

# Science in Personal and Social Perspectives

## Content Standard F:

As a result of activities in grades 9-12, all students should develop understanding of

- Personal and community health
- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges



# Content Summary

National Science Education Content Standards	<b>K-2</b>	<b>5-8</b>	<b>9-12</b>	
	<p><b>Personal health</b></p> <p><b>Characteristics and changes in populations</b></p> <p><b>Types of resources</b></p> <p><b>Changes in environments</b></p> <p><b>Science and technology in local challenges</b></p>	<p><b>Personal Health</b></p> <p><b>Population, resources, and environments</b></p> <p><b>Natural hazards</b></p> <p><b>Risks and benefits</b></p> <p><b>Science and technology in society</b></p>	<p><b>Personal and community health</b></p> <p><b>Population growth</b></p> <p><b>Natural resources</b></p> <p><b>Natural and human induced hazards</b></p> <p><b>Science and technology in local, national and global challenges</b></p>	
	<b>Primary Level</b>	<b>Intermediate Level</b>	<b>Middle Level</b>	<b>High School Level</b>
Minnesota Graduation Standards	<p><b>Personal Health and Fitness:</b></p> <p>Understand and participate in activities that promote personal fitness, health, nutrition and safety</p>	<p><b>Personal Health and Nutrition:</b></p> <p>Use a decision-making model to promote personal health, nutrition and safety</p> <p><b>Writing:</b></p> <p>Write for a variety of academic and technical purposes and audiences</p> <p><b>Geography and Citizenship:</b></p> <p>Understand the interaction of people, places and locations</p>	<p><b>Personal Health:</b></p> <p>Make informed decisions based on information to promote personal health and nutrition</p> <p><b>Current Issue Analysis:</b></p> <p>Defend a position concerning a current event or issue</p> <p><b>Nonfiction Reading, Viewing and Listening:</b></p> <p>Comprehend, interpret and evaluate information from a variety of non-fiction formats in reading, viewing and listening</p>	<p><b>Environmental Systems:</b></p> <p>Apply scientific methods to issues involving relationships among the individual, the society, the economy and the environment</p> <p><b>Natural/Managed Systems:</b></p> <p>Understand the interaction and interdependence of natural and managed systems</p> <p><b>Academic Writing:</b></p> <p>Demonstrate the ability to write for a variety of academic purposes and situations</p> <p><b>Issue Analysis:</b></p> <p>Research an issue and evaluate proposed positions or solutions</p> <p><b>Individuals and Community Health:</b></p> <p>Make informed decisions that enhance individuals, family and community health</p> <p><b>Human Geography:</b></p> <p>Understand how cultures interact with their environments</p>

## Focus K-12

Grade	Early	Late
<b>K-4</b>	The focus of instruction early in this grade range is on providing opportunities for all students to develop initial understandings about the relationships between science, personal health, and the environment.	The focus of instruction later in this grade range is on providing opportunities for all students to develop understandings about science-related personal and societal challenges and engage in some personal actions in local challenges related to science and technology.
<b>5-8</b>	The focus of instruction early in this grade range is on providing opportunities for all students to develop a more conceptual understanding of science-related social issues, make connections, and engage in actions related to science and personal and social challenges in their community.	The focus of instruction for all students later in this grade range is on developing a scientific understanding of health and enabling students to make reasoned decisions and take relevant actions in personal and community challenges related to science, technology, and society.
<b>9-12</b>	The focus of instruction for all students at the high school level is on improving all students' scientific understandings of science, technology, and societal challenges, how they interact, and on developing their abilities to evaluate the consequences of associated actions or decisions.	The focus of instruction for students pursuing further study is on providing support for students as they engage in personal actions and inform and persuade others to make appropriate decisions relating to personal, community, and global actions.

## Close-up 9-12

The focus of instruction at the high school level is on improving all students' scientific understandings of science, technology, and societal challenges how they interact, and on developing their abilities to evaluate the consequences of associated actions or decisions.

All high school students expand their understanding of the effects of science and technology in local and global changes. They relate these effects to personal and global decision making and actions. There are many ways that this standard can be approached and teachers must choose which topics and issues most appropriately relate to their course. The *National Science Education Standards* list several possible topics as conceptual organizers which could be included in high school science courses. However, each topic which is explored should include personal and global impacts and be related to the content studied. Some examples of issues that could be included are: population growth, toxic materials, nuclear waste, and global climate change. Activities could include risk/benefit analysis, scientific reading and research, and involvement in local and/or global issues. The study of these issues can help students make connections between isolated concepts and understand the mechanisms and processes involved. Students and teachers observe established science safety procedures.

The focus of instruction for students pursuing further study is on providing support for students as they engage in personal actions and inform and persuade others to make appropriate decisions relating to personal, community, and global actions.

Students pursuing further study in science in personal and social perspectives will integrate understandings of life, earth, and physical science along with non-science disciplines. Students investigate and propose evidence-based resolutions to science and technology-based issues. Students may analyze the social context within which science is carried out. Activities may include participation on local committees, leading and participating in seminars, and the development of position papers for publication. It is expected that students will choose what to study and exhibit autonomy as they pursue their investigations. Teachers, and often a member of the community, suggest resources and help students construct meaning. Student understanding should allow them to work independently as they investigate these concepts. Students and teachers observe established science safety procedures.

# On Location 9-12

*Mr. M uses a high interest activity as a context for teaching substantial chemistry content. His students explore the conductivity of dissolved materials in water. They take an in-depth look at the properties of water, as well as chemical reactions, solutions, and stoichiometry.*

Mr. M's chemistry class is about to undertake an extended study of total dissolved solids (TDS) in lake waters and chlorides in soil. They begin in the classroom by learning and practicing some techniques for collecting and testing water and soil. Using an LED conductivity device, they learn that some materials are electrolytes and others are not. As an electrolyte is added to water, the brightness of the LED bulb provides a qualitative measure of the amount of electrolyte added.

After having been "drown proofed" in the high school swimming pool, Mr. M's students are bussed to a near-by lake. At the lake, the students collect water samples and record lake temperatures at various depths. They use a sampling map to collect soil samples from around the lake.

Back in class, students work in groups to measure TDS by conductivity. Students then use the conductivity meter to check the readings of samples of water taken at each meter interval of the lake. When they measure samples taken below four meters, the needle on the conductivity meter jumps right off the chart. As students reset the instrument, they find that the value is five times as high as the previous reading. Students ask, "Why is the TDS so high?" "Why is the highest TDS on the bottom of the lake?" "Does the temperature of the water make a difference?"

Students conduct further investigations to answer these questions, and further testing reveals that the negative ion is chloride, and that the lake is heavily laden with sodium chloride. Students quantitatively determine the concentration of sodium chloride through stoichiometry and Mr. M incorporates concepts related to solutions and equilibrium to their study.

Further work reveals that the sodium chloride may either come from the soil or from another, unnamed source. Subsequent visits or good first time observation implicates concrete pipes on both sides of the lake that direct the storm sewer run-off from a twenty-five square kilometer area into the lake.



# National Science Education Content Standards

## 9-12 Content Standard F

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### Personal and Community Health

- Hazards and the potential for accidents exist. Regardless of the environment, the possibility of injury, illness, disability, or death may be present. Humans have a variety of mechanisms—sensory, motor, emotional, social, and technological—that can reduce and modify hazards.
- The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism. Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.
- Personal choice concerning fitness and health involves multiple factors. Personal goals, peer and social pressures, ethnic and religious beliefs, and understanding of biological consequences can all influence decisions about health practices.
- An individual's mood and behavior may be modified by substances. The modification may be beneficial or detrimental depending on the motives, type of substance, duration of use, pattern of use, level of influence, and short- and long-term effects. Students should understand that drugs can result in physical dependence and can increase the risk of injury, accidents, and death.
- Selection of foods and eating patterns determine nutritional balance. Nutritional balance has a direct effect on growth and development and personal well-being. Personal and social factors—such as habits, family income, ethnic heritage, body size, advertising, and peer pressure—influence nutritional choices.
- Families serve basic health needs, especially for young children. Regardless of the family structure, individuals have families that involve a variety of physical, mental, and social relationships that influence the maintenance and improvement of health.
- Sexuality is basic to the physical, mental, and social development of humans. Students should understand that human sexuality involves biological functions, psychological motives, and cultural, ethnic, religious, and technological influences. Sex is a basic and powerful force that has consequences to individuals' health and to society. Students should understand various methods of controlling the reproduction process and that each method has a different type of effectiveness and different health and social consequences.

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### Population Growth

- Populations grow or decline through the combined effects of births and deaths, and through emigration and immigration. Populations can increase through linear or exponential growth, with effects on resource use and environmental pollution.
- Various factors influence birth rates and fertility rates, such as average levels of affluence and education, importance of children in the labor force, education and employment of women, infant mortality rates, costs of raising children, availability and reliability of birth control methods, and religious beliefs and cultural norms that influence personal decisions about family size.
- Populations can reach limits to growth. Carrying capacity is the maximum number of individuals that can be supported in a given environment. The limitation is not the availability of space, but the number of people in relation to resources and the capacity of earth systems to support human beings. Changes in technology can cause significant changes, either positive or negative, in carrying capacity.

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### Natural Resources

- Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.
- The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
- Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

# National Science Education Content Standards

## 9-12 Content Standard F (continued)

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### Environmental Quality

- Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.
- Materials from human societies affect both physical and chemical cycles of the earth.
- Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

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### Natural and Human-Induced Hazards

- Normal adjustments of earth may be hazardous for humans. Humans live at the interface between the atmosphere driven by solar energy and the upper mantle where convection creates changes in the earth's solid crust. As societies have grown, become stable, and come to value aspects of the environment, vulnerability to natural processes of change has increased.
- Human activities can enhance the potential for hazards. Acquisition of resources, urban growth, and waste disposal can accelerate rates of natural change.
- Some hazards, such as earthquakes, volcanic eruptions, and severe weather, are rapid and spectacular. But there are slow and progressive changes that also result in problems for individuals and societies. For example, change in stream channel position, erosion of bridge foundations, sedimentation in lakes and harbors, coastal erosions, and continuing erosion and wasting of soil and landscapes can all negatively affect society.
- Natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society, as well as cause risks. Students should understand the costs and trade-offs of various hazards—ranging from those with minor risk to a few people to major catastrophes with major risk to many people. The scale of events and the accuracy with which scientists and engineers can (and cannot) predict events are important considerations.

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### Science and Technology in Local, National, and Global Challenges

- Science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.
- Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.
- Progress in science and technology can be affected by social issues and challenges. Funding priorities for specific health problems serve as examples of ways that social issues influence science and technology.
- Individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them. Students should understand the appropriateness and value of basic questions—“What can happen?” —“What are the odds?” — and “How do scientists and engineers know what will happen?”
- Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use—which decreases space available to other species—and pollution—which changes the chemical composition of air, soil, and water.

# Minnesota Graduation Standards

## High School Level

### Environmental Systems:

Apply decision-making model(s) to issues involving relationships among the individual, the society, the economy and the environment.

#### What students should know:

1. Understand the scientific concepts, principles, laws or theories that affect and are affected by environmental changes
2. Understand the components of social systems (e.g., economic, technological, political, communications) that affect and are affected by environmental changes
3. Understand the interactions between social and natural systems
4. Understand implications of changes in the environment:
  - a. short- or long-term
  - b. local, regional and/or global levels
5. Understand methods for citizenship action

#### What students should do:

1. Analyze a significant environmental topic to identify problems
2. Analyze an environmental problem to identify related issues
3. Develop a conceptual understanding of a local issue:
  - a. identify related scientific concepts and ecological systems
  - b. identify relevant social systems
  - c. identify interest groups, their points of view, and possible solutions
  - d. analyze how humans and natural systems affect and are affected by the local issue
4. Design and conduct primary research to enhance understanding of the local issue
5. Develop and evaluate a personal action plan designed to promote a specific solution

#### In Addition:

1. This standard should be paired with a standard from Inquiry, People and Cultures, Decision Making or Managing Resources whenever appropriate.
2. Students are encouraged to communicate to an audience outside of the school setting whenever possible.
3. Students must demonstrate basic safety procedures and skills when using tools and equipment.
4. Students are encouraged to consider a wide range of primary research techniques such as model building, field study, experiments, surveys, questionnaires, interviews, or observations.

### Natural/Managed Systems:

Understand the interaction and interdependence of natural and managed systems.

#### What students should know:

1. Understand natural ecosystems
2. Understand human-managed systems

#### What students should do:

1. Develop and communicate a resource management plan involving natural and managed systems:
  - a. describe the biological, physical and human characteristics of the systems
  - b. gather data using appropriate techniques
  - c. identify the nature of the interactive and interdependent relationships
  - d. use appropriate environmental impact criteria
  - e. analyze economic and environmental costs and benefits
  - f. present and defend a cost/benefit risk analysis to a jury of peers
  - g. modify the plan based on feedback

# Minnesota Graduation Standards

## High School Level

### Academic

#### Writing:

Demonstrate the ability to write for a variety of academic purposes and situations.

#### What students should do:

1. Describe, narrate or explain observations of human events or situations (e.g., biographies, historical narrative, ethnography)
2. Analyze patterns and relationships of ideas, topics or themes (e.g., literary analysis, ethnography, academic essay)
3. Construct support for a position, argument, plan or idea
4. Evaluate (e.g., review or critique) an idea, topic or theme based on criteria

#### In Addition:

1. Writing must represent a variety of purposes and situations.
2. Assessment task must include several products including one piece of writing of at least 1500 words in length.
3. The work must be validated as original through a "paper trail," observations, and/or conference.

### Human

#### Geography:

Understand how cultures interact with their environments.

#### What students should know:

1. Identify the location of major places and geographic features on the surface of the earth
2. Understand the physical and cultural characteristics of places
3. Understand the physical processes that shape patterns (e.g., forests, deserts, oceans) on the Earth's surface
4. Understand how movement of cultural characteristics interconnects various places
5. Understand how the physical environment is modified by and modifies human activities

#### What students should do:

1. Interpret and communicate geographic information through maps and other forms of graphic tools (e.g., air photos, satellite images) and geographic information systems (e.g., generate maps or correlations from information stored by location in databases)
2. Analyze the effects of alterations on cultural and/or physical landscapes (e.g., changes in local traffic patterns, construction of a mall, reclamation of wetlands)
3. Analyze the relationship between geography and a dispute about land use vs. ownership or political control
4. Analyze the relationship between geography and culture

# Minnesota Graduation Standards

## High School Level

### Individual/ Community Health:

Make informed decisions that enhance individual, family and community health in all six priority health areas:

#### Promote

- healthful nutrition/dietary practices
- physical fitness

#### Reduce/Prevent

- tobacco use
- drug/alcohol use
- intentional and unintentional injuries
- HIV/STD/unintentional pregnancies

### What students should know:

1. Understand how the priority health areas are interconnected in the areas of:
  - a. long-term health promotion and disease prevention (e.g., dietary practices)
  - b. community and/or societal influences
2. Know community-based health care services, products, providers and referral options

### What students should do:

1. Analyze how the following factors influence health maintenance and disease prevention decisions:
  - a. media
  - b. technological advances
  - c. interpersonal communication
  - d. immediate and long-term risk factors
2. Select information, products and/or services to respond in real or simulated situations of need:
  - a. personal/family
  - b. community/workplace
3. Create a plan for an in-depth study of one of the six priority health areas:
  - a. identify in-depth information needed
  - b. identify procedures required
  - c. identify how this area is impacted by other priority health areas
  - d. identify options for completing in-depth study (e.g., mentorship, internship, service learning)

### In Addition:

1. Tasks must reflect the interconnectedness of the six priority health behavior areas as defined by the Centers for Disease Control and Prevention and the National Health Education Standards: HIV/STD/unintentional pregnancy, drug and alcohol use, intentional and unintentional injury, tobacco use, nutrition/dietary practices and physical fitness.
2. In order to achieve at high standard level, students must complete an in-depth study as planned in #3 above.

### Issue Analysis:

Research an issue and evaluate proposed positions or solutions.

### What students should do:

1. Gather information on past or contemporary issues
2. Identify relevant questions or a range of points of view
3. Summarize relevant background information
4. Examine information from each source for bias and intended audience
5. Identify areas of conflict, compromise or agreement among various groups concerning the issue
6. Evaluate multiple positions and proposed solutions for the issue:
  - a. analyze conclusions, arguments and supporting evidence
  - b. identify motives of groups or individuals
  - c. analyze feasibility and practicality
  - d. identify impact on policies
  - e. compare alternative solutions
  - f. project consequences

