2.3	1 and 9
	• Apply nomenclature rules and formula writing to covalent compounds.	2.1-2.3	
	• Utilize the "table of common ions" in formula writing and nomenclature	2.1-2.3	
	• Draw appropriate Lewis diagrams.	2.1-2.3	1 and 9
	• Recognize differences in molecular bonding theory.	2.1-2.3,5.1-5.4, 6.2, 6.3	
Formula and Equation Writing	• Apply nomenclature rules and formula writing to ionic and covalent compounds.	2.1-2.3	
	• Balance equations and interpret their significance's through calculations.	2.1-2.3	
	• Apply the law of definite composition to appropriate problems.	2.1-2.3	

CHEMISTRY

Grade Level: 11 and 12 **Course Duration:** Full Year
Prerequisite: Concurrent enrollment of completion of Math III
Course Description: Chemistry I is a survey course dealing with the compositions of substances and the changes they undergo. The basic principles and concepts of chemistry are developed through extensive laboratory investigations.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes - The student will be proficient in solving problems and demonstrating skills in the following areas.**	**MT Standard**	**Technology Stand/Bench.**
Formula and Equation Writing	• Explain the significance of the law of conservation of matter.	2.3, 2.6, 2.7, 5.1-5.4, 6.1-6.3	1 and 9
Gases	• Solve basic and advanced Stoichiometric problems. • Relate the postulates of the kinetic molecular theory to the fundamental properties of gasses including ideal gases.	1.2, 2.1-2.3, 5.1, 5.2, 5.4, 6.1-6.3 1.2, 2.1-2.3, 5.4, 6.1-6.3	
Solutions and Suspensions	• Solve appropriate gas law problem. • Explain terminology associated with solution phenomena • Discuss factors affecting solubility • Describe the nature of specific solutions • Interpret solubility curves • Distinguish colloids from true solutions • Define various concentration units and use them to solve appropriate problems	1.2, 2.1-2.3, 5.4, 6.1-6.3 2.1, 2.2 2.1, 2.2 2.1, 2.2 1.2, 2.1, 2.2 2.1, 2.2, 6.2, 6.3 1.2, 2.1-2.6, 6.2, 6.3	3 4
Acids and Bases	• Explain the strength of acids and bases • Solve problems involving pH and acidity • Relate hydrolysis to solution formation of acidic, basic and neutral salts • Describe titration curves and relate them to strengths of acids and bases • Explain how acid/base indicators work • Compare and contrast several acid/base models • Solve problems involving the volumetric analysis of acids and bases • Use the pH scale and indicators to determine acid and base strength	2.1-2.3 1.2, 2.1-2.3 1.2, 2.1-2.3 1.2, 2.1-2.3 2.1-2.3 2.1-2.4, 5.1-5.4, 6.2, 6.3 1.2, 2.1-2.3, 5.1-5.4, 6.2,6.3 1.2, 2.1-2.3, 5.1-5.4, 6.2,6.3	1 and 9 4
Energy and Reaction Rates	• Distinguish between kinetic and potential energy • Interpret potential energy diagrams • Use enthalpy and entropy to predict reaction spontaneity and their relationship to free energy. • Describe those factors affecting reaction rates • Discuss the significance of energy distribution diagrams	2.6 1.2, 2.6 2.6 2.2-2.4, 2.6 2.2-2.4, 2.6	
Chemical Equilibrium	• Relate the postulates of the kinetic molecular theory to the fundamental properties of solids and liquids. • Interpret vapor pressure curves and their application in the determination of boiling points.	2.1-2.3, 2.6, 6.2,6.3 1.2, 2.1, 2.3, 2.6	

CHEMISTRY

Grade Level: 11 and 12 **Course Duration:** Full Year
Prerequisite: Concurrent enrollment of completion of Math III
Course Description: Chemistry I is a survey course dealing with the compositions of substances and the changes they undergo. The basic principles and concepts of chemistry are developed through extensive laboratory investigations.

Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes -** The student will be proficient in solving problems and demonstrating skills in the following areas.	**MT Standard**	**Technology Stand/Bench.**
	• Apply Le Chatelier's principle to various equilibrium systems	1.1-1.4,2.2-2.4, 2.6, 5.3, 5.4, 6.2,6.3	3 and 4
	• Apply solution equilibrium to crystal development.	2.1-2.4, 2.6	
	• Define and use the law of mass action in theory and problems	1.1-1.4, 2.3, 2.6	
	• Derive and solve problems involving equilibria constants	1.2, 2.3, 2.6	
Oxidation/Reduction	• Recognize redox reactions and assign oxidation numbers to elements in a compound	2.1-2.7, 6.2-6.3	
	• Balance redox reactions by the electron transfer method	1.2, 2.1-2.7, 6.2,6.3	
	• Identify oxidizing and reducing agents.	2.2, 2.3, 6.2, 6.3	
	• Describe the process of electrolysis	2.2, 2.3, 6.2,6.3	1 and 9
Thermodynamics	• Relate Hess's Law, enthalpy, heats of formation to the First Law of Thermodynamics	1.1-1.3, 2.1-2.7, 3.1-6.3	1 and 9
	• Apply specific heat to calorimetry	1.1, 1.3, 2.1-2.7. 6.1-6.3	
	• Evaluate enthalpy, entropy and temperature to determine spontaneity of reactions	1.2, 2.3, 2.4, 2.6	

CHEMISTRY IN THE COMMUNITY

Grade Level: 11 and 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Course Description: Chemcom is a course to show how chemistry relates to the everyday world. This course will cover many of the same topics of the Chemistry I course and include extensive laboratory investigation. The major difference will be less emphasis on the mathematical concepts related to Chemistry.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes - The student will be proficient in solving problems and demonstrating skills in the following areas.**	**MT Standard**	**Technology Stand/Bench.**
Measurement and Math Skills	5. Gain a perspective of the history of chemistry.	5.1-5.5, 6.1-6.3	2 and 9
	• Discuss the significance of chemistry today.	5.1-5.5, 6.1-6.3	
	• Measure and convert within the SI and other standard systems.	1.2	3
	• Demonstrate an ability to solve appropriate problems involving basic algebra.	1.2, 2.1-2.7	
	• Explain the significance of numbers an uncertainty of measurements.	1.2	4
	• Apply dimensional analysis to problem solving.	1.2	4
	• Solve problems involving ratio, proportion and percentages.	1.2	
	• Write numbers in exponential notation.	1.2	
	• Relate scientific method to problem solving.	1.1-1.6, 2.1-2.7, 5.1-5.5	3
	• Describe the methodology, terms and implications of scientific thought and processes.	1.1-1.6, 5.1-5.5	1
Laboratory	• Demonstrate appropriate laboratory techniques and safe use of equipment while working individually and in small groups.	1.1-1.6	
	• Evaluate critical experiments in which variables are measured, analyzed and controlled, using tools such as accuracy and precision.	1.1-1.6, 2.3-2.5	3
	• Graph correctly and interpret experimental data.	1.1-1.6	3
	• Gain experience and develop skills in laboratory techniques which are emphasizes in experimental procedures.	1.1-1.6, 2.1- 2.7	

PHYSICAL SCIENCE

Grade Level: 11 - 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Recommended for: College Preparatory - Non-Science Degrees
Course Description: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry. Many of the same topics of the Chemistry I and Physics courses will be covered. This course teaches Physics and Chemistry concepts through the investigation of local issues and current events. Topics covered are listed below. The value of teaching physical science conceptually is NOT to minimize mathematics, but to maximize the use of student's personal experiences such as laboratory exercises, field studies and community partnerships.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Measurement and Math Skills	• gain a perspective of the history of chemistry.	5.1-5.5, 6.1-6.3	2
	• discuss the significance of chemistry today.	5.1-5.5, 6.1-6.3	
	• measure and convert within the SI and other standard systems	1.2	3
	• demonstrate an ability to solve appropriate problems involving basic algebra	1.2, 2.3-2.7	
	• explain the significance of numbers and uncertainty of measurements	1.2, 2.3,2.4	
	• solve problems involving ratio, proportion and percentages.	1.2	3
	• write numbers in scientific notation.	1.2	
	• relate scientific method to problem solving.	1.1-1.5, 2.1-2.7, 5.1-5.5	4
	• describe the methodology, terms and implications of scientific thought and processes	1.3-1.5, 5.1-5.4, 6.1, 6.2	
General	• demonstrate respect for classroom equipment	1.1	
	• practice safe laboratory procedures	1.1	
	• integrate the basic skills of reading, writing, speaking, listening, and mathematics into the study of physics.	1.1, 1.2,1.3, 1.6, 2.4, 2.6, 5.2	
	• understand the historical, social, and scientific events that have contributed to the development of physics.	6.1, 6.2	2
	• communicate to others that physics is a dynamic field in which concepts change as new relationships are discovered.	1.3, 6.2, 6.3	7 and 9
	• compare the differences and interrelationships between technology and science.	6.2, 6.3	7 and 9
	• model good data-gathering and measurement techniques in the laboratory.	1.1, 1.2, 1.3, 1.5, 1.6, 2.3, 2.4, 2.5, 2.6, 5.2	3
	• conduct scientific investigations and communicate the results of these studies to others	1.1, 1.2, 1.6, 2.2, 2.3, 2.4, 2.5, 2.6, 5.2	3, 4, and 7
	• exhibit analytical and critical thinking.	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.3, 2.4, 2.5, 2.6, 5.2, 5.4	4
	• give examples of chemical reactions important to industry and living organisms	2.3, 5.1- 5.5, 6.1- 6.3	
Laboratory	• demonstrate appropriate laboratory techniques and safe use of equipment while working individually and in small groups.	1.1-1.5	

PHYSICAL SCIENCE

Grade Level: 11 - 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Recommended for: College Preparatory - Non-Science Degrees
Course Description: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry. Many of the same topics of the Chemistry I and Physics courses will be covered. This course teaches Physics and Chemistry concepts through the investigation of local issues and current events. Topics covered are listed below. The value of teaching physical science conceptually is NOT to minimize mathematics, but to maximize the use of student's personal experiences such as laboratory exercises, field studies and community partnerships.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Laboratory	• evaluate critical experiments in which variables are measured, analyzed and controlled, using tools such as accuracy and precision.	1.1-1.6,2.3-2.5	3
	• graph correctly and interpret experimental data.	1.1-1.5	3
	• gain experience and develop skills in laboratory techniques, which emphasize experimental procedures.	1.1-1.6, 2.1- 2.7	
Atomic Structure and Periodic Properties of Atoms	• describe the formation of isotopes through the use of nuclear equations	2.1	
	• relate periodic trends, such as electro negativity, affinity, and atomic size to ion formation and bonding.	2.1-2.3, 2.7	
	• illustrate the formation of ions.	2.1	9
	• explain the fundamental structure of the atom.	2.1- 2.3, 5.1-5.4, 6.2, 6.3	1, 7, and 9
	• relate radioactivity to atomic structure.	2.1, 2.4, 2.7, 5.1-5.4	
	• sketch appropriate Bohr shell diagrams.	2.1, 2.3	
	• relate chemical properties to atomic structure.	2.1, 2.3	
	• describe the development and arrangement of the modern periodic table	2.1- 2.3, 5-1,5-2	7 and 9
	• relate elemental position on the periodic table to atomic structure.	2.1- 2.3	
	• illustrate behavior of elements in a family and in a period.	2.1- 2.3	
	• apply basic bonding theory to compounds involving representative elements including ionic and covalent bonding and Van der Waal forces	2.1- 2.3,6.1-6.3	
	• describe general metal properties and use both systems of nomenclature to name and write formulas of transitional metal compounds.	2.1- 2.3	
Properties of Matter	• distinguish between matter and energy.	2.1,2.2,2.4- 2.6	
	• describe elements, compounds, mixtures.	2.1, 2.2, 6.1-6.3	7 and 9
	• differentiate between chemical and physical properties and changes	2.2,2.2	
	• solve appropriate problems involving density and specific gravity.	2.1,2.2,2.4	3
	• write and interpret elemental symbols and compound formulas.	2.1,2.2	
	• differentiate phases of matter and their relationship to the kinetic molecular theory.	2.2, 2.6	
	• apply the principles of fluid dynamics.	2.6	1, 3, and 4

PHYSICAL SCIENCE

Grade Level: 11 - 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Recommended for: College Preparatory - Non-Science Degrees
Course Description: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry. Many of the same topics of the Chemistry I and Physics courses will be covered. This course teaches Physics and Chemistry concepts through the investigation of local issues and current events. Topics covered are listed below. The value of teaching physical science conceptually is NOT to minimize mathematics, but to maximize the use of student's personal experiences such as laboratory exercises, field studies and community partnerships.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Chemical Bonding	• identify the geometry of molecules and relate to electro negativity and bond polarity. • relate chemical activity to electron gain or loss. • differentiate ionic bonding from covalent bonding. • illustrate covalent bonding. • apply nomenclature rules and formula writing to covalent compounds.	2.2,2.3,2.7 2.1-2.3 2.1-2.3 2.1-2.3 2.1-2.3	7 and 9
Formula and Equation Writing	• apply nomenclature rules and formula-writing to ionic and covalent compounds • balance equations and interpret their significance vis-à-vis calculations. • explain the significance of the law of conservation of matter.	2.1-2.3 2.1-2.3 2.3,2.6,2.7,5.1-5.4	
Gases	• relate the postulates of the kinetic molecular theory to the fundamental properties of gasses including ideal gases. • solve appropriate gas law problem. • explain impact of terrestrial and atmospheric conditions on global climatic patterns.	1.2,2.1-2.3,5.4, 1.2,2.1-2.3,5.4, 4.5	5
Solutions and Suspensions	• explain terminology associated with solution phenomena • discuss factors affecting solubility • describe the nature of specific solutions • distinguish colloids from true solutions • define various concentration units and use them to solve appropriate problems	2.1, 2.2 2.1, 2.2 2.1, 2.2 2.1, 2.2 2.1- 2.3	7 and 9
Acids and Bases	• explain the strength of acids and bases • solve problems involving pH and acidity • explain how acid/base indicators work • use the pH scale and indicators to determine acid and base strength	2.1- 2.3 2.1- 2.3 2.1- 2.3 2.1- 2.3	1 and 3
Energy and Reaction Rates	• distinguish between kinetic and potential energy	2.1- 2.6	
Chemical Equilibrium	• relate the postulates of the kinetic molecular theory to the fundamental properties of solids and liquids.	2.1- 2.6	7 and 9

PHYSICAL SCIENCE

Grade Level: 11 - 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Recommended for: College Preparatory - Non-Science Degrees
Course Description: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry. Many of the same topics of the Chemistry I and Physics courses will be covered. This course teaches Physics and Chemistry concepts through the investigation of local issues and current events. Topics covered are listed below. The value of teaching physical science conceptually is NOT to minimize mathematics, but to maximize the use of student's personal experiences such as laboratory exercises, field studies and community partnerships.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Oxidation/Reduction	• identify oxidizing and reducing agents.	2.1- 2.6	
	• describe the process of electrolysis	2.1- 2.6	7 and 9
Mechanics:	• distinguish among and utilize the concepts of speed, distance, position, acceleration, velocity, and momentum.	2.2, 2.3, 2.4, 2.5, 2.6, 5.5	1, 3, and 4
	• distinguish among and utilize the concepts of potential energy, kinetic energy, work, power, and simple mechanics.	1.4, 2.2, 2.3, 2.4, 2.5, 2.6, 5.5	1, 3, and 4
	• use graphs to understand the concepts of mechanics.	2.4, 2.5, 2.6	
	• describe Newton's laws and their applications.	1.2, 1.4, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6, 5.4	7 and 9
	• express the conservation laws for energy and for momentum.	1.2, 1.4, 2.2, 2.3, 2.4, 2.5, 2.6	
	• use vectors to describe motion and solve problems.	1.2, 1.4, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6	3
	• use the conservation laws to solve problems.	1.5, 2.4, 2.6	
	• understand gravitational interactions.	1.2, 1.4, 1.5, 2.2-2.4, 2.5, 2.6, 5.4	
Waves:	• express the nature of waves as to type and characteristics.	1.2, 1.5, 2.2	
	• explain how energy is transferred through wave motion.	1.2, 1.4, 1.5, 2.2-2.4, 2.6, 2.7	7 and 9
	• explain how waves reflected, refracted, and diffracted.	1.2, 1.5, 2.2-2.4, 2.6, 2.7	
	• compare the various electromagnetic waves (gamma, x-ray, ultraviolet, visible, infrared, microwaves and radio waves) in terms of energy and wavelength	2.5- 2.6, 4.4- 4.7, 5.2- 5.4, 6.1- 6.3	4
	• identify practical uses of various electromagnetic waves	2.7, 4.7, 5.2-5.5	3
	• compare visible light colors in terms of energy and wavelength	2.7	4
	• describe the quantization of electromagnetic radiation	2.7, 4.7, 5.2- 5.5	
	• recognize that every substance emits and absorbs certain wavelengths	2.7	
	• explain how electromagnetic waves are reflected, refracted and absorbed	2.5, 2.7	
	• discuss interference of waves.	1.3, 1.5, 2.2, 2.3, 2.6, 2.7	
	• describe the relationship of waves to sound and light.	1.3, 1.5, 2.2, 2.3, 2.6, 2.7	7 and 9

PHYSICAL SCIENCE

Grade Level: 11 - 12 **Course Duration:** Full Year
Prerequisite: Successful completion of Earth Science and Biology
Recommended for: College Preparatory - Non-Science Degrees
Course Description: Physical Science is a course that integrates the two scientific disciplines of Physics and Chemistry. Many of the same topics of the Chemistry I and Physics courses will be covered. This course teaches Physics and Chemistry concepts through the investigation of local issues and current events. Topics covered are listed below. The value of teaching physical science conceptually is NOT to minimize mathematics, but to maximize the use of student's personal experiences such as laboratory exercises, field studies and community partnerships.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Heat:	• distinguish between heat and temperature.	2.3, 2.6	
	• demonstrate heat exchange and its applications.	1.4, 2.2 -2.4, 2.6, 2.7	
	• compare the relationship of heat and work, including heat engines.	1.2, 1.4, 1.5, 2.2-2.4, 2.6, 5.2	4
	• relate the concepts behind changes of state.	1.2, 1.4, 1.5, 2.2- 2.4, 2.6	
Electricity and Magnetism	• describe magnetism (including poles and fields), and its relationship to electric current.	1.4, 1.5, 2.3, 2.5, 2.7	7 and 9
	• describe and apply electrostatic principles.	1.4, 1.5, 2.1	7 and 9
	• apply the principles of electricity to every day life.	1.4, 1.5, 2.3, 2.5, 6.2	6
Light	• illustrate how light rays reflect from a surface.	2.3, 2.7	7 and 9
	• locate and describe images formed by plane and spherical mirrors.	1.2, 5.2	
	• use Snell's law and ray diagrams to explain the refraction of light rays.	1.2, 1.5, 5.2, 6.2	
	• explain the behavior of convex and concave lenses.	1.2, 1.5, 5.2	7 and 9
	• locate and describe images formed by convex and concave lenses.	1.2, 1.5	
	• explains Newton's particulate theory of light.	2.3	7 and 9
	• describe the current understanding of the nature of light.	1.2, 2.6,	2 and 9
	• demonstrate the interference and diffraction of light.	2.3	9
	• illustrate the position of visible light in the electromagnetic spectrum.	2.3	
	• recognize modern applications of optics.	1.3, 2.3, 2.6, 5.4	
Modern Physics	• restate that the speed of light is constant, regardless of the relative motion of source or observer.	2.3	
	• describe Einstein's theory of special relativity.	5.2, 5.4, 6.2	7 and 9
Robotics	• Describe and apply fundamentals of an electronic circuit, in connection with controlling a robot	1.2-1.2.6,2.7,5.2-5.2-5.4	1, 4, and 6
	• construct a robot	2.4-2.6, 6.2,6.3	1, 4, and 6
	• communication with a robot using C language and/or an appropriate programming language	2.3	1, 4, and 6

CHEMISTRY II

Grade Level: 12 **Course Duration:** Full Year
Prerequisite: Chemistry I and instructor approval, concurrent enrollment in Math IV or equal level math
Recommended for: College Preparatory
Course Description: Chemistry II is an opportunity for students who have a desire to continue their study of chemistry and apply their knowledge in a relevant, practical, and useful course while increasing their understanding of fundamental principles, problem solving and laboratory sills and techniques. The chemical analysis learned in this course is used in many fields of science and the skills and techniques learned in this course are invaluable to the student choosing a science-related career.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Measurement and Math Skills	• Gain a perspective of the history of chemistry.	5.1-5.5, 6.1-6.3	2
	• Discuss the significance of chemistry today.	5.1-5.5, 6.1-6.3	1 and 9
	• Measure and convert within the SI and other standard systems.	1.2	3
	• Demonstrate an ability to solve appropriate problems involving basic algebra.	1.2, 2.3-2.7	
	• Explain the significance of numbers and uncertainty of measurements.	1.2, 2.3, 2.4	
	• Apply dimensional analysis to problem solving.	1.2	4
	• Solve problems involving ratio, proportion and percentages.	1.2	3
	• Write numbers in scientific notation.	1.2	
	• Relate scientific method to problem solving.	1.1-1.6, 2.1-2.7, 5.1-5.5	
Laboratory	• Demonstrate appropriate laboratory techniques and safe use of equipment while working individually and in small groups.	1.1-1.6	
	• Evaluate critical experiments in which independent and dependent variables are measured, analyzed and controlled, using tools such as accuracy and precision.	1.1-1.6, 2.3-2.5	4
	• Graph correctly and interpret experimental data.	1.1-1.6	3
	• Gain experience and develop skills in laboratory techniques which are emphasized in experimental procedures.	1.1-1.6, 2.1-2.7	
Stoichiometry	• Predict, calculate, and quantify chemical reactions and formation of chemical compounds	1.2, 2.2-2.4, 5.1, 5.2	
	• Use molarity, solubility, redox, etc for aqueous systems and solution chemistry	1.2, 2.1-2.6	
Atomic Structure and Periodic Properties of Atoms	• Relate atomic structure and the electronic structure of atoms	1.3, 2.1-2.7, 6.1-6.3	
	• Explore from the Bohr model through the Quantum Theory of the atom	1.3, 2.1-2.7, 6.1-6.3	1 and 9
	• Explore the wave nature of light and atomic spectra	1.1, 1.3, 2.1-2.7, 6.1-6.3	3 and 4
	• Gain an historical perspective of the periodic table	1.3, 2.1-2.7, 6.1-6.3	2
	• Relate periodic trends of electro negativity, ionization energy, electron affinity, atomic radius, metal/nonmetal character and group trends	1.3, 1.4, 2.1-2.3, 2.6, 2.7	
Thermodynamics	• Relate Hess's Law, enthalpy, heats of formation to the First Law of Thermodynamics	1.1-1.3, 2.1-2.7, 6.1-6.3	
	• Apply specific heat to calorimetry	1.1, 1.3, 2.1-2.7, 6.1-6.3	3 and 4
	• Evaluate enthalpy, entropy and temperature to determine spontaneity of reactions	1.2, 2.3, 2.4, 2.6	
Chemical Bonding	• Predict ionic compounds and relate crystal structure to ion size	1.2, 2.2	
	• Apply the octet rule, exceptions, Lewis dot structures, resonance and oxidation numbers to covalent bonding	1.3,1.4, 2.1-2.3, 2.6, 2.7	

CHEMISTRY II

Grade Level: 12 **Course Duration:** Full Year
Prerequisite: Chemistry I and instructor approval, concurrent enrollment in Math IV or equal level math
Recommended for: College Preparatory
Course Description: Chemistry II is an opportunity for students who have a desire to continue their study of chemistry and apply their knowledge in a relevant, practical, and useful course while increasing their understanding of fundamental principles, problem solving and laboratory sills and techniques. The chemical analysis learned in this course is used in many fields of science and the skills and techniques learned in this course are invaluable to the student choosing a science-related career.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Oxidation and Reduction	• Recognize redox reactions and assign oxidation numbers to elements in a compound • Balance redox reactions by the electron transfer method • Identify oxidizing and reducing agents • Describe the process of electrolysis	2.1-2.7, 6.2-6.3 1.2, 2.1-2.7, 6.2, 6.3 2.2, 2.3, 6.2, 6.3 2.2, 2.3, 6.2, 6.3	1 and 9
Molecular Geometry	• Apply VSEPR theory and molecular orbital theory (hybridization and multiple bonds) to predict molecular geometry	1.3,1.4, 2.1-2.3, 2.6, 2.7	3
Organic Chemistry	• Apply nomenclature rules and formula writing to alkanes, alkenes and alkynes • Relate nomenclature to structure and properties of organic molecules	1.2, 2.1-2.4, 6.1-6.3 1.2, 2.1-2.4, 6.1-6.3	
Gases	• Relate the postulates of the Kinetic Molecular Theory to the fundamental properties of gases (pressure, volume, temperature); including ideal gases • Predict volumes, pressures of gases in chemical reactions	1.2, 1.3, 1.4, 2.2, 2.4, 6.1-6.3 1.2, 2.2, 2.4	

Analysis	• Apply and integrate varied background knowledge to perform laboratory investigation of:
	  ◦ Volumetric analysis
	  ◦ Gravimetric analysis
	  ◦ Colorimetric analysis
	  ◦ Qualitative analysis
		
		1.1-1.5, 2.1-2.4, 2.6, 6.2
		1.1-1.5, 2.1-2.4, 2.6, 6.2
		1.1-1.5, 2.1-2.4, 2.6, 6.2
		1.1-1.5, 2.1-2.4, 2.6, 6.2
			3 and 4

Equilibrium	• Derive and solve problems involving Equilibrium constants • Predict changes in equilibrium using Le'Chatelier's Principle • Compare and contrast several acid/base models • Relate strength to K_a and K_b • Apply concepts of buffers and common ion effect • Relate salt hydrolysis to solution formation of acidic, basic, and neutral salts • Apply criteria for precipitation or dissolution	1.1-1.5, 2.3, 2.4, 2.6 1.1-1.5, 2.3, 2.4, 2.6 1.3-1.5, 2.1, 2.3, 2.4, 2.6 1.3-1.5, 2.3, 2.4, 2.6 1.3-1.5, 2.3, 2.4, 2.6 1.3-1.5, 2.3, 2.4, 2.6 1.4,1.5, 2.3, 2.4, 2.6	1 and 9
Chemical Kinetics	• Describe the relationship between reaction rate and temperature/concentration (change in concentration over time)	1.2-1.5, 2.3, 2.4, 2.6	1 and 9
Oxidation/Reduction	• Apply redox to voltaic cells, EMF, and Electrolysis • Predict spontaneity of redox reactions	1.2-1.5, 2.3, 2.4, 2.6 1.2-1.5, 2.3, 2.4, 2.6	3
Nuclear Chemistry	• Relate nuclear stability to radioactivity • Investigate rates of radioactive decay • Distinguish between fission and fusion and relate to energy changes in nuclear reactions	1.1-1.5, 2.3, 2.4, 2.6, 6.1-6.3 1.1-1.5, 2.3, 2.4, 2.6, 6.1-6.3 1.1-1.5, 2.3, 2.4, 2.6, 6.1-6.3	3, 4, and 5 3

PHYSICS

Grade Level: 11 - 12 **Course Duration:** Full Year

Prerequisite: Three years of math are required: Algebra I, Geometry, and Algebra II, though Algebra II may be taken concurrently. Trigonometry and three years other sciences are recommended.

Course Description: Physics is the study of the relationships of matter and energy. Laboratory experiences are used to teach such topics as motion, heat, sound, wave mechanics, light, magnetism, and electricity. In addition to lab work, discussions and demonstrations as well as text assignments will be part of the course.

Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – The student will be proficient in solving problems and demonstrating skills with:**	**MT Standard**	**Technology Stand/Bench.**
General	• demonstrate respect for classroom equipment	1.1	
	• practice safe laboratory procedures	1.1	
	• integrate the basic skills of reading, writing, speaking, listening, and mathematics into the study of physics.	1.1, 1.3,1.6, 2.4,2.6, 5.2	
	• appreciate the historical, social, and scientific events that have contributed to the development of physics.	5.5, 6.1, 6.2	2
	• communicate to others that physics is a dynamic field in which concepts change as new relationships are discovered.	1.3, 5.3, 5.4, 6.1, 6.2, 6.3	7 and 9
	• compare the differences and interrelationships between technology and science.	5.1, 6.1, 6.2	7 and 9
	• model good data-gathering and measurement	1.1, 1.2, 1.3, 1.5, 2.4, 2.5, 2.6	3
	• conduct scientific investigations and communicate the results of these studies to others.	1.1, 1.2, 2.2 2.4, 2.5, 2.6	3, 4, and 7
	• exhibit analytical and critical thinking.	1.1, 1.2, 2.3, 2.4, 2.5, 2.6,5.2,5.4	4
Mechanics	• distinguish among and utilize the concepts of speed, distance, position, acceleration, velocity, and momentum.	2.2, 2.3, 2.5, 5.5	
	• distinguish among and utilize the concepts of potential energy, kinetic energy, work, power, and simple mechanics.	1.4, 2.3, 2.4, 2.5, 2.6	
	• use graphs to understand the concepts of mechanics.	2.4, 2.5, 2.6	1 and 3
	• describe Newton's laws and their applications.	1.4, 1.5, 2.2, 2.3, 2.4, 2.5,2.6,5.4,6.1	
	• use vectors to describe motion and to solve problems.	1.2, 1.4, 1.5,2.2, 2.3, 2.4, 2.5, 2.6	
	• express the conservation laws for energy and for momentum.	1.1, 1.2, 1.4, 2.2, 2.3, 2.4, 2.5, 2.6	
	• use the conservation laws to solve problems.	1.5, 2.4, 2.6	
Waves	• express the nature of waves as to type and characteristics.	1.1, 1.2, 1.5,2.2, 2.7	
	• explain how energy is transferred through wave motion.	1.1, 1.2, 1.4, 1.5, .2,2.3,2.4, 2.6, 2.7	
	• explain how waves reflected, refracted, and diffracted.	1.1, 1.2, 1.5, 2.2-2.4, 2.6, 2.7	
	• discuss interference of waves.	1.1, 1.2, 1.3, 1.5,2.2, 2.3, 2.6, 2.7	

PHYSICS

Grade Level: 11 - 12 **Course Duration:** Full Year

Prerequisite: Three years of math are required: Algebra I, Geometry, and Algebra II, though Algebra II may be taken concurrently. Trigonometry and three years other sciences are recommended.

Course Description: Physics is the study of the relationships of matter and energy. Laboratory experiences are used to teach such topics as motion, heat, sound, wave mechanics, light, magnetism, and electricity. In addition to lab work, discussions and demonstrations as well as text assignments will be part of the course.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes – The student will be proficient in solving problems and demonstrating skills with:**	**MT Standard**	**Technology Stand/Bench.**
Waves	• describe the relationship of waves to sound and light.	1.2, 1.5, 2.2,	
	• compare the various electromagnetic waves (gamma rays, x-rays, ultraviolet, visible) in terms of energy and wave length	2.5, 2.6, 2.7, 4.4-4.7 ,5.2-5.4, 6.1-6.3	3
	• identify practical uses of various electromagnetic waves	2.7, 4.7, 5.2-5.5	
	• compare the visible light colors in terms of energy and wavelength	2.7	3
	• describe the quantization of electromagnetic radiation and absorbs certain wave lengths	2.7, 4.7, 5.2-5.5	
	• recognize that every substance emits	2.7	
Waves	• explain how electromagnetic waves are reflected, refracted and absorbed	2.5, 2.7	
Heat	• distinguish between heat and temperature.	2.3, 2.6	
	• demonstrate heat exchange and its applications.	1.1, 1.4, 2.2-2.4, 2.6, 2.7	
	• compare the relationship of heat and work, including heat engines.	1.2, 1.4, 1.5	4
	• test the laws of thermodynamics.	1.1, 1.4, 1.5, 2.2, 2.3, 2.4, 2.6	4
	• relate the concepts behind changes of state.	1.2, 1.4, 1.5, 2.2, 2.3, 2.4, 2.6	
Electricity and Magnetism	• describe magnetism (including poles and fields), and its relationship to electric current	1.4, 1.5, 2.3, 2.5, 2.7	
	• describe the characteristics of electrostatic charges	2.1	
	• demonstrate how to charge an object	1.2, 1.4	
	• state the differences between conductors insulators	1.2, 1.4	
	• define what an electric field is	1.4	
	• distinguish between force and field	1.4	
	• measure an electric field	1.2, 1.4	3
	• define electric current and ampere	1.2, 2.6	
	• define power in electric circuits	1.2, 2.6	
	• define resistance	1.2, 1.4	
	• define Ohm's Law	1.4	
	• diagram simple electric circuits	1.4	
	• use Ohmmeters, voltmeters and ammeters	1.2, 1.4	3

PHYSICS

Grade Level: 11 - 12 **Course Duration:** Full Year

Prerequisite: Three years of math are required: Algebra I, Geometry, and Algebra II, though Algebra II may be taken concurrently. Trigonometry and three years other sciences are recommended.

Course Description: Physics is the study of the relationships of matter and energy. Laboratory experiences are used to teach such topics as motion, heat, sound, wave mechanics, light, magnetism, and electricity. In addition to lab work, discussions and demonstrations as well as text assignments will be part of the course.

Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – The student will be proficient in solving problems and demonstrating skills with:**	**MT Standard**	**Technology Stand/Bench.**
Light	• illustrate how light rays reflect from a surface.	2.3, 2.7	
	• locate and describe images formed by plane and spherical mirrors	1.1, 1.2, 5.2	
	• use Snell's law and ray diagrams to explain the refraction of light rays	1.1, 1.2, 1.5, 5.2, 6.1, 6.2	
	• explain the behavior of convex and concave lenses.	1.1, 1.2, 1.5, 5.2	
	• locate and describe images formed by convex and concave lenses.	1.1, 1.2, 1.5	
	• explains Newton's particulate theory of light.	2.3	9
	• use Huygen's principle to explain the behavior of light.	2.3	9
	• describe the current understanding of the nature of light.	1.1, 1.2, 2.6	
	• demonstrate the interference and diffraction of light.	1.1, 2.3	
	• illustrate the position of visible light in the electromagnetic spectrum.	2.3	
	• recognize modern applications of optics.	1.1, 1.3, 2.3,2.6, 5.4	1, 3, 4, and 6
Modern Physics	• restate that the speed of light is constant, regardless of the relative motion of source or observer	2.3	
	• describe Einstein's theory of special relativity.	5.2, 5.4, 6.1, 6.2	9
	• define isotope and nuclide	2.2, 2.3	
	• describe three modes of radioactive decay	2.3	
	• define half life	2.1	
	• recognize the role and nature of the strong nuclear force	2.6, 5.3, 5.4	

SCIENCE SEMINAR

Grade Level: 12 **Course Duration:** Full Year

Prerequisite: Must have completed at least 4 lab sciences with a grade of "B" or better and signature of instructor

Course Description: This course is available to seniors who have demonstrated high ability and motivation in science by taking many high school laboratory science courses and excelling in all the science courses taken. This course provides an opportunity for students to explore science enrichment topics not emphasized in other science courses. Scientific problems, concerns and controversial issues will be explored through literature review, student presentation, debate, and discussion within the class and interaction with community resource personnel. Students will have the opportunity to explore careers in science, scientific technology, and related fields. Students shall also write a technical library or investigative research paper on a scientific problem, concern, or controversial issue. Extended and local field trips shall be a part of this course. Students choosing not to go on the extended trip will be given alternative assignments. The extended trip shall occur during the regular academic schedule. The cost of the extended trip is paid by the student or the student's parents, either directly or through fundraisers.

Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – At proficiency, the student will;**	**MT Standard**	**Technology Stand/Bench.**
Understanding Scientific Research	• Students will be given the opportunity to view or read about current scientific research and discoveries. Students will discuss and evaluate these topics and try to determine how they relate to their lives and our future.	1.1-1.3, 1.5, 1.6, 3.3, 5.1, 5.2, 5.4, 6.2, 6.3	3, 5, 7, 8, 9
The Relationship of Science and Politics	• Students will demonstrate their understanding of the relationship between science and politics through discussion, written work, and class presentations.	3.4, 3.5, 5.4, 5.5, 6.2, 6.3	1, 3, 5, 7, 8, 9
Bioethics	• Students will discuss and communicate their thoughts on various bioethical issues through written assignments, journals, class discussions, and presentations. They will be encouraged to express their opinions and to be tolerant of each other's viewpoints.	5.2-5.5, 6.1, 6.2, 6.3	1, 3, 5, 7, 8, 9
Environmental Topics	• Students will identify current environmental dilemmas and compare and contrast the pros and cons. Students will demonstrate their understanding of these issues through class discussions, written work and class presentations and projects.	1.4, 1.5, 5.1, 5.2, 5.4, 5.5, 6.2, 6.3	1, 3, 5, 7, 8, 9

CRIME SCENE INVESTIGATIONS

Grade Level: 11 or 12 **Course Duration:** Full Year
Prerequisite: Passed Earth Science and Biology
Course Description: The cornerstone of criminalistics is science, therefore, basic content knowledge, skills, and laboratory techniques are emphasized. Appropriate evidence collecting skills will be practiced in a realistic context. Students are exposed to the nature of crime scene investigation. Immersion in the various aspects of criminal investigation allows students to focus on the potential career pathways.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Process	• explain the importance of the work of various forensics pioneers	6.1-6.1	2, 7, and 9
	• describe the development of technology important to forensics	5.2	9
	• explain the importance of Locard's "Exchange Principle" of evidence	2.2-2.4, 5.3, 5.4	
	• evaluate admissibility of various types of evidence	5.4	1, 3, and 4
	• evaluate the nature of forensics both with and without certain technologies	5.1, 5.4	1, 3, 4, and 6
Evidence	• describe the different types of evidence	5.1, 5.3	9
	• explain how evidence is deposited	5.2, 5.4	9
	• explain why certain evidence may be more likely to be found than others	5.3, 5.4	9
	• evaluate types of evidence law enforcement should search for in specific crimes	5.3, 5.4	9
	• evaluate the use of certain types of evidence in court proceedings	5.4	9
Crime Scene	• explain the reasons for isolating and protecting a crime scene from outside contamination	5.1	
	• explain the importance of the "chain of evidence"	5.4	
	• explain the steps for thoroughly recording the crime scene	5.3	
	• describe the proper procedures for conducting a systematic search of a crime scene for physical evidence	1.1-1.6, 2.3- 2.6, 5.1	
	• be able to secure a crime scene	5.1	
	• search a crime scene	5.3	
	• collect evidence and retain the "chain of evidence"	1.1- 1.6	
	• draw and use a crime scene sketch	5.3	3
Fingerprints / Shoe Prints / Lip Prints	• identify the basic types of fingerprint classification	5.3, 5.4	
	• describe the types of fingerprints found	5.3, 5.4	
	• describe the reasons and importance of fingerprint databases	5.3, 5.4	
	• describe the methods of retrieving latent fingerprints	5.3, 5.4	
	• compare fingerprints found at the crime scene with known samples	5.3, 5.4	
	• process latent prints on a variety of surfaces using different methods	5.3, 5.4	
	• build and use an electrostatic dust print lifter	1.2	
	• explain and demonstrate electrical circuits, voltage, wattage, ohms, direct current, alternating current, electromagnets	2.4- 2.6	1
	• describe how CAT Scans, MRI's, and X-rays are used as crime scene aids	1.2, 5.2- 5.4	3

CRIME SCENE INVESTIGATIONS

Grade Level: 11 or 12 **Course Duration:** Full Year
Prerequisite: Passed Earth Science and Biology
Course Description: The cornerstone of criminalistics is science, therefore, basic content knowledge, skills, and laboratory techniques are emphasized. Appropriate evidence collecting skills will be practiced in a realistic context. Students are exposed to the nature of crime scene investigation. Immersion in the various aspects of criminal investigation allows students to focus on the potential career pathways.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Chemistry/ Qualitative Analysis	• identify unknown nonmetallic white powders	2.1- 2.3, 5.1- 5.3	
	• identify unknown liquids	2.1- 2.3, 5.1- 5.3	
	• use periodic table to name elements, compounds, formulas	2.1- 2.3, 5.1- 5.3	
	• identify cations and anions	2.1- 2.3, 5.1- 5.3	
	• explain ionic and covalent bonding	2.1- 2.3, 5.1- 5.3	
	• balance chemical equations	2.1- 2.3, 5.1- 5.3	
	• properly determine products created from a chemical reaction	2.1- 2.3, 5.1- 5.3	
	• introduction to molarity		
	• titration-acids/bases		
Blood	• describe the various components of blood, and the evidence each part contains	3.1, 3.3, 3.4	
	• describe the nature of blood type, and its relative importance as evidence	3.1, 3.3, 3.4	
	• describe different blood stain patterns based on source, direction, and angle of trajectory	3.1, 3.3, 3.4	
	• explain the method of chemically isolating old, invisible blood stains	2.2, 2.3	
	• identify each of the components of blood (using prepared microscope slides)	2.2, 2.3	
	• determine blood type (using simulated blood)	2.3, 5.3	4
	• determine the direction and trajectory of blood stains (using red paint)	2.5, 2.6	4
	• process old blood stains (using non-human blood sources) with luminal	2.4	
Trace Evidence	• describe the parts of hair	3.1, 3.4	
	• identify mammal hair types, i.e: dog, cat, cow, horse, elk, deer, antelope, cougar	3.1, 3.4	
	• describe the basic types of fibers in use today	5.3	
	• identify plastic and plastic fibers using flame, acetone, and density tests	2.3	
	• explain “energy of deformation”	2.5, 2.6	
	• describe the types of tool marks	5.3	
	• use microscopes to compare hair, fiber, and tool mark evidence	1.2, 2.1	
Ballistics	• identify the four basic types of guns	5.1- 5.3	
	• describe the types and uses of different bullets	5.1- 5.3	
	• describe the use of serial numbers for guns and bullets	5.1- 5.3	
	• describe how powder burns are used to gauge the distance of the shooter from the victim	2.3, 2.6	
	• compare tool marks on bullets and casings	2.3, 2.5, 5.6.2, 6.3	3 and 4
	• reconstruct bullet trajectories (using simulated bullet holes)	2.6	3 and 4
	• demonstrate an understanding of projectile motion	2.6	
	• solve trajectory problems using formulas	2.6	

CRIME SCENE INVESTIGATIONS

Grade Level: 11 or 12 **Course Duration:** Full Year
Prerequisite: Passed Earth Science and Biology
Course Description: The cornerstone of criminalistics is science, therefore, basic content knowledge, skills, and laboratory techniques are emphasized. Appropriate evidence collecting skills will be practiced in a realistic context. Students are exposed to the nature of crime scene investigation. Immersion in the various aspects of criminal investigation allows students to focus on the potential career pathways.

Scientific Processes	*The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.*		
Course content	**Learner outcomes**	**MT Standard**	**Technology Stand/Bench.**
Ballistics	• gauge distance of shooter from powder burns (using case studies)	2.3- 2.5	3 and 4
Collisions/Impacts	• describe the characteristics of automobile impact	2.5- 2.6	
	• understand the causes of auto accidents involving rollover, head-on collision, angular collision, skid marks, dents	2.5- 2.6	
	• explain force, mass, and acceleration	2.5- 2.6, 5.2- 5.3	
	• solve problems involving vehicular impact	1.1- 1.6, 2.5- 2.6, 5.2- 5.3	1, 3, and 4
Injuries	• describe various types of injuries	3.1-3.2	
	• explain how to determine the cause of an injury	5.3	
	• determine the cause of injuries (using case studies)	5.3-5.4	3 and 4
DNA Evidence	• describe the nature of introns and exons in the human genome	3.3	
	• explain the importance of various DNA markers to criminal investigations	3.3	
	• describe the methods of DNA collection, amplification, and analysis	5.3	
	• evaluate the use of various DNA markers	5.3	3 and 4
	• collect a DNA sample	5.3	
	• use PCR to amplify a DNA sample	5.3	3
	• compare and analyze DNA samples using gel electrophoresis	5.3	3
Forensic Anthropology	• identify the parts of a skeleton	2.1, 3.1	
	• explain how gender, age, and race may be determined, and the limits of such determination	2.4, 5.2- 5.4	
	• explain the relationship of dental records to both the identification of remains and bite mark analysis	5.2- 5.3	
	• determine the gender, age, and race of skeletal remains (using skeletal models)	5.2- 5.3	4
	• match bite marks in clay to casts of human teeth (using dental casts)	2.4	4
Death & Decomposition	• describe the nature of death and decomposition	2.3, 5.3, 5.4	
	• explain how determining time of death relates to decomposition	2.3, 5.3, 5.4	
	• explain how cause of death is determined using entomology	3.2, 5.2	
	• describe the detailed nature of an autopsy	3.1, 3.2	
	• determine time of death based upon multiple factors (using case studies)	2.3	3 and 4
	• determine the cause of death (using autopsy case studies)	5.3	3 and 4
	• perform an autopsy on a preserved fetal pig	1.2, 3.1	
Career Paths & Other Areas of Forensics Knowledge	• Describe the possible careers available to students in forensics	5.1- 5.5	1 and 9
	• Job shadow specific careers involving forensics, i.e. detective, police officer, county coroner, toxicologist, geneticist, and mortician	5.1- 5.5	

ENVIRONMENTAL STUDIES/GREEN GROUP

Grade Level: 9 - 12 **Course Duration:** Full Year
Prerequisite: None
Course Description: A rapidly changing world with urgent environmental issues calls for a rapidly responsive course in which students can analyze and address those issues. Environmental Studies/Green Group will fill this need. The course "textbook" will be the Internet, newspapers, radio, television, magazines, journals, and other current sources of information. Students and teachers will locate environmental articles, interview local experts, analyze data, design experiments, write and present their findings, make improvements in Helena School systems, help care for Helena Public Schools and grounds, and volunteer in the community. The structure of this course will have the flexibility, fluidity, and immediacy that is necessary for responding to today's complex problems.

Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Land Use	• define an individual relationship to the land	4.2, 4.4, 4.5	
	• understand the perspectives several Montana American Indian cultures have toward the land	1.6, 5.5	2
	• use technology such as Google Earth, GPS mapping, and geo-caching to understand the relative locations of cities, rivers, mountains, and other geographical features in an around Helena	4.2, 4.7	3
	• graph population projections for our city, state and world using current data	4.4	3
	• understand current and historic land use planning	4.2, 6.1 – 6.3	
	• learn how various interests compete for land use and how public and private land use decisions are made	5.4, 5.5, 6.3	5
Energy	• identify sources of non-renewable and renewable energy (electricity) statewide and nationwide	4.2	
	• know the percentage of energy that comes from each source	2.4, 4.2	
	• design, conduct and communicate experiments that measure energy use for various appliances in the school and at home	1.1-1.5, 5.4	
	• calculate kilowatt hours in various energy-using scenarios	2.4	
	• collect electricity readings at their own homes and analyze their own energy bills	5.4	3
	• compare renewable and non-renewable energy sources	2.4, 4.2	5
Climate Change	• analyze meteorological, biological, botanical, and geological evidence of earth's historic and current climate	3.4. 3.5, 4.4, 4.5, 5.4, 5.5	2
	• create future climate change models based on those trends	1.1-1.5, 4.4, 4.5	5
	• learn the effects of climate change on various global ecosystems	2.4, 5.4	
	• predict the effects of continuing climate change on these	3.4, 3.5, 5.4, 5.5	
	• gather local and state climate data (numerical and anecdotal)	4.4, 4.5	
	• design, conduct and communicate experiments on how climate change affects plants, animals, and people	1.1,1.5, 4.4	1, 6, 7, and 9
Materials	• compare current U.S. consumption patterns with historic trends, Montana American Indian cultures and other cultures worldwide	1.6, 5.4, 5.5, 6.1-6.3	
	• understand how over-consumption affects ecosystems and the environment	3.4, 3.5	
	• learn that energy is required to manufacture and transport goods	2.4	
	• review the concept that energy creation from non-renewable sources depletes resources and causes air pollution	2.4, 4.4, 4.5	
	• learn the pros and cons of recycling (materials are re-used but this takes energy and creates pollution)	2.4, 4.2, 4.4, 4.5	

ENVIRONMENTAL STUDIES/GREEN GROUP

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Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Materials	• describe the "stuff cycle" from product creation to product disposal	2.4, 5.4, 5.5, 6.1	
	• understand basic waste disposal systems and their financial and environmental costs	2.4, 3.4, 3.5, 4.4, 4.5, 6.1	
Health, Pollution & Toxicology	• design, conduct and communicate experiments on factors that decrease air quality	1.1-1.5, 4.4, 4.5	3 and 4
	• identify the link between pollution and disease (asthma, etc.)	4.4, 5.1	
	• research work-related toxins and disease	4.4, 5.1, 5.2	9
	• learn about famous pollution events in the US and the world	5.2, 5.4, 5.5	
	• model an epidemiologist's path to determine the cause of pollution-related diseases	3.4, 5.1	
	• investigate the role of the EPA and state agencies in regulating pollution	4.4, 4.5, 5.2	
Transportation	• identify the types of transportation used in the world today and the percentage of pollution produced by each type	4.4, 4.5	
	• compare these current types with past forms of transportation	5.4, 6.1, 6.2, 6.3	2
	• learn the energy used and the pollution output for each type of transportation	2.4, 4.2	
	• analyze the effects of transportation pollution on various environmental ecosystems	3.4, 3.5	5
	• experience alternative forms of energy and transportation	2.4, 4.2, 4.4, 4.5	
	• compute personal transportation footprints	4.4, 4.5	3
Food, Plants and Animals	• learn how food production has changed from local to industrial and the effects of this change	6.1, 6.2, 6.3	5
	• understand how population affects food supply	3.4, 6.1	
	• predict future food production outcomes using population projections	6.1, 6.2, 6.3	3
	• learn specific systems of industrialized food production and the pros and cons of this type of production, including ethical concerns	4.4, 4.5	6
	• consider the carbon footprints of the production of various foods	2.4, 4.4, 4.5	6
	• analyze differences in food production and consumption across cultures	1.6	2
	• understand the possible effects of climate change on food production analyze personal consumption of food and learn ways to lessen one's personal impact	3.4, 3.5	
	• analyze personal consumption of food and learn ways to lessen one's personal impact	5.5	6
	• analyze how climate change currently is impacting plants and wildlife	3.2, 3.4, 4.4	

ENVIRONMENTAL STUDIES/GREEN GROUP

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Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Food, Plants and Animals	• predict how climate change will impact plants and wildlife locally and globally	3.2, 4.4	3
	• learn the variables that cause plant and animal extinction	3.4, 4.3, 6.1	
	• identify invasive plant and animal species and learn the impacts of these	3.5	
	• evaluate how human population affects plants and wildlife, including habitat loss	5.3, 5.4	1 and 9
Water	• understand the possible effects of climate change and pollution on water quantity and quality	4.4, 4.5 , 5.2	
	• understand how these effects will impact plants, animals, and people	3.4, 3.5, 4.4, 4.5, 5.4	
	• compare the differences between surface water and ground water	4.4	4
	• design, conduct and communicate experiements on Helena-area water	1.1-1.5, 4.4	3
	• understand how the City of Helena's water and wastewater plants operate and the environmental effects of those plants	5.4, 4.4	3
	• calculate the ecological value of wetlands as habitat and water filtration systems	3.4, 3.5, 4.4, 5.4	
	• understand how climate change and pollution affects oceans, rivers and lakes	4.4, 4.5	
Environmental Law and Ethics	• understand the concept of environmental justice and its impact on Montana American Indians and other cultures	1.6, 6.1	
	• learn about state and federal laws concerning environmental rights	4.2, 4.4	
	• research a specific topic of environmental ethics	5.4, 6.1, 6.2, 6.3	
	• devise possible solutions to minimize human impact on the planet	3.4, 5.4, 5.5	5
Geology	• explore the impact of terrestrial conditions and changes on Earth's climate	4.4, 4.5	
	• trace the diversity and complexity of life through geologic time	4.3, 5.1	
	• examine / discuss benefits, limitations, costs, consequences and ethics involved in using scientific and technological innovations to make reasoned decisions through the study of natural resources and environmental pollution.	5.1-5.4, 6.1-6.3	6
	• investigate the roles and processes of ground and surface water in the hydrologic cycle	1.1-1.5, 2.2, 2.3, 4.4	
Oceanography	• investigate chemical, physical and biological characteristics of the oceans	1.1-1.6, 2.1, 2.2, 4.1, 4.5, 5.1-5.5, 6.1-6.3	
	• explore geologic features of ocean basins and continental margins	1.3, 1.4, 1.6, 2.7, 4.1, 4.5, 6.1-6.3	
	• investigate processes which create waves and currents explore the wave theory as it applies to oceanic waves	1.3, 1.4, 1.6, 2.7, 4.1, 4.5	

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Scientific Processes	***The benchmarks for Montana Content Standard 1 which are not addressed at the High School level are taught at grades K-8.***		
Course content	**Learner outcomes – At the proficiency level, students will:**	**MT Standard**	**Technology Stand/Bench.**
Oceanography	• explore the relationship between oceanic circulation and Earth's climate	1.3, 1.4, 1.6, 4.1, 4.4, 4.5, 5.1-5.5, 6.1-6.3	
	• investigate historical discoveries in oceanography	5.1-5.3	
Meteorology	• utilize raw data to develop weather maps and predict weather	1.1-1.2, 1.4, 4.4, 4.5	3
	• discuss and investigate evaporation, condensation, precipitation and humidity	1.1-1.6, 2.7, 4.4, 5.5, 6.1	
	• measure and evaluate the effects of pressure, temperature, humidity and atmospheric composition on weather	1.2, 1.4, 4.4, 4.5	
	• investigate climate factors and climate change	1.2, 1.4, 4.4,4.5, 5.1	
	• investigate the effects of man's activities on the atmosphere	1.4, 2.7, 4.2, 4.4, 4.5, 5.1-5.5, 6.1-6.3	
	• investigate the composition of the atmosphere and its dynamic nature	1.2, 1.6, 2.4, 2.7, 4.4, 4.5, 5.4, 5.5, 6.1-6.3	
	• explore the cyclic nature and balances that exist in the atmosphere	1.1-1.6, 2.4, 4.4, 4.5	
	• examine the role of convection in atmospheric circulation	2.5, 2.6, 4.4, 4.5	
	• examine and explore the processes and effects of plate tectonics as they relate to climate change	1.1-1.6, 4.1, 4.5	
	• explain the relationship of the hydrologic cycle to weather.	1.1-1.6, 4.1, 4.5	
	• explain the Greenhouse Effect and discuss its connection to Global Warming	2.6, 4.4, 4.5	5
	• collect and analyze local, regional, and global weather-related data in order to make inferences and predictions about weather patterns.	1.1-1.6, 4.4, 4.5	5
	• explain the impact of terrestrial, solar, oceanic, and atmospheric conditions on global climatic patterns	4.5	5