

A. Science Connections

CONTENT STANDARD A: Students in the Union Grove area schools will understand that there are unifying themes: systems, order, organization, and interactions; evidence, models and explanations; constancy, change, and measurement; evolution, equilibrium and energy; form and function among scientific disciplines.

Rationale: These unifying themes are ways of thinking rather than theories or discoveries. Students should know about these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Science is a system and should be seen as a single discipline rather than a set of separate disciplines. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

A.8.1 Science Themes: *Develop their understanding of the science themes** by using the themes to frame questions about science-related issues and problems.

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- Define and explain how the following science themes can be applied to the natural world: systems (solar system), order (planets), organization (kingdoms), and interactions (motion and energy); evidence (data), models (solar system) and explanations (Newton's Laws); constancy (law of conservation of energy), change (mountain building), and measurement (temperature, weight); evolution (geological time periods), equilibrium (motion, force, and energy), and energy (kinetic and potential).

A.8.2 Science Systems and the Themes: *Describe* limitations of science systems* and give reasons why specific science themes* are included in or excluded from those systems.*

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- Describe limitations of science systems and give reasons why specific science themes are included in or excluded from those systems (i.e., collecting data about the solar system may be limited by cost, time, technology and knowledge).

A.8.3 Defending and Critiquing Explanations: *Defend explanations* and models* by collecting and organizing evidence* that supports them and critique explanations and models by collecting and organizing evidence that conflicts with them.*

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- Discuss the characteristics of a good explanation (use supporting evidence) and why models are used (i.e., economical and practical, less dangerous).

A.8.4 Evidence: *Collect evidence* to show* that models* developed as explanations* for events were (and are) based on the evidence available to scientists at the time.*

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- Collect evidence to show that models developed as explanations for events were (and are) based on the evidence available to scientists at the time (i.e., early maps of the world were based on limited explorer knowledge). WGSD, D

A.8.5 New Evidence: *Show* [include the following themes when showing] how models* and explanations*, based on systems*, were changed as new evidence* accumulated (the effects of constancy*, evolution*, change*, and measurement* should all be part of these explanations).*

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- Understand that models will change over time as new evidence is collected.

A.8.6 Predicting with Models and Explanations: *Use models* and explanations* to predict* actions and events in the natural world.*

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- Use models and/or explanations to predict actions and events in the natural world (i.e., predict the impact of volcanoes, glaciers and earthquakes on the landscape and people living in the affected areas).

A.8.7 **Models:** *Design real or thought investigations* to test the usefulness and limitations of a model*.*

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- Work as a group to identify the usefulness and limitations of a model (i.e., discuss limitations of equipment used for laws of motion, earthquake safe buildings, solar system models, globes).

A.8.8 **Predicting with Themes:** *Use the themes* of evolution*, equilibrium*, and energy* to predict* future events or changes* in the natural world.*

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- Use the themes of evolution, equilibrium, and energy to predict future events or changes in the natural world (i.e., effects of plate tectonics on future locations of land masses).

B. Nature of Science

CONTENT STANDARD B: Students in the Union Grove area schools will understand that science is ongoing and inventive, and that scientific understandings have changed over time as new evidence is found. Students should develop an understanding of science as a human endeavor.

Rationale: Students will realize that scientific knowledge is developed from the activities of scientists and others who work to find the best possible explanations of the natural world. Researchers and those who are involved in science follow a generally accepted set of rules to produce scientific knowledge that others can confirm with experimental evidence. This knowledge is public, replicable, and undergoing revision and refinement based on new experiments and data.

B.8.1 Science Knowledge and Concepts: *Describe* how scientific knowledge and concepts have changed over time in the earth and space, life and environmental and physical sciences.*

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- Describe how scientific knowledge and concepts have changed over time in the Earth and space (i.e., because of carbon dating, discovery of new fossils, continental drift).

B.8.2 Change Over Time: *Identify* and describe* major changes that have occurred over time in conceptual models* and explanations* in the earth and space, life and environmental, and physical sciences and Identify* the people, cultures, and conditions that led to these developments.*

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- Identify and describe major changes that have occurred over time in conceptual models and explanations in the earth and space, life and environmental, and physical sciences and identify the people, cultures, and conditions that led to these developments (i.e. ancient models of the universe, shape of the earth).

B.8.3 Rules of Science: *Explain* how the general rules of science apply to the development and use of evidence* in science investigations, model*-making, and applications*.*

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- Understand that the rules of science require using data without changing data to meet expected outcomes.
- Understand that repeated tests with similar results can support the development of a model.

B.8.4 Reasoning: *Describe* types of reasoning and evidence* used outside of science to draw conclusions about the natural world.*

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- Provide examples of non-scientific reasoning being used to draw conclusions about the natural world (i.e., mythology, astrology).

B.8.5 Application of Science Knowledge: *Explain* ways in which scientific knowledge is shared, checked, and extended, and show* how these processes change over time.*

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- Understand that much of today's scientific knowledge is based on previous scientific ideas that have changed over time (i.e., model of solar system).

B.8.6 Uses and Limitations of Science: *Explain* the ways in which scientific knowledge is useful and also limited when applied to social issues.*

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- Understand the cost factors related to further development of space exploration and travel (i.e., tourists in space).

C. Science Inquiry

CONTENT STANDARD C: Students in the Union Grove area schools will investigate questions using scientific methods and tools, revise their personal understanding to accommodate knowledge, and communicate these understandings to others. Students should develop abilities necessary to do scientific inquiry and an understanding about scientific inquiry.

Rationale: Students should experience science in a form that engages them in actively constructing ideas and explanations and enhances their opportunities to develop the skills of doing science. Such inquiry (problem solving) should include questioning, forming hypotheses, collecting and analyzing data, reaching conclusions and evaluating results, and communicating procedures and findings to others.

C.8.1 Questioning: *Identify* questions they can investigate** using resources and equipment they have available.
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- Before and after conducting an experiment in class, the students will identify questions that they have about the topic.

C.8.2 Data and Information Sources: *Identify* data and locate sources of information* including their own records to answer the questions being investigated.

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- Use the data collected during investigations to develop conclusions and report findings.

C.8.3 Conducting Investigations: *Design and safely conduct investigations* that provide reliable quantitative or qualitative data, as appropriate, to answer their questions.*

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- Know the essential components of a scientific study. D

C.8.4 Inferences: *Use inferences* to help decide possible results of their investigations, [and] use observations to check their inferences.*

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- Understand what inferences are.

C.8.5 Explaining Results: *Use accepted scientific knowledge, models*, and theories* to explain* their results and to raise further questions about their investigations*.*

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C.8.6 Relating Inferences from Investigations: *State what they have learned from investigations*, relating their inferences* to scientific knowledge and to data they have collected.*

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C.8.7 Explaining Conclusions: *Explain* their data and conclusions in ways that allow an audience to understand the questions they selected for investigation* and the answers they have developed.*

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- Practice explaining data and conclusions in a way that allows others to understand the questions they elected to investigate.

C.8.8 Using Technology: *Use computer software and other technologies to organize, process, and present their data.*

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- Use computer software and other technologies to organize, process, and present their data (Power Point, Inspiration, Excel, internet, etc.).

C.8.9 Defending Validity: *Evaluate*, explain*, and defend the validity of questions, hypotheses, and conclusions to their investigations*.*

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- Share and defend data from an investigation with peers and teacher.

C.8.10 Realizing the Importance of Implications: *Discuss the importance of their results and implications of their work with peers, teachers, and other adults.*

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- Discuss the importance of data collected from investigations and its connections to real life situations.

C.8.11 Further Questioning: *Raise further questions which still need to be answered.*

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- Working as a group, raise further questions about investigations which still need to be answered.

D. Physical Science

CONTENT STANDARD D: Students in the Union Grove area schools will demonstrate an understanding of the physical and chemical properties of matter, the forms and properties of energy, and the ways in which matter and energy interact. (See Appendix B for NSES details on these fundamental concepts and principles.)

Rationale: Knowledge of the physical and chemical properties of matter and energy is basic to an understanding of the earth and space, life and environmental, and physical sciences. The properties of matter can be explained in terms of the atomic structure of matter. Natural events are the result of interactions of matter and energy. When students understand how matter and energy interact, they can explain and predict chemical and physical changes that occur around them.

D.8.1 Physical and Chemical Properties: *Observe*, describe*, and measure* physical and chemical properties of elements and other substances to identify* and group* them according to properties* such as density, melting points, boiling points, conductivity, magnetic attraction, solubility, and reactions to common physical and chemical tests.

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D.8.2 Chemical Interactions (Changes): Use the major ideas of atomic theory and molecular theory to *Describe* physical and chemical interactions* among substances*, including solids, liquids, and gases.

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D.8.3 New Substances: *Understand* how chemical interactions* (change) and behaviors lead to new substances with different properties.*

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D.8.4 Explaining Interactions: While conducting investigations*, *use the science themes* to Develop explanations* of physical and chemical interactions* and energy* exchanges.*

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D.8.5 Forces of Motion: While conducting investigations*, *Explain* the motion of objects* by describing* the forces acting on them.

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- Give examples of a force.
- Apply **Newton's Law** in explaining forces during investigations.

D.8.6 Explaining Motion: While conducting investigations*, *Explain* the motion of objects* using concepts of speed, velocity, acceleration, friction, momentum, and changes over time, among others, and *Apply* these concepts and explanations* to real-life situations outside the classroom.*

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- Know the mathematical formula for speed.
- Identify and give examples of **velocity, speed, acceleration, friction and momentum**.
- Use speed and acceleration data to create charts and graphs and interpret the results. (Graphing includes a variety of mediums, calculators, computers, and other tools).

D.8.7 Using Definitions and Ideas: While conducting investigations* of common physical and chemical interactions* occurring in the laboratory and the outside world, *Use commonly accepted definitions of energy* and the idea of energy conservation.*

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- Explain and give examples of different forms of energy.
- Give an example of energy changing forms.
- State the **Law of Conservation** of energy and explain the concept.

D.8.8 Interactions of Objects: *Describe* and investigate* the properties of light, heat, gravity, radio waves, magnetic fields, electrical fields, and sound waves as they interact* with material objects in common situations.*

- 6:**
- Explain and give examples of light, heat, gravity, and sound waves.
 - Identify sources of light, heat, gravity, sound waves and electric fields. WGSD, WC

D.8.9 Models of Energy Transmission: *Explain* the behaviors of various forms of energy* by using the models* of energy transmission, both in the laboratory and in real-life situations in the outside world.*

- 6:**
- Understand how the sun's energy transfers through plants (food chains).
 - Explain how radiant energy converts to electrical energy.

D.8.10 Models of Atomic Structure: *Explain* how models* of the atomic structure of matter have changed over time, including historical models and modern atomic theory.*

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E. Earth and Space Science

CONTENT STANDARD E: Students in the Union Grove area schools will demonstrate an understanding of the structure and systems of earth and other bodies in the universe and of their interactions. (See Appendix B for NSES details on these fundamental concepts and principles).

Rationale: By studying the earth, its composition, history and the processes that shape it, students gain a better understanding of the planet on which they live. In addition, all bodies in space, including the earth, are influenced by forces acting throughout the solar system and the universe. Studying the universe enhances students' understanding of the earth's origins, its place in the universe, and its future. Understanding these geologic, meteorological, astronomical and oceanographic processes allows students to make responsible choices and to evaluate the consequences of their choices.

E.8.1 Changes in Earth Features: Using the science themes*, *Explain* and predict* changes* in major features of land, water, and atmospheric systems.*

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- Give examples of **land features** and water systems that have changed over time. WGSD
- Explain how environmental changes affect major land features and water systems. WGSD

E.8.2 Underlying Structures of the Earth: *Describe* underlying structures of the earth that cause changes* in the earth's surface.*

6:

- Describe underlying structures of the earth. WGSD
- Explain how changes in the interior of the earth cause changes on the earth's surface. WGSD

E.8.3 Forces Acting on the Earth: Using the science themes* during the process of investigation*, *Describe* climate, weather, ocean currents, soil movements and changes* in the forces acting on the earth.*

6:

- Identify the forces that wear down and build the Earth's surface. WGSD
- Compare and contrast climates and give reasons for differences. WGSD

E.8.4 Influence of Living Organisms: Using the science themes*, *Analyze* the influence living organisms have had on the earth's systems*, including their impact on the composition of the atmosphere and the weathering of rocks.

6:

- Explain the role of living organisms in the production of fossil fuels.

E.8.5 Evidence of Earth History: *Analyze* the geologic and life history of the earth*, including change* over time, using various forms of scientific evidence.

6:

- Identify the **geological eras**. WGSD
- Collect and identify fossils. WGSD
- Identify characteristics associated with the different geological areas. WGSD

E.8.6 Use of Resources: *Describe* through investigations the use of the earth's resources by humans in both past and current cultures*, particularly how changes in the resources used for the past 100 years are the basis for efforts to conserve and recycle renewable and non-renewable resources.

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- Compare and contrast current and past use of earth **resources** giving reasons why the resources we have used have changed.
- Predict how current resource use patterns will affect resource supplies for the next generation.
- Explain how **recycle** programs may affect **renewable** and **non-renewable resources**.

E.8.7 Celestial Models: *Describe* the general structure of the solar system, galaxies, and the universe*, explaining the nature of the evidence* used to develop current models* of the universe.

6:

- Identify and understand differences between structures of the **solar system, galaxies and the universe**.

E.8.8 Cycles of the Earth: Using past and current models* of the structure of the solar system, *Explain* the daily, monthly, yearly, and long-term cycles of the earth*, citing evidence* gained from personal observation* as well as evidence used by scientists.

6:

- Explain how **rotation** and **revolution** of the earth **moon system** effects daily, monthly, yearly and long term **cycles** of the earth.

F. Life and Environmental Science

CONTENT STANDARD F: Students in the Union Grove area schools will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with one another and their environment. (See Appendix B for NSES details on these fundamental concepts and principles.)

Rationale: Students will enhance their natural curiosity about living things and their environment through study of the structure and function of living things, ecosystems, life cycles, energy movement (transfer), energy change (transformation), and changes in populations of organisms through time. Knowledge of these concepts and processes of life and environmental science will assist students in making informed choices regarding their lifestyles and the impact they have on communities of living things in their environment.

F.8.1 Structure and Function of Living Things: *Understand* the structure and function* of cells, organs, tissues, organ systems, and whole organisms.*

6:

- Understand that a cell is a basic building block of all life.
- Distinguish between various types of cells.
- Define and explain relationships between cells, organs, tissues, organ systems, and whole organisms.

F.8.2 Adaptation Structures: *Show* how organisms have adapted structures to match their functions*, providing means of encouraging individual and group survival within specific environments.*

6:

- Give examples of adaptations in different organisms.

F.8.3 Single and Multi Celled Organisms: *Differentiate between single-celled and multiple-celled organisms (humans) through investigation, comparing the cell functions of specialized cells for each type of organism.*

6:

- Explain the difference between single-celled (bacteria and protists) and multiple-celled organisms (plants and fungi) and give examples of each.

F.8.4 Characteristic Traits: *Investigate* and explain* that heredity is comprised of the characteristic traits found in genes within the cell of an organism.*

6:

F.8.5 Passing on Characteristics: *Show* how different structures both reproduce and pass on characteristics of their group.*

6:

F.8.6 Internal and External Regulation: *Understand* that an organism is regulated both internally and externally.*

6:

- Define what is meant by internal and external regulation in an organism.
- Give examples of internal and external regulation in an organism.

F.8.7 Behavior Adaptations: *Understand* that an organism's behavior evolves through adaptation to its environment.*

6:

F.8.8 Population Balance: *Show* through investigations* how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system* of life on the planet.*

6:

- Identify how populations within an ecosystem affect one another.
- Explain what happens when populations in an ecosystem are not in equilibrium.

F.8.9 Changes that Impact on the Survival and Growth of Certain Species: *Explain* how some of the changes* on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species.*

6:

- Give examples of local and global changes which have affected various **species** and explain how the species was affected (**i.e., endangered species**).

F.8.10 Human Influence on the Environment: *Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends.*

6:

- Define **natural resources** and give examples.
- Identify uses of natural resources and their limits.

G. Science Application

CONTENT STANDARD G: Students in the Union Grove area schools will demonstrate an understanding of the relationship between science and technology and the ways in which that relationship influences human activities.

Rationale: Science and technology compliment each other. Science helps drive technology and technology provides science with tools for investigation, inquiry and analysis. Together, science and technology applications provide solutions to human problems, needs and aspirations. Students should understand that advances in science and technology affect the earth's systems.

G.8.1 Careers: *Identify* and investigate* the skills people need for a career in science or technology and identify the academic courses that a person pursuing such a career would need.*

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- Identify careers that involve science and technology.
- Identify skills one would need to have a career in a science field (i.e., making observations, strong sense of inquiry, patience, analyzing data, collecting information, communication skills, understanding tools and technology).
- Identify course work required in high school and post high school institutions for specific careers in science.

G.8.2 Influence of Discoveries: *Explain* how current scientific and technological discoveries have an influence on the work people do and how some of these discoveries also lead to new careers.*

6:

- Identify scientific and technological discoveries through discussion of current events.
- Explain how scientific and technological discoveries have influenced careers (i.e., environmental science, space research, forensics, research, computer programming, transplant technology, gene therapy, water treatment, sanitation, bridge construction).

G.8.3 Impact of Science and Technology: *Illustrate* the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life.*

6:

- Identify and explain positive and negative effects science and technology have had on society (i.e., faster pace, longer life expectancy, accessibility, invasion of privacy, loss/increase of jobs, organization, opportunities, internet usage, impact on environment, energy sources, energy consumption and costs).

G.8.4 Science Models/Machines: *Propose a design (or re-design) of an applied science model or a machine that will have an impact in the community or elsewhere in the world and show* how the design (or re-design) might work, including potential side effects.*

6:

- Design applied science models or machines and explain how they could affect society (i.e., egg drop, design temperature control {insulation} containers, structural design, landscape design, living habitat design, Rube Goldberg).

G.8.5 Science or Technology Solutions: *Investigate* a specific local problem to which there has been a scientific or technological solution, including proposals for alternative courses of action, the choices that were made, reasons for the choices, any new problems created, and subsequent community satisfaction.*

6:

- Identify local scientific or technological problems and their solutions and explain **processes** (methods) by which problems were solved.

G.8.6 Discoveries Result in New Technology: Use current texts, encyclopedias, source books, computers, experts, the popular press, or other relevant sources to *Identify* examples of how scientific discoveries have resulted in new technology.*

6:

- Gather information, using a variety of current and reliable resources, to identify scientific discoveries which have resulted in new technologies (Science in the News activity). (i.e., genetics and cloning, Global Positioning System, pacemakers, velcro, genetic engineering, laser eye surgery.)

G.8.7 Science and Technology Interdependence: *Show* evidence* of how science and technology are interdependent, using some examples drawn from personally conducted investigations*.*

6:

- Describe how science and technology are interdependent by citing examples.

H. Science in Social and Personal Perspectives

CONTENT STANDARD H: Students in the Union Grove area schools will use scientific information and skills to make decisions about themselves, Wisconsin, and the world in which they live. Students should develop an understanding of personal health and science and technology in society.

Rationale: An important purpose of science education is to give students a means to understand and act on personal, economic, social, political and international issues. Knowledge and methodology of the earth and space, life and environment, and physical sciences facilitate analysis of topics related to personal health, environment, and management of resources, and help evaluate the merits of alternative courses of action.

H.8.1 Evidence in Media: *Evaluate* the scientific evidence* used in various media (for example, television, radio, Internet, popular press, and scientific journals) to address a social issue, using criteria of accuracy, logic, bias, relevance of data, and credibility of sources.*

6:

- Analyze, and discuss scientific evidence from various media sources, for **accuracy, logic, bias, relevance** of data, and **credibility** of sources.
- Identify scientific and technological discoveries through discussion of current events.
- Recognize what makes a source reliable.

H.8.2 Scientific Solution: *Present a scientific solution to a problem involving the earth and space, life and environmental, or physical sciences and participate in a consensus-building discussion to arrive at a group decision.*

6:

- Identify scientific problems and possible solutions.
- Participate in group discussions regarding an environmental problem and potential solutions.
- Develop group decisions.

H.8.3 Consequences of Decisions on Health and Safety: *Understand* the consequences of decisions affecting personal health and safety.*

6:

- Define consequences of decisions affecting personal health and safety (i.e., environmental consequences).
 - Participate in the Science Safety Unit.