COLORADO MODEL ACADEMIC STANDARDS

STANDARD 1: Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

RATIONALE: In everyday life, we find ourselves gathering and evaluating information (data), noting and wondering about patterns and regularities, devising and testing possible explanations for how things work, and discussing ideas with others. These characteristically human activities mirror in many ways how scientists think and work. Scientific investigation (inquiry) often begins with a question or problem and usually ends with further questions to investigate. Such investigations may include long-term field studies and are not limited to direct experimentation in a lab setting. They involve the identification and control of variables. Inquiry in the science classroom helps students develop a useful base of scientific knowledge, communicated in increasingly mathematical and conceptual ways as they progress through school. In addition, scientific inquiry stimulates student interest, motivation, and creativity. Designing and conducting investigations encourages students to interpret, analyze, and evaluate what is known, how we know it, and how scientific questions are answered. The knowledge and skills related to scientific inquiry enable students to understand how science works, and are powerful ways for students to build their understanding of the scientific facts, principles, concepts, and applications that are described in the other science content standards, particularly standards two, three, and four. To comprehend the world around them, students need opportunities to pursue questions that are relevant to them and to learn how to conduct scientific investigations. Some scientific inquiries can only be investigated by the use of models since actual events are not repeatable.

GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

- identifying and evaluating alternative explanations and procedures

 SE/TE: 31, 59, 107

- using examples to demonstrate that scientific ideas are used to explain previous observations and to predict future events (for example, plate tectonics and future earthquake activity)

  SE/TE: 33, 36, 44, 62-65, 68, 97, 98

- asking questions and stating hypotheses that lead to different types of scientific investigations (for example, experimentation, collecting specimens, constructing models, researching scientific literature)

  SE/TE: 18, 30, 31, 37, 58, 59, 86, 106, 107, 123, 136, 137, 163, 167

- creating a written plan for an investigation

  SE/TE: 30, 31, 37, 58, 59, 86, 106, 107, 123, 136, 137, 163, 167, 179

- using appropriate tools, technologies, and measurement units to gather and organize data

  SE/TE: 30, 31, 37, 58, 59, 86, 106, 107, 123, 136, 137, 163, 167, 180, 181

- interpreting and evaluating data in order to formulate conclusions

  SE/TE: 31, 32, 37, 59, 67, 86, 107, 123, 136, 137, 157, 163, 183

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**COLORADO MODEL ACADEMIC STANDARDS**  

| **PAGE(S) WHERE TAUGHT** (If submission is not a book, cite appropriate location(s)) | **• communicating results of their investigations in appropriate ways (for example, written reports, graphic displays, oral presentations)** | SE/TE: 31, 37, 40, 59, 67, 86, 107, 110, 137, 140, 163, 167, 170 |
| | **• using metric units in measuring, calculating, and reporting results** | SE/TE: 12, 30, 31, 35, 36, 58, 59, 118, 119, 122, 123, 180, 181 |
| | **• explaining that scientific investigations sometimes result in unexpected findings that lead to new questions and more investigations** | SE/TE: 182, 183 |
| | **• giving examples of how collaboration can be useful in solving scientific problems and sharing findings.** | SE/TE: 22, 24-27, 32, 179 |

**STANDARD 2: Physical Science:** Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)

2.1 Students know that matter has characteristic properties, which are related to its composition and structure

**RATIONALE:** Everyone has experience with matter in a variety of forms. Such experiences help build students’ understanding of similarities and differences in the properties of matter. Their personal experiences help students understand common properties such as hardness, strength, color, shape, and states of matter (solid, liquid, and gaseous). Knowledge of observable properties of matter and its structure and composition is helpful in considering matter’s varied uses, availability, and limitations in our world.

**GRADES 5-8**

*As students in grades 5-8 extend their knowledge, what they know and are able to do includes*

<p>| <strong>SE/TE:</strong> | <strong>• examining, describing, comparing, measuring, and classifying objects based on common physical and chemical properties (for example, states of matter, mass, volume, electrical charge, temperature, density, boiling points, pH, magnetism, solubility)</strong> | 87, 114-123, 143, 146 |
| | <strong>• separating mixtures of substances based on their properties (for example, solubility, boiling points, magnetic properties, densities)</strong> | N/A |
| | <strong>• classifying and describing matter in terms of elements, compounds, mixtures, atoms, and molecules (for example, copper is an element, water is a compound, air is a mixture)</strong> | 87, 145 |
| | <strong>• developing simple models to explain observed properties of matter (for example, using a particle model to account for the solubility of a substance).</strong> | 23 |</p>
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<tbody>
<tr>
<td>2.2 Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).</td>
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<tr>
<td>RATIONALE: Energy is a central concept in science because all physical interactions involve changes in energy. Students need to understand that all physical events involve transferring energy or changing one form of energy into another. When a transformation of energy takes place, some of it is likely to appear as heat. Knowledge of forms of energy, its transfer and transformation, is essential to interpreting, explaining, predicting, and influencing change in our world.</td>
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<tr>
<td>GRADES 5-8</td>
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<tr>
<td>As students in grades 5-8 extend their knowledge, what they know and are able to do includes</td>
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<tr>
<td>• measuring quantities associated with energy forms (for example, temperature, mass, speed, distance, electrical charge, current, voltage)</td>
<td>SE/TE: 12, 14, 90</td>
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<tr>
<td>• describing qualitative and quantitative relationships, using data and observations and graphs, associated with energy transfer or energy transformation (for example, speed of object vs. height of ramp; length of string vs. pitch of sound; electric current vs. volume of gas produced in electrolysis, with length of time kept constant).</td>
<td>SE/TE: 14-17</td>
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<tr>
<td>2.3 Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.</td>
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<tr>
<td>RATIONALE: Interactions between matter and energy account for changes observed in everyday events. Understanding how matter and energy interact extends students’ knowledge of the physical world and allows them to monitor and explain a wide variety of changes and to predict future physical and chemical changes. Students gain both a practical and conceptual understanding of the laws of conservation of matter and energy.</td>
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<td>GRADES 5-8</td>
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<tr>
<td>As students in grades 5-8 extend their knowledge, what they know and are able to do includes</td>
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<tr>
<td>• identifying and classifying factors causing change within a system (for example, force, light, heat)</td>
<td>SE/TE: 14-17, 44-50, 152, 164-166</td>
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<tr>
<td>• identifying and predicting what will change and what will remain unchanged when matter experiences an external force or energy change (for example, boiling a liquid; comparing the force, distance, and work involved in simple machines)</td>
<td>SE/TE: 14, 50, 152</td>
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<tr>
<td>• observing and gathering data to support the concept of conservation of mass within a closed system (for example, precipitation reaction, forming mixtures, gas production)</td>
<td>SE/TE: N/A</td>
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<tr>
<td>• describing, measuring (for example, temperature, mass, volume, melting point of a substance) and calculating quantities before and after a chemical or physical change within a system (for example, temperature change, mass change, specific heat)</td>
<td>SE/TE: 160, 161</td>
</tr>
<tr>
<td>• describing, measuring (for example, time, distance, mass, force) and calculating quantities that characterize moving objects and their interactions within a system (for example, force, velocity, acceleration, potential energy, kinetic energy).</td>
<td>SE/TE: N/A</td>
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**STANDARD 3: Life Science:** Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (Focus: Biology--Anatomy, Physiology, Botany, Zoology, Ecology)

3.1 Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.

**RATIONALE:** As a result of their study of a variety of organisms and where they live, students gain a better understanding of their world. Students have a natural curiosity about life and the great diversity of organisms. Their curiosity leads to the study of organisms and how the organisms interact with the world. Through the study of similarities and differences of organisms, students learn the importance of classification as a tool used by scientists. In their future as citizens, students will need to think about and make decisions about the diversity and extinction of organisms in their communities and the world.

**GRADES 5-8**

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

• constructing and using classification systems based on the structure of organisms | SE/TE: N/A |
• describing the importance of plant and animal adaptations, including local examples | SE/TE: 157, 158 |
• creating and interpreting food chains and food webs | SE/TE: N/A |
• explaining the interaction and interdependence of nonliving and living components within ecosystems | SE/TE: 157, 158 |
• describing how an environment’s ability to provide food, water, space, and essential nutrients determines carrying capacity. | SE/TE: 157, 158 |

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3.2 Students know and understand interrelationships of matter and energy in living systems.

**RATIONALE:** From experience, students know that they must eat food to live. As a result of their study of energy movement (transfer) and change (transformation) in living organisms, students understand that the Sun is the primary and ultimate source of energy for living organisms. They learn why a constant input of matter and energy is critical for life. Photosynthetic organisms are critical to all organisms and need to be maintained. If one or more components are altered in an ecosystem, all other components are affected. Through studying the interrelationships of organisms, students learn that they can have a critical impact on other organisms.

**GRADES 5-8**

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

<table>
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<tr>
<td>• describing the basic processes of photosynthesis and respiration and their importance to life (for example, set up a terrarium or aquarium and make changes such as blocking out light);</td>
<td>SE/TE: 158</td>
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<tr>
<td>• comparing and contrasting food webs within and between different ecosystems (for example, grasslands, tundra, marine) and predicting the consequences of disrupting one of the organisms in a food web;</td>
<td>SE/TE: N/A</td>
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<tr>
<td>• describing ways (for example, digestion, transport of nutrients by circulatory system) that multicellular organisms get food and other matter to their cells;</td>
<td>SE/TE: 158</td>
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<tr>
<td>• explaining the recycling of materials by determining a pathway of a substance that is important for life (for example, trace water through an ecosystem); and</td>
<td>SE/TE: N/A</td>
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<tr>
<td>• describing the role of organisms in the decomposition and recycling of dead organisms (for example, bacteria’s role in the decomposition and recycling of matter from a dead animal).</td>
<td>SE/TE: N/A</td>
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</table>
### 3.3 Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms.

**RATIONALE:** Students are interested in learning about their bodies and how they relate biologically to other forms of life. The study of structure and function, body organization, growth and development, and maintenance of other organisms enhances students’ understanding of human development, health, and disease. Knowledge of these areas can assist students in making informed choices regarding nutrition, exercise, and other factors that influence how their body functions.

**GRADES 5-8**

*As students in grades 5-8 extend their knowledge, what they know and are able to do includes*

- describing the observable components and functions of a cell (for example, cell membrane, nucleus, cytoplasm, chloroplasts; movement of molecules into and out of cells)  
  SE/TE: N/A

- comparing and contrasting the basic structures and functions of different types of cells (for example, single-celled organisms in pond water, Elodea, onion cell, human cheek cell)  
  SE/TE: N/A

- describing the growth and development of several organisms (for example, embryonic development of a vertebrate)  
  SE/TE: N/A

- describing the structures and functions of human body systems; and  
  SE/TE: N/A

- describing and giving examples of noncommunicable diseases and communicable diseases (for example, heart disease and chicken pox).  
  SE/TE: N/A

### 3.4 Students know and understand how organisms change over time in terms of biological evolution and genetics.

**RATIONALE:** Students study the scientific concept of biological evolution—the changes in populations of organisms through time—in order to understand diversity and relatedness within the living world. Inquiries into evolution explain the ways in which natural processes produce life’s diversity. These studies help students understand that evolution is the major unifying concept in the biological sciences and that it explains a wide variety of observations that can be made about the living world. In particular, students see that the study of evolution initiates questions about biodiversity, adaptation, genetics, mutations, the geological record, and the observed unity at molecular and whole-organism levels. This content standard does not define any student expectations related to the origin of life.

**GRADES 5-8**

*As students in grades 5-8 extend their knowledge, what they know and are able to do includes*

- describing the purpose of body cell division and sex cell division  
  SE/TE: N/A
COLORADO MODEL ACADEMIC STANDARDS (Adopted 5/1995; Amended 11/1995) | PAGE(S) WHERE TAUGHT (If submission is not a book, cite appropriate location(s))
---|---
• describing the role of chromosomes and genes in heredity (for example, genes control traits, while chromosomes are made up of many genes); and | SE/TE: N/A
• describing evidence that reveals changes or constancy in groups of organisms over geologic time. | SE/TE: 20, 166

STANDARD 4: Earth and Space Science: Students know and understand the processes and interactions of Earth’s systems and the structure and dynamics of Earth and other objects in space. (Focus: Geology, Meteorology, Astronomy, Oceanography)

4.1 Students know and understand the composition of Earth, its history, and the natural processes that shape it.

RATIONALE: By studying Earth, its composition, history, and the processes that shape it, students gain a better understanding of the planet on which they live. Landforms, resources, and natural events such as earthquakes, flooding, and volcanic eruptions affect the location of population centers. Life throughout geologic time has been, and continues to be, affected by changes that occur at a varying rate on Earth’s surface. Knowledge of the structure and composition of the Earth provides a basis for making informed decisions. Understanding geologic events, such as earthquakes and volcanic eruptions, allows students to make responsible choices, evaluate the consequences, and predict the impact of future occurrences.

GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

• explaining how minerals, rocks, and soils form | SE/TE: 47, 102, 124-129
• explaining how fossils are formed and used as evidence to indicate that life has changed through time | SE/TE: 20, 166
• modeling natural processes that shape Earth’s surface (for example, weathering, erosion, mountain building, volcanic activity); and | SE/TE: 30, 31, 45, 48, 94, 99, 157
• explaining the distribution and causes of natural events (for example, earthquakes, volcanoes, landslides). | SE/TE: 45-50, 82-87, 96

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## Prentice Hall Science Explorer: Inside Earth © 2005

Correlated to:

**Colorado Model Content Standards for Science, (Grades 6-8)**

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### 4.2 Students know and understand the general characteristics of the atmosphere and fundamental processes of weather.

**RATIONALE:** Our Earth’s atmosphere is vital to life. The Sun and atmosphere affect every aspect of our lives, including work productivity, food supply, energy use, transportation, recreation, environmental quality, and human health and safety. Weather-related choices we make range from selecting appropriate clothing to more complex situations, including preparing for and responding to hazardous weather. Preparedness and response to weather conditions require knowledge of how energy transfer influences atmospheric changes. The more we know about weather, the greater the chances that we will make informed decisions concerning its impact.

### GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

- describing the basic composition, properties, and structure of the atmosphere (for example, the range and distribution of temperature and pressure in the troposphere and stratosphere);  
  SE/TE: N/A

- observing, measuring, and recording changes in weather conditions (for example, humidity, temperature, air pressure, cloud types, wind, precipitation);  
  SE/TE: N/A

- explaining how atmospheric circulation is driven by solar heating (for example, the transfer of energy by radiation, convection, conduction); and  
  SE/TE: N/A

- describing large-scale and local weather systems (for example, fronts, air masses, storms).  
  SE/TE: N/A

### 4.3 Students know major sources of water, its uses, importance, and cyclic patterns of movement through the environment.

**RATIONALE:** The world’s water is vital to life. Both subtle and wholesale changes in Earth’s water can have profound effects on human existence. In order to preserve both the quality and quantity of water for daily living, wise management of water resources is crucial. As the population and economies of the world grow, water becomes an even more important political and economic issue. Knowing the properties of water, its influences on weather, and its availability is necessary for understanding its importance to life. Knowledge of Earth’s oceans is important for an understanding of how they affect weather, climate, and life. It is important to understand the circulation of water because the amount of water on Earth is finite.

### GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

- investigating and comparing the properties and behavior of water in its solid, liquid, and gaseous states  
  SE/TE: N/A

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<td>• describing the distribution and circulation of the world’s water through oceans, glaciers, rivers, groundwater, and atmosphere; and</td>
<td>SE/TE: N/A</td>
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<tr>
<td>• describing the composition and physical characteristics of oceans (for example, currents, waves, features of the ocean floor, salinity).</td>
<td>SE/TE: N/A</td>
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4.4 Students know the structure of the solar system, composition and interactions of objects in the universe, and how space is explored.

RATIONALE: Observing the sky has always fascinated human cultures and civilizations. These observations resulted in the development of ways to measure time and predict natural phenomena. All bodies in space, including Earth, are influenced by forces acting throughout the solar system and the universe. Studying the universe enhances our understanding of Earth’s origins, its place in the universe, and its future. Much of what we know about Earth’s atmosphere and our solar system is due to space exploration. Modern society benefits from many of the technological advances developed for space exploration, including robotics, telecommunications, satellites, and miniaturized components used in computers and other electronic devices. Knowledge of the universe and past space exploration enables people to make informed decisions about the future of space exploration.

GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

• describing the basic components, composition, size, and theories of origin of the solar system | SE/TE: N/A |

• explaining the effects of relative motion and positions of the Sun, Earth, and Moon (for example, seasons, eclipses, moon phases, tides) | SE/TE: N/A |

• comparing Earth to other planets (for example, size, composition, relative distance from the Sun); and | SE/TE: N/A |

• identifying technology needed to explore space (for example, telescopes, spectrosopes, spacecraft, life support systems). | SE/TE: N/A |

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COLORADO MODEL ACADEMIC STANDARDS  

STANDARD 5: Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.

RATIONAL: Our world is shaped in many ways by scientific advances, technology (involving applications of science), and human activity. Science and technology provide useful connections between the natural world and the designed world. Since the invention of stone tools, technological applications have provided, and will continue to provide, humans the ability to modify their environment. Because scientific advances and technology affect all of Earth’s living and non-living systems, it is vital that students understand the interrelationships of science, technology, and human activity.

GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

| • investigating and describing the extent of human uses of renewable and non-renewable resources (for example, forests, fossil fuels) | SE/TE: 130-135 |
| • describing advantages and disadvantages that might accompany the introduction of a new technology (for example, mountain bikes, cellular telephones, pagers) | SE/TE: 60-66, 74, 128, 132, 133 |
| • describing how the use of technology can help solve an individual or community problem (for example, using catalytic converters on automobiles to help reduce air pollution); and | SE/TE: 43, 60-66, 74 |
| • describing how people use science and technology in their professions | SE/TE: 1-3 |

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STANDARD 6: Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines

RATIONALE: Human societies have long asked questions about, observed and collected data on, and offered explanations for natural phenomena. Scientific evidence and knowledge are distinguished from other ways of knowing and other bodies of knowledge in terms of the criteria that must be met. These criteria include the use of empirical standards and rules of evidence, a logical structure, rational thought, questioning, and openness to criticism. Scientific disciplines differ from one another in what is studied, techniques used, and outcomes sought. They share a common purpose—to explain and predict events and phenomena—and offer strategies to solve defined problems. Scientific knowledge is dynamic. Although some scientific theories have withstood the test of time and are still used, other knowledge claims have been altered by new scientific evidence. Change, continuity, and stability are characteristic features of science. Although acquiring scientific knowledge of laws, concepts, and theories is central to learning science, it does not necessarily lead to an understanding of how science itself works. Students need to understand that science works by weaving different aspects of science together so that they reinforce one another. To bring coherence to seemingly diverse sets of ideas or facts involving natural phenomena, scientific themes such as change, systems, models, and organization are highly useful. Themes can encompass and connect large quantities of basic data and evidence in science and can be used to integrate science with other disciplines.

GRADES 5-8

As students in grades 5-8 extend their knowledge, what they know and are able to do includes

- explaining why a controlled experiment must have comparable results when repeated
  SE/TE: 183

- giving examples of how scientific knowledge changes as new knowledge is acquired and previous ideas are modified (for example, through space exploration)
  SE/TE: 18-22, 25, 32, 130, 131

- describing contributions to the advancement of science made by people in different cultures and at different times in history
  SE/TE: 18-22, 25, 32, 130, 131

- identifying, comparing, and predicting variables and conditions related to change (for example, climate, population, motion)
  SE/TE: 33, 36, 62-65, 97, 98

- identifying and illustrating natural cycles within systems (for example, water, planetary motion, geological changes, climate); and
  SE/TE: 164-166

- using a model to predict change (for example, computer simulation, video sequence, stream table)
  SE/TE: 14, 30, 31, 37, 50, 82

Reference: http://www.cde.state.co.us/download/pdf/science.pdf