

**CHAPTER 3501**  
**DEPARTMENT OF EDUCATION**  
**GRADUATION STANDARDS**

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**3501.0620** [Repealed, 34 SR 643]

**3501.0625** [Repealed, 34 SR 643]

**3501.0630** [Repealed, 34 SR 643]

**3501.0635** [Repealed, 34 SR 643]

**3501.0800 KINDERGARTEN THROUGH GRADE 3 STANDARDS.**

Subpart 1. **Artistic foundations.**

A. The student will demonstrate knowledge of the foundations of the arts area.

B. The student will demonstrate knowledge and use of the technical skills of the art form, integrating technology when applicable.

C. The student will demonstrate understanding of the personal, social, cultural, and historical contexts that influence the arts areas.

Subp. 2. **Artistic process: create or make.** The student will create or make in a variety of contexts in the arts area using the artistic foundations.

Subp. 3. **Artistic process: perform or present.** The student will perform or present in a variety of contexts in the arts area using the artistic foundations.

Subp. 4. **Artistic process: respond or critique.** The student will respond to or critique a variety of creations or performances using the artistic foundations.

Subp. 5. **Arts areas.** The student will receive arts education that complies with these academic standards in at least two of the three arts areas required to be offered by a public elementary or middle school from the following: dance, music, theater, and visual arts. The student may receive arts education in media arts in addition to the two required arts areas.

**Statutory Authority:** *MS s 120B.02; 120B.023*

**History:** *34 SR 643*

**3501.0805 GRADES 4 AND 5 STANDARDS.**

Subpart 1. **Artistic foundations.**

A. The student will demonstrate knowledge of the foundations of the arts area.

B. The student will demonstrate knowledge and use of the technical skills of the art form, integrating technology when applicable.

C. The student will demonstrate understanding of the personal, social, cultural, and historical contexts that influence the arts areas.

Subp. 2. **Artistic process: create or make.** The student will create or make in a variety of contexts in the arts area using the artistic foundations.

Subp. 3. **Artistic process: perform or present.** The student will perform or present in a variety of contexts in the arts area using the artistic foundations.

Subp. 4. **Artistic process: respond or critique.** The student will respond to or critique a variety of creations or performances using the artistic foundations.

Subp. 5. **Arts areas.** The student will receive arts education that complies with these academic standards in at least two of the three arts areas required to be offered by a public elementary or middle school from the following: dance, music, theater, and visual arts. The student may receive arts education in media arts in addition to the two required arts areas.

**Statutory Authority:** *MS s 120B.02; 120B.023*

**History:** *34 SR 643*

### 3501.0810 GRADES 6 THROUGH 8 STANDARDS.

#### Subpart 1. **Artistic foundations.**

A. The student will demonstrate knowledge of the foundations of the arts area.

B. The student will demonstrate knowledge and use of the technical skills of the art form, integrating technology when applicable.

C. The student will demonstrate understanding of the personal, social, cultural, and historical contexts that influence the arts areas.

Subp. 2. **Artistic process: create or make.** The student will create or make in a variety of contexts in the arts area using the artistic foundations.

Subp. 3. **Artistic process: perform or present.** The student will perform or present in a variety of contexts in the arts area using the artistic foundations.

Subp. 4. **Artistic process: respond or critique.** The student will respond to or critique a variety of creations or performances using the artistic foundations.

Subp. 5. **Arts areas.** The student will receive arts education that complies with these academic standards in at least two of the three arts areas required to be offered by a public elementary or middle school from the following: dance, music, theater, and visual arts. The student may receive arts education in media arts in addition to the two required arts areas.

**Statutory Authority:** *MS s 120B.02; 120B.023*

**History:** *34 SR 643*

### 3501.0815 GRADES 9 THROUGH 12 STANDARDS.

#### Subpart 1. **Artistic foundations.**

A. The student will demonstrate knowledge of the foundations of the arts area.

B. The student will demonstrate knowledge and use of the technical skills of the art form, integrating technology when applicable.

C. The student will demonstrate understanding of the personal, social, cultural, and historical contexts that influence the arts areas.

Subp. 2. **Artistic process: create or make.** The student will create or make in a variety of contexts in the arts area using the artistic foundations.

Subp. 3. **Artistic process: perform or present.** The student will perform or present in a variety of contexts in the arts area using the artistic foundations.

Subp. 4. **Artistic process: respond or critique.** The student will respond to or critique a variety of creations or performances using the artistic foundations.

Subp. 5. **Arts areas.** The student will receive arts education that complies with these academic standards in at least one of the three arts areas required to be offered by a public high school from the following: media arts, dance, music, theater, and visual arts.

**Statutory Authority:** *MS s 120B.02; 120B.023*

**History:** *34 SR 643*

## ACADEMIC STANDARDS IN SCIENCE

**3501.0900 KINDERGARTEN STANDARDS.**Subpart 1. **The nature of science and engineering.**

A. The practice of science. The student will understand that scientific inquiry is a set of interrelated processes used to pose questions about the natural world and investigate phenomena.

B. The practice of engineering. The student will understand that some objects occur in nature. The student will understand that others have been designed and processed by people.

Subp. 2. **Physical science; matter.** The student will understand that objects can be described in terms of the materials they are made of and their physical properties.

Subp. 3. **Earth and space science; interdependence within the earth system.** The student will understand that weather can be described in measurable quantities and changes from day to day and with the seasons.

Subp. 4. **Life science.**

A. Structure and function in living systems. The student will understand that living things are diverse with many different observable characteristics.

B. Interdependence among living systems. The student will understand that natural systems have many components that interact to maintain the living system.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0905 GRADE 1 STANDARDS.**Subpart 1. **The nature of science and engineering.**

A. The practice of science. The student will understand that scientists work as individuals and in groups to investigate the natural world, emphasizing evidence and communicating with others.

B. Interactions among science, technology, engineering, mathematics, and society. The student will understand that designed and natural systems exist in the world. The student will understand that these systems are made up of components that act within a system and interact with other systems.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

Subp. 2. **Earth and space science; earth structure and processes.** The student will understand that earth materials include solid rocks, sand, soil, and water. The student will understand that these materials have different observable physical properties that make them useful.

Subp. 3. **Life science.**

A. Structure and function in living systems. The student will understand that living things are diverse with many different observable characteristics.

B. Interdependence among living systems. The student will understand that natural systems have many components that interact to maintain the system.

C. Evolution in living systems. The student will understand that plants and animals undergo a series of orderly changes during their life cycles.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0910 GRADE 2 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of science. The student will understand that scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.

B. The practice of engineering. The student will understand that engineering design is the process of identifying a problem and devising a product or process to solve the problem.

**Subp. 2. Physical science.**

A. Matter. The student will understand that objects can be described in terms of the materials they are made of and their physical properties.

B. Matter. The student will understand that the physical properties of materials can be changed, but not all materials respond the same way to what is done to them.

C. Motion. The student will understand that the motion of an object can be described by a change in its position over time.

D. Motion. The student will understand that the motion of an object can be changed by push or pull forces.

Subp. 3. **Earth and space science; interdependence within the earth system.** The student will understand that weather can be described in measurable quantities and changes from day to day and with the seasons.

**Subp. 4. Life science.**

A. Structure and function in living systems. The student will understand that living things are diverse with many different observable characteristics.

B. Interdependence among living systems. The student will understand that natural systems have many components that interact to maintain the system.

C. Evolution in living systems. The student will understand that plants and animals undergo a series of orderly changes during their life cycles.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0915 GRADE 3 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of science. The student will understand that scientists work as individuals and in groups, emphasizing evidence, open communication, and skepticism.

B. The practice of science. The student will understand that scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

D. Interactions among science, technology, engineering, mathematics, and society. The student will understand that tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish.

Subp. 2. **Physical science; energy.** The student will understand that energy appears in different forms, including sound and light.

**Subp. 3. Earth and space science.**

A. The universe. The student will understand that the sun and moon have locations and movements that can be observed and described.

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B. The universe. The student will understand that objects in the solar system as seen from Earth have various sizes and distinctive patterns of motion.

**Subp. 4. Life science.**

A. Structure and function in living systems. The student will understand that living things are diverse with many different characteristics that enable them to grow, reproduce, and survive.

B. Evolution in living systems. The student will understand that offspring are generally similar to their parents, but may have variations that can be advantageous or disadvantageous in a particular environment.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0920 GRADE 4 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of engineering. The student will understand that engineers design, create, and develop structures, processes, and systems that are intended to improve society and may make humans more productive.

B. The practice of engineering. The student will understand that engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that the needs of any society influence the technologies that are developed and how they are used.

**Subp. 2. Physical science.**

A. Matter. The student will understand that objects have observable properties that can be measured.

B. Matter. The student will understand that solids, liquids, and gases are states of matter that have unique properties.

C. Energy. The student will understand that energy appears in different forms, including heat and electromagnetism.

D. Energy. The student will understand that energy can be transformed within a system or transferred to other systems or the environment.

**Subp. 3. Earth and space science.**

A. Earth structure and processes. The student will understand that rocks are Earth materials that may vary in composition.

B. Interdependence within the Earth system. The student will understand that water circulates through the Earth's crust, oceans, and atmosphere in what is known as the water cycle.

C. Human interactions with Earth systems. The student will understand that in order to improve their existence, humans interact with and influence Earth systems.

Subp. 4. **Life science; human interactions with living systems.** The student will understand that microorganisms can get inside one's body and they may keep it from working properly.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0925 GRADE 5 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of science. The student will understand that science is a way of knowing about the natural world, is done by individuals and in groups, and is characterized by empirical criteria, logical argument, and skeptical review.

B. The practice of science. The student will understand that scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

D. Interactions among science, technology, engineering, mathematics, and society. The student will understand that tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish.

Subp. 2. **Physical science; motion.** The student will understand that an object's motion is affected by forces and can be described by the object's speed and the direction it is moving.

**Subp. 3. Earth and space science.**

A. Earth structure and processes. The student will understand that the surface of the Earth changes. The student will understand that some changes are due to slow processes and some changes are due to rapid processes.

B. Human interactions with Earth systems. The student will understand that in order to maintain and improve their existence, humans interact with and influence Earth systems.

**Subp. 4. Life science.**

A. Structure and function in living systems. The student will understand that living things are diverse with many different characteristics that enable them to grow, reproduce, and survive.

B. Interdependence among living systems. The student will understand that natural systems have many components that interact to maintain the living system.

C. Human interactions with living systems. The student will understand that humans change environments in ways that can be either beneficial or harmful to themselves and other organisms.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0930 GRADE 6 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of engineering. The student will understand that engineers create, develop, and manufacture machines, structures, processes, and systems that impact society and may make humans more productive.

B. The practice of engineering. The student will understand that engineering design is the process of devising products, processes, and systems that address a need, capitalize on an opportunity, or solve a specific problem.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that designed and natural systems exist in the world. The student will understand that these systems consist of components that act within the system and interact with other systems.

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D. Interactions among science, technology, engineering, mathematics, and society. The student will understand that current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.

**Subp. 2. Physical science.**

A. Matter. The student will understand that pure substances can be identified by properties which are independent of the sample of the substance and the properties can be explained by a model of matter that is composed of small particles.

B. Matter. The student will understand that substances can undergo physical changes which do not change the composition or the total mass of the substance in a closed system.

C. Motion. The student will understand that the motion of an object can be described in terms of speed, direction, and change of position.

D. Motion. The student will understand that forces have magnitude and direction and affect the motion of objects.

E. Energy. The student will understand that waves involve the transfer of energy without the transfer of matter.

F. Energy. The student will understand that energy can be transformed within a system or transferred to other systems or the environment.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0935 GRADE 7 STANDARDS.****Subpart 1. The nature of science and engineering.**

A. The practice of science. The student will understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument, and skeptical review.

B. The practice of science. The student will understand that scientific inquiry uses multiple interrelated processes to investigate questions and propose explanations about the natural world.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.

**Subp. 2. Physical science; matter.** The student will understand that the idea that matter is made up of atoms and molecules provides the basis for understanding the properties of matter.

**Subp. 3. Life science.**

A. Structure and function in living systems. The student will understand that tissues, organs, and organ systems are composed of cells and function to serve the needs of all cells for food, air, and waste removal.

B. Structure and function in living systems. The student will understand that all organisms are composed of one or more cells which carry on the many functions needed to sustain life.

C. Interdependence among living systems. The student will understand that natural systems include a variety of organisms that interact with one another in several ways.

D. Interdependence among living systems. The student will understand that the flow of energy and the recycling of matter are essential to a stable ecosystem.

E. Evolution in living systems. The student will understand that reproduction is a characteristic of all organisms and is essential for the continuation of a species. The

student will understand that hereditary information is contained in genes which are inherited through asexual or sexual reproduction.

F. Evolution in living systems. The student will understand that individual organisms with certain traits in particular environments are more likely than others to survive and have offspring.

G. Human interactions with living systems. The student will understand that human activity can change living organisms and ecosystems.

H. Human interactions with living systems. The student will understand that human beings are constantly interacting with other organisms that cause disease.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

### **3501.0940 GRADE 8 STANDARDS.**

#### **Subpart 1. The nature of science and engineering.**

A. The practice of science. The student will understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument, and skeptical review.

B. The practice of science. The student will understand that scientific inquiry uses multiple interrelated processes to investigate questions and propose explanations about the natural world.

C. Interactions among science, technology, engineering, mathematics, and society. The student will understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

D. Interactions among science, technology, engineering, mathematics, and society. The student will understand that science and engineering operate in the context of society and both influence and are influenced by this context.

E. Interactions among science, technology, engineering, mathematics, and society. The student will understand that current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.

#### **Subp. 2. Physical science.**

A. Matter. The student will understand that pure substances can be identified by properties which are independent of the sample of the substance and the properties can be explained by a model of matter that is composed of small particles.

B. Matter. The student will understand that substances can undergo physical changes and chemical changes which may change the properties of the substance but do not change the total mass in a closed system.

C. Energy. The student will understand that waves involve the transfer of energy without the transfer of matter.

#### **Subp. 3. Earth and space science.**

A. Earth structure and processes. The student will understand that the movement of tectonic plates results from interactions among the lithosphere, mantle, and core.

B. Earth structure and processes. The student will understand that landforms are the result of the combination of constructive and destructive processes.

C. Earth structure and processes. The student will understand that rocks and rock formations indicate evidence of the materials and conditions that produced them.

D. Interdependence within the Earth system. The student will understand that the sun is the principal external energy source for the Earth.



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E. Interdependence within the Earth system. The student will understand that patterns of atmospheric movement influence global climate and local weather.

F. Interdependence within the Earth system. The student will understand that water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle.

G. The universe. The student will understand that the Earth is the third planet from the sun in a system that includes the moon, the sun, seven other planets and their moons, and smaller objects.

H. Human interactions with Earth systems. The student will understand that in order to maintain and improve their existence, humans interact with and influence Earth systems.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

## 3501.0945 GRADES 9-12 STANDARDS.

Subpart 1. **The nature of science and engineering.**

A. The practice of science. The student will understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument, and skeptical review.

B. The practice of science. The student will understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.

C. The practice of engineering. The student will understand that engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes, and systems.

D. The practice of engineering. The student will understand that engineering design is an analytical and creative process of devising a solution to meet a need or solve a specific problem.

E. Interactions among science, technology, engineering, mathematics, and society. The student will understand that natural and designed systems are made up of components that act within a system and interact with other systems.

F. Interactions among science, technology, engineering, mathematics, and society. The student will understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

G. Interactions among science, technology, engineering, mathematics, and society. The student will understand that science and engineering operate in the context of society and both influence and are influenced by this context.

H. Interactions among science, technology, engineering, mathematics, and society. The student will understand that science, technology, engineering, and mathematics rely on each other to enhance knowledge and understanding.

Subp. 2. **Physical science.**

A. Matter. The student will understand that the structure of the atom determines chemical properties of elements.

B. Matter. The student will understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.

C. Motion. The student will understand that an object's mass and the forces on it affect the motion of an object.

D. Energy. The student will understand that energy can be transformed within a system or transferred to other systems or the environment, but is always conserved.

E. Human interactions with physical systems. The student will understand that there are benefits, costs, and risks to different means of generating and using energy.

**Subp. 3. Earth and space science.**

A. Earth structure and processes. The student will understand that the relationships among earthquakes, mountains, volcanoes, fossil deposits, rock layers, and ocean features provide evidence for the theory of plate tectonics.

B. Earth structure and processes. The student will understand that by observing rock sequences and using fossils to correlate the sequences at various locations, geologic events can be inferred and geologic time can be estimated.

C. Interdependence within the Earth system. The student will understand that the Earth system has internal and external sources of energy, which produce heat and drive the motion of material in the oceans, atmosphere, and solid earth.

D. Interdependence within the Earth system. The student will understand that global climate is determined by distribution of energy from the sun at the Earth's surface.

E. Interdependence within the Earth system. The student will understand that the cycling of materials through different reservoirs of the Earth's system is powered by the Earth's sources of energy.

F. The universe. The student will understand that the solar system, sun, and Earth formed over billions of years.

G. The universe. The student will understand that the Big Bang theory states that the universe expanded from a hot, dense, chaotic mass, after which chemical elements formed and clumped together to eventually form stars and galaxies.

H. Human interactions with Earth systems. The student will understand that people consider potential benefits, costs, and risks to make decisions on how they interact with natural systems.

**Subp. 4. Life science.**

A. Structure and function in living systems. The student will understand that organisms use the interaction of cellular processes as well as tissues and organ systems to maintain homeostasis.

B. Structure and function in living systems. The student will understand that cells and cell structures have specific functions that allow an organism to grow, survive, and reproduce.

C. Interdependence among living systems. The student will understand that the interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.

D. Interdependence among living systems. The student will understand that matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.

E. Evolution in living systems. The student will understand that genetic information found in the cell provides information for assembling proteins, which dictate the expression of traits in an individual.

F. Evolution in living systems. The student will understand that variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.

G. Evolution in living systems. The student will understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.

H. Human interactions with living systems. The student will understand that human activity has consequences on living organisms and ecosystems.

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I. Human interactions with living systems. The student will understand that personal and community health can be affected by the environment, body functions, and human behavior.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0950 GRADES 9-12 CHEMISTRY STANDARDS.****Subpart 1. The nature of science and engineering.**

A. Interactions among science, technology, engineering, mathematics, and society. The student will understand that developments in chemistry affect society and societal concerns affect the field of chemistry.

B. Interactions among science, technology, engineering, mathematics, and society. The student will understand that physical and mathematical models are used to describe physical systems.

**Subp. 2. Physical science.**

A. Matter. The student will understand that the periodic table illustrates how patterns in the physical and chemical properties of elements are related to atomic structure.

B. Matter. The student will understand that chemical and physical properties of matter result from the ability of atoms to form bonds.

C. Matter. The student will understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.

D. Matter. The student will understand that states of matter can be described in terms of motion of molecules and that the properties and behavior of gases can be explained using the kinetic molecular theory.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*

**3501.0955 GRADES 9-12 PHYSICS STANDARDS.****Subpart 1. The nature of science and engineering.**

A. Interactions among science, technology, engineering, mathematics, and society. The student will understand that developments in physics affect society and societal concerns affect the field of physics.

B. Interactions among science, technology, engineering, mathematics, and society. The student will understand that physical and mathematical models are used to describe physical systems.

**Subp. 2. Physical science.**

A. Motion. The student will understand that forces and inertia determine the motion of objects.

B. Motion. The student will understand that when objects change their motion or interact with other objects in the absence of frictional forces, the total amount of mechanical energy remains constant.

C. Energy. The student will understand that sound waves are generated from mechanical oscillations of objects and travel through a medium.

D. Energy. The student will understand that electrons respond to electric fields and voltages by moving through electrical circuits and this motion generates magnetic fields.

E. Energy. The student will understand that magnetic and electric fields interact to produce electromagnetic waves.

F. Energy. The student will understand that heat energy is transferred between objects or regions that are at different temperatures by the processes of convection, conduction, and radiation.

**Statutory Authority:** *MS s 120B.02*

**History:** *34 SR 1609*