

# Sixth Grade Science – Earth Science

## State Standards

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.

**Course Abilities for Earth Science** to be applied to Content Standards as appropriate to grade level:

### Develop abilities in science.

1. Higher thinking (analyze, evaluate, predict, decide, relate, interpret).
2. Communications (present, demonstrate, explain, defend).
3. Goal setting/attainment (brainstorm, envision, research, plan, organize).
4. The planning process (draft, analyze, and revise when producing products).

### Apply science knowledge and skills to a variety of purposes.

1. Solve problems using the scientific method.
2. Conduct research (field research, library research, experimentation).
3. Use scientific equipment appropriately (safely).
4. Apply knowledge of the relationship between humans, the environment and the earth's resources to improve the environment.
5. Possess technical skills:
  - read/write/present: instructions, table, chart, reports (progress, research, lab), proposal, letters (complaint, request, response), manual, checklist, pamphlet, technical research, bid, technical analysis, summary
  - technology: word processing, spreadsheet, database, desktop publishing, Internet, search tools, current technology
  - measurement practice in standard and metric

## Course Content for Earth Science by Standards/Benchmarks & ELEs (Essential Learner Expectations)

**\*\* NOTE: Under each "Essential Vocabulary" those words in bold are words found on OPI's Science Vocabulary list for Earth Science**

**CONTENT STANDARD 1: Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.**

**Identify a question, determine relevant variable and a control, formulate a testable hypothesis, plan and predict the outcome of an investigation, safely conduct scientific investigation, and compare and analyze data.**

1. Compare testable vs. non-testable questions

2. Write a testable question for an investigation
  3. Explain the difference between variables and control
  4. Determine the variables and control for an investigation
5. Distinguish between a testable question and a testable hypothesis
  6. Write a testable hypothesis for an investigation
  7. Formulate a plan to test the hypothesis that includes materials, procedures, control, variables, safety precautions, data collection and analysis methods
  8. Conduct investigation by following student-designed plan

**Essential Vocabulary:** hypothesis, control, variable, data, independent variable, dependent variable, prediction, testable question, Prefixes: milli, centi, kilo, deca, deci, nano

**Select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations.**

1. Identify metric base units
2. Construct properly labeled data tables
3. Select and use appropriate measurement tool(s) and metric units to gather data
4. Identify and use the appropriate graphical representation of the data
5. Analyze data using median, mean, mode, range and graphical comparisons
6. Convert within the metric scale
7. Convert standard to metric and metric to standard

**Essential Vocabulary:** gram, liter, meter, Celsius, mean, median, mode, range, Kelvin, cm<sup>3</sup>

**Review, communicate and defend results of investigations, including considering alternative explanations.**

1. Identify data examples that support or refute the hypothesis
2. Judge whether or not the data supports the hypothesis
3. Communicate results by sharing and comparing data with others
4. Compare the differences between student-collected data
5. Infer the reasons why student collected data may vary
6. Defend conclusions by providing examples from the data
7. Share and discuss alternative conclusions

**Essential Vocabulary:** supported, refute, hypothesis, pie, bar & line graph, scatterplot, data analysis, draw conclusions

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

1. Identify the similarities and differences between working models and representative models
2. Create representative models to demonstrate knowledge of scientific concepts (i.e., biomes, cells, life systems, density, water cycle)
3. Create working models to illustrate scientific concepts (i.e., biome, cells, life systems motion, energy, and water cycle)
4. Manipulate working models to predict and make conclusions about scientific concepts
5. Identify the advantages and limitations of various models

**Essential Vocabulary:** working models, representative models

**Identify strengths and weakness in an investigation design.**

1. Identify the essential components of investigation design (i.e. sample size and selection, repetition, controls)
2. Explain the purpose of each essential component and why you must plan an investigation
3. Identify the strengths and weaknesses in a variety of investigations

**Essential Vocabulary:** inquiry, investigation, sample size, control, repeated trials

**Compare how observations of nature form an essential base of knowledge among the Montana American Indians.**

1. Identify examples of various Montana American Indian tribes using observation
2. Compare how observations of nature form an essential base of knowledge among the different Montana American Indian tribes (e.g., migration patterns, planting cycles, etc.)

**Essential Vocabulary: Montana American Indian tribes: Crow, Blackfeet, Salish, Kootenai, Assiniboine Sioux, Little Shell, Northern Cheyenne, Chippewa Cree, Pend d'Orelle, and Gros Vetnre**

**Standard 2:** addressed in the Physical Science Course Content

**Standard 3:** addressed in the Life Science Course Content

**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.**

**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.**

1. Identify internal structures of the earth and their characteristics
2. Model or diagram the internal structure of the earth
3. Diagram convection currents inside of the earth
4. Explain the movement of plates over time
5. Explain or model the differences between Oceanic and Continental plates
6. Model and explain constructive forces on the earth (i.e., plate tectonics).
7. Compare and contrast types of rocks formed from different earth processes
8. Model and explain the appearance of the earth caused by destructive forces (i.e., weathering and erosion)

**Essential Vocabulary: mantle, inner core, outer core, crust, lithosphere, rock cycle, metamorphic, sedimentary, igneous, constructive, weathering, erosion**

**Differentiate between rocks types and minerals types and classify both by how they are formed and the utilization by humans.**

1. Make use of common rock and mineral identification tests to identify rocks and minerals, including common Montana rocks and minerals
2. List how rocks and minerals are used in daily life
3. Explain the importance of the mining industry in Montana and the uses of rocks and minerals
4. Diagram the interaction between igneous, sedimentary and metamorphic rocks through the rock cycle

**Essential Vocabulary: mineral, rock, hardness, streak, luster, rock cycle, metamorphic, sedimentary, igneous**

**Use fossils to describe the geological timeline.**

1. Identify major geologic divisions of time
2. Categorize the predominant organisms that appear within each major division of geologic time

**Essential Vocabulary: Cenozoic era, Mesozoic era, Paleozoic era, Precambrian**

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

1. Identify, diagram and label the composition and structure of the atmosphere
2. Identify, diagram and label the components of the water cycle
3. Describe convection currents
4. Explain how ocean currents are caused by convection currents
5. Explain the impact of ocean currents on large-scale weather patterns

**Essential Vocabulary:** atmosphere, precipitation, evaporation, condensation, water vapor, troposphere, convection currents, ocean currents, jet stream, el Niño, gulf stream

**Describe and model the motion and tilt of earth in relation to the sun, and explain the concepts of day, night, seasons, year, and climatic changes.**

1. Explain, using a model, how the Earth rotates and revolves around the sun
2. Identify Earth's climate zones and their key characteristics
3. Explain how Earth's tilt and revolution affects climate zones
4. Explain how Montana's location on earth influences Montana's climate
5. Predict how a change in planetary movement would change Earth's days, seasons, years and climate

**Essential Vocabulary:** rotation, revolution, orbit, axis, solstice, climate zone, Northern/Southern hemisphere, latitude, elevation, equator

**Describe the earth, moon, planets and other objects in space in terms of size, force of gravity, structure, and movement in relation to the sun.**

1. Describe the earth, moon, planets and other objects in space in terms of relative size and structure
2. Identify that planets in our solar system have different lengths of orbits and periods of rotation around the sun
3. Discuss how length of orbit and period of rotation affects length of years and days
4. Compare and contrast the length of days and years on different planets.
5. Describe the role of gravity in the orbit of moons around planets and planets around the sun

**Essential Vocabulary:** planet, moon, orbit, period of rotation, year, day, gravity, force

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

1. Define scientific theory as an explanation supported by rigorous testing and multiple lines of evidence
2. Recognize that the sun and planets formed from the accretion of dust and gases
3. Identify how planets, such as the Earth, changed after their formation

**Essential Vocabulary:** scientific theory, evidence, solar system, gas, dust, accretion

**CONTENT STANDARD 5: Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.**

**Describe the specific fields of science and technology as they relate to occupations within those fields.**

1. Research a variety of science and technological fields
2. Identify and describe a variety of occupations within fields of science and technology
3. Identify and describe uses of technology unique to specific occupations within each field of science

**Essential Vocabulary:** occupations, science, technology, science fields (life science, earth science, engineering, physical science)

**Apply scientific knowledge and process skills to understand issues and everyday events.**

1. Identify a local current event or problem involving science
2. Research and summarize the scientific issues relevant to that local current event or problem
3. Present and discuss the research on the scientific issues relevant to that local current event or problem

**Simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.**

1. Identify and describe methods scientists use to collaborate and share scientific findings with other scientists
2. Identify and describe methods scientists use to share scientific findings with the public
3. Identify, working in collaboration, a current event or problem involving science
4. Research and summarize, working in collaboration, the scientific issues relevant to that current event or problem
5. Present and discuss, working in collaboration, the scientific issues relevant to that current event or problem

**Essential Vocabulary: current event, problem, issue, research, summarize, collaborate, relevant**

**Use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.**

1. Identify and research a local issue with an environmental impact
2. Explain possible environmental impacts
3. Propose solutions

**Essential Vocabulary: environmental impact, proposed solutions**

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

1. Investigate how science and technology have impact on Montana American Indians
2. Explain the impact of science and technology on Montana American Indians

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

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

1. Identify and describe examples of technological advances throughout history, including Montana American Indian examples
2. Identify and explain scientific discoveries influenced by these technologies
3. Explain how technology advances science understanding

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

1. Identify and describe the importance of various physical scientists and their discoveries such as Aristotle (motion) Archimedes (levers and properties of buoyancy), Galileo, Newton & DaVinci (further researched motion), Einstein (discovered gravity's effect on light), Goddard (designed the first liquid propelled rocket)
2. Identify and describe the importance of various life scientists and their discoveries such as Hooke & Van Leeuwenhoek (development of microscope), Pasteur (pasteurization and vaccines), Mendel (heredity), Darwin (evolution), Curie (radiation), Linnaeus (binomial nomenclature), Virchow, Schwann & Schleiden (cell theory), Crick & Watson (DNA)
3. Identify and describe the importance of various earth scientists and their discoveries such as Steno (recognized the importance of rock layers), Hutton (Naturalness of change theory), Boltwood (dating and timescale), Horner (fossils and Museum of the Rockies), Hubble (astronomy), Cousteau (oceanography)

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

1. Describe examples of scientific knowledge changing human understanding of the natural world
2. Describe and explain the features of science that make it a human endeavor and an ongoing process