KENOSHA UNIFIED SCHOOL DISTRICT NO. 1
CURRICULUM AND INSTRUCTIONAL SERVICES

STANDARDS AND BENCHMARKS
SCIENCE

GRADES 9 **BIOLOGY**
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 ***Models are often used to think about processes that are not easily observed.*** ***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 an 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 ***In living organisms, atoms are arranged n special molecules that function in the processes necessary to support life.***
D-2: Structure of Matter (No Biology Benchmarks)
D-3: Physical, Chemical and Nuclear Changes in Matter A wide variety of biological, chemical, and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.
D-4: Position and Motion of Objects (No Biology Benchmarks)
D-5: Forces of Nature (No Biology Benchmarks)

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D-6: Interactions of Energy and Matter
All living things use energy.

The sun is a major source of energy for changes on the earth's surface.

Plants convert light energy into stored chemical energy through photosynthesis, and animals get energy from cellular respiration (i.e. energy can change from one form to another in living things).

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.

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

E-1: Properties and Structures of the Earth and its Materials
(No Biology Benchmarks)

E-2: History and Changes of the Earth
(No Biology Benchmarks)

E-3: Cycles in the Earth System
(No Biology Benchmarks)

E-4: The Earth, Our Solar System, and Space
(No Biology Benchmarks)

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
Every cell is covered by a membrane that controls what can enter and leave the cell.

A living cell is composed of a small number of chemical elements mainly carbon, hydrogen, nitrogen, oxygen, phosphorous, and sulfur.

Different molecules inside the cell form structures that carry out cell functions.

Cell functions include transport of materials, energy capture and release, protein building, waste disposal, information feedback, and movement.

The work of a cell is carried out by the many different proteins it assembles from 20 different amino acids.

The function of each protein molecule depends on its sequence of amino acids.

The genetic information in DNA molecules provides instructions for assembling protein molecules. The code used is virtually the same for all life forms.

Complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Cell behavior can also be affected by molecules from other parts of the organism.

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Most cells function best within a narrow range of temperature and acidity.

Plant cells contain chloroplasts, the site of photosynthesis.

Plants and many microorganisms use solar energy to combine molecules of carbon dioxide and water into complex, energy-rich compounds and release oxygen to the environment.

Complex multicellular organisms are formed as a highly organized arrangement of differentiated cells.

The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism.

F-2: Life Cycles and Heredity of Living Things

The information passed from parents to offspring is coded in DNA molecules.

The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes and replicated.

Genes are segments of DNA molecules.

The sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the off-spring of any two parents.

Inserting, deleting, or substituting DNA segments can alter genes; and an altered gene may be passed on to every cell that develops from it. This may help, harm, or have little effect on the offspring's success in its environment.

Behavior is one kind of response an organism can make to an internal or environmental stimulus. Behavioral response is a set of actions determined in part by heredity and in part from experience.

F-3: Organisms, Populations, and Ecosystems

Organisms are classified into a hierarchy of groups and sub-groups based on anatomical similarities and the similarity of their DNA sequences.

Organisms both cooperate and compete in ecosystems. The ecosystems may be stable for hundreds or thousands of years.

Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite.

Genetic variability of organisms due to mutation and recombination of genes makes some organisms better able to survive and leave offspring.

Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms as well as for the striking molecular similarities observed among the diverse species of living organisms.

A great diversity of species increases the chance that at least some living things will survive in the face of large changes in the environment.

Human beings are part of the earth's eco-systems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems

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F-4: Matter and Energy in Living Systems

Living systems require a continuous input of energy to maintain their chemical and physical organizations.

The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.

Energy flows through eco-systems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.

Plants capture energy by absorbing light and using it to form strong chemical bonds between the atoms of carbon-containing molecules. The energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.

At each link in a food web, some energy is stored in newly made structures; but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going.

The amount of life any environment can support is limited by the available energy, water, oxygen, and minerals and by the ability of ecosystems to recycle the residue of dead organic materials. Human activities and technology can change the flow.

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.

Science and technology are pursued for different purposes. Scientific inquiry is driven by the desire to understand the natural world, and technology is driven by the need to meet human needs and solve human problems.

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.

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.

H-2: Human Population Growth

(No Biology Benchmarks)

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H-3: Types of Resources (No Biology Benchmarks)
H-4: Quality of and Changes in Environments (No Biology Benchmarks)
H-5: Science and Technology in Society (No Biology Benchmarks)