



**KENOSHA UNIFIED SCHOOL DISTRICT NO. 1
CURRICULUM AND INSTRUCTIONAL SERVICES**

**STANDARDS AND BENCHMARKS
SCIENCE**

ELECTIVES

STANDARD A: SCIENCE CONNECTIONS—STUDENTS WILL UNDERSTAND AND DESCRIBE THE UNIFYING CONCEPTS AND PROCESSES AMONG SCIENCE TOPICS WHICH LEAD TO CONNECTIONS BETWEEN PHYSICAL SCIENCE, EARTH/SPACE SCIENCE, AND LIFE SCIENCE.

A-1: Systems

A system has properties that are different from those of its parts.

The successful operation of a system involves feedback.

It may not be possible to predict accurately the result of changing some part of a system.

A-2: Models

The basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same ways as the objects or processes under investigation.

The usefulness of a model can be tested by comparing its predictions to actual observations in the real world.

A-3: Change and Constancy

A system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small. Large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium.

The concept of the conservation of matter and energy is involved in all fields of science.

Graphs and equations are useful ways for depicting and analyzing patterns of change.

In evolutionary change, the present arises gradually from the materials and forms of the past.

The precise behavior of most systems is unpredictable.

A-4: Scale

Representing large numbers in terms of powers of ten makes it easier to think about them and to compare things that are greatly different.

Large changes in scale typically change the way that things work in physical or biological systems.

As the number of parts of a system grows in size, the number of possible internal interactions increases much more rapidly.

A-5: Connections

Any event, issue, or problem in the natural or designed world can be associated with the general domains of science and the unifying themes of science.

Many scientific investigations require the contributions of individuals from different disciplines, including engineering.

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STANDARD B: NATURE OF SCIENCE—STUDENTS WILL UNDERSTAND THAT THE STUDY OF SCIENCE IS ONGOING, AND THEORIES AND CONCEPTS IN SCIENCE CHANGE OVER TIME AS NEW EVIDENCE IS FOUND. SCIENTIFIC EXPLANATIONS MUST ADHERE TO CRITERIA SUCH AS: A PROPOSED EXPLANATION MUST BE LOGICALLY CONSISTENT, IT MUST ABIDE BY THE RULES OF EVIDENCE, IT MUST BE OPEN TO QUESTIONS AND POSSIBLE MODIFICATION, AND IT MUST BE BASED ON HISTORICAL AND CURRENT SCIENTIFIC KNOWLEDGE.

B-1: Science is a Human Endeavor, and There are Many Commonly Known Careers in Science.

Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations.

Many people choose science as a career and devote their lives to studying it.

Scientists value peer review, truthful reporting about the methods and outcomes of investigations, and making public the results of work.

B-2: Nature of Scientific Process and Knowledge

Scientists strive for the best possible explanations about the natural world.

Scientific explanations must be consistent with experimental and observational evidence.

Scientific knowledge is subject to change as new evidence becomes available.

Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations, and communicating results.

B-3: History of Science

In history, diverse cultures have contributed scientific knowledge and technologic inventions.

Changes in science occur as modifications in existing knowledge.

The historical perspective of scientific explanations demonstrates how scientific knowledge changes by evolving over time.

STANDARD C: SCIENCE INQUIRY—STUDENTS WILL INVESTIGATE QUESTIONS USING SCIENTIFIC METHODS AND TOOLS, REVISE THEIR PERSONAL UNDERSTANDING TO ACCOMMODATE KNOWLEDGE, AND COMMUNICATE THOSE UNDERSTANDINGS TO OTHERS.

C-1: Ask Questions about Objects, Organisms, and Events in the Everyday World.

Formulate a testable hypothesis suggested by current social issues, scientific literature, or observations of phenomena and demonstrate its connections to scientific concepts.

C-2: Make Connections to Prior Knowledge.

Use prior knowledge of scientific facts, concepts, and investigations to make predictions and guide the design of an experiment.

C-3: Gather Background Knowledge Related to the Questions Being Investigated.

Locate and access data and scientific knowledge in age-appropriate information sources and reference materials. (See English/ Language Arts and Information and Technology Literacy Standards.)

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C-4: Design and Conduct Responsible and Safe Investigations to Help Answer Questions.
Demonstrate knowledge of age-appropriate safe laboratory procedures.

Design an appropriate scientific investigation based on current issues, scientific concepts, or student observations.

C-5: Safely Use Appropriate Senses, Equipment and Tools to Make Observations and Gather Data.
Select and use appropriate tools and equipment to make accurate observations and SI measurements for the purpose of scientific investigation.

C-6: Collecting and Representing Qualitative and Quantitative Data
(See Math Standard E.)
Collect and organize qualitative and quantitative data in a lab notebook or report, or by using media and technology appropriate to purpose and content.

Create and interpret appropriate types of graphs.

C-7: Summarizing, Synthesizing, Inferring, and Building Explanations
Use experimental results, mathematical formulas, models, and current scientific knowledge to develop and defend likely explanations of investigation results and refine work.

Relate mathematical functions to data.

C-8: Communicating Results
Complete appropriate lab report.

Share, defend, and revise results, explanations, and procedures using media and technology appropriate to purpose and content.

Evaluate physical and conceptual models for accuracy and completeness.

STANDARD D: PHYSICAL SCIENCE —STUDENTS 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.

D-1: Properties of Matter
(No Elective Benchmarks)

D-2: Structure of Matter
(No Elective Benchmarks)

D-3: Physical, Chemical and Nuclear Changes in Matter
(No Elective Benchmarks)

D-4: Position and Motion of Objects
Objects change their motion only when a net force is applied. Laws of motion are used to calculate and graph precisely the effects of forces on the motion of objects.

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D-5: Forces of Nature

Gravitational force is an attraction between masses. The strength of the force is proportional to the masses and weakens rapidly with increasing distance between them.

The electric force is a universal force that exists between any two charged objects. Opposite charges attract, while like charges repel.

The strength of the electric force is proportional to the charges and inversely proportional to the square of the distance between them.

Negative charges, being associated with electrons, are far more mobile in materials than positive charges are. A very small excess or deficit of negative charges in a material produces noticeable electric forces.

At the atomic level, electric forces between oppositely charged electrons and protons hold atoms and molecules together and are involved in all chemical reactions. These forces also hold solid and liquid materials together and act between objects when they are in contact.

Electricity and magnetism are two aspects of a single electro-magnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.

The forces that hold the nucleus of an atom together are much stronger than the electro-magnetic force, so great amounts of energy are released from the nuclear reactions in the sun and other stars.

D-6: Interactions of Energy and Matter

Different kinds of materials respond differently to electric forces. In conducting materials such as metals, electric charges flow easily, whereas in insulating materials, such as glass, they can move hardly at all.

At very low temperatures, some materials become super-conductors and offer no resistance to the flow of current.

Electromagnetic waves result when a charged object is accelerated or decelerated.

The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.

To see an object, light from that object—emitted by or scattered from it—must enter the eye.

To hear a sound, waves from an object must enter the ear.

D-7: Conservation of Energy

The total energy of the universe is constant. Energy can be transferred in many ways but it can never be destroyed.

As transfers of energy occur, the matter involved becomes steadily less ordered.

STANDARD E: EARTH SCIENCE—STUDENTS WILL DEMONSTRATE AN UNDERSTANDING OF THE STRUCTURE AND SYSTEMS OF EARTH AND THE UNIVERSE AND OF THEIR INTERACTIONS.

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E-1: Properties and Structures of the Earth and its Materials

Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of heat. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.

The solid crust of the earth consists of separate plates that ride on a denser, hot, gradually deformable layer of the earth. The crust sections move very slowly, pressing against one another in some places, pulling apart in other places. Earthquakes, volcanic activity, mountain building and sea floor formation may occur at these boundaries.

E-2: History and Changes of the Earth

The sun, the earth, and the rest of the solar system formed from a nebular cloud of dust and gas approximately 4.6 billion years ago. The early earth was very different from the planet we live on today.

Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radio-active isotopes present in rocks to measure the time since the rock was formed.

Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in ongoing changes of the earth system.

Evidence for one-celled forms of life extends back more than 3.5 billion years. The development of life on earth caused dramatic changes in the composition of the atmosphere, which did not originally contain oxygen.

E-3: Cycles in the Earth System

Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Weather and climate involve the transfer of energy in and out of the atmosphere.

The earth is a system containing essentially a fixed amount of each stable chemical, atom, or element. Each element can exist in several different chemical reservoirs.

Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter.

The formation, weathering, sedimentation, and reformation of rock constitute a continuing "rock cycle" in which the total amount of material stays the same as its forms change.

E-4: The Earth, Our Solar System, and Space

The origin of the universe remains one of the greatest questions in science.

The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot, dense state; according to this theory, the universe has been expanding ever since.

Early in the history of the universe, matter—primarily the light atoms, hydrogen and helium—clumped together by gravitational attraction to form countless trillions of stars.

Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe.

Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.

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STANDARD F: LIFE AND ENVIRONMENTAL SCIENCE —STUDENTS 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.

F-1: Characteristics, Structure, and Function in Living Things

Differentiation of cells is regulated through the expression of different genes.

F-2: Life Cycles and Heredity of Living Things

(No Elective Benchmarks)

F-3: Organisms, Populations, and Ecosystems

(No Elective Benchmarks)

F-4: Matter and Energy in Living Systems

(No Elective Benchmarks)

STANDARD G: SCIENCE APPLICATIONS—STUDENTS WILL DEMONSTRATE AN UNDERSTANDING OF THE RELATIONSHIP BETWEEN SCIENCE AND TECHNOLOGY AND THE WAYS IN WHICH THAT RELATIONSHIP INFLUENCES HUMAN ACTIVITIES.

G-1: The Process of Technological Design

Identify a problem or an opportunity to improve a design; propose designs and choose between alternative solutions; implement a proposed solution; evaluate the solution and its consequences; and communicate the problem, process, and solution.

G-2: Abilities to Distinguish Between Natural Objects and Objects Made by Humans

Design, build, evaluate, and revise models and explanations related to the earth and space, life and environmental, and physical sciences.

Analyze the costs, benefits, or problems resulting from a scientific or technological innovation.

G-3: Understanding About Science and Technology

Science often advances with the introduction of new technologies, and solving technological problems often results in new scientific knowledge.

Scientists rely on technology to enhance the gathering and manipulation of data.

The accuracy and precision of data depends on the technology used.

STANDARD H: SCIENCE IN SOCIAL AND PERSONAL PERSPECTIVES—STUDENTS WILL USE SCIENCE INFORMATION AND SKILLS TO MAKE INFORMED DECISIONS ABOUT THEMSELVES, THEIR COMMUNITY, AND THE WORLD IN WHICH THEY LIVE.

H-1: Personal and Community Health

Scientific knowledge can be used to make real-life decisions.

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H-2: Human 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.

Populations can reach limits to growth. Carrying capacity is the maximum number of individuals that can be supported in a given environment.

H-3: Types of 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.

H-4: Quality of and Changes in Environments

Human activities can enhance 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.

Humans have a major effect on other species.

H-5: Science and Technology in Society

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.

Progress in science and technology can be affected by social issues and challenges.