

Minneapolis Public Schools
Biology – Grades 9-10
STANDARDS AND BENCHMARKS ADDRESSED

KEY TO THE FOLLOWING STANDARDS FORMAT:

- *Italics indicates language added to the state standards by Minneapolis teachers.*
- **Bold words indicate “Power Benchmarks” that should be addressed in detail.**
- The other benchmarks are to be addressed when possible but as time permits.

IV. LIFE SCIENCE

A. CELLS

The student will comprehend that all living things are composed of cells, and that the life processes in a cell are based on molecular interactions.

Benchmarks:

- 1. The student will relate cellular structures to their functions.**
2. The student will compare and contrast the structures found in typical plant, animal and bacterial cells.
- 3. *The student will compare and contrast viruses with living cells.***
- 4. The student will explain the role of the cell membrane as a highly selective barrier in diffusion, osmosis and active transport.**
- 5. The student will describe the role of enzymes as catalysts in metabolism and cellular synthesis of new molecules.**
- 6. The student will differentiate between the processes of photosynthesis and respiration in terms of energy flow, reactants and products.**
7. The student will describe the process of mitosis and its role in the cell cycle.

B. DIVERSITY OF ORGANISMS

The student will classify, compare, and contrast the diversity of organisms on Earth and their modes of accommodating the requirements for life.

Benchmarks:

- 1. The student will relate the structure, complexity and organization of organ systems to the methods of obtaining, transforming, releasing and eliminating the matter and energy used to sustain the organism.**
- 2. The student will recognize that organisms have both innate and learned behavioral responses to internal and external stimuli, including the trophic responses in plants.**
- 3. The student will use scientific evidence, including the fossil record, homologous structures, embryological development or biochemical similarities, to classify organisms in order to**

show probable evolutionary relationships and common ancestry.

C. INTERDEPENDENCE OF LIFE

The student will describe how the environment and interactions between organisms can affect the number of species and the diversity of species in an ecosystem.

Benchmarks:

1. **The student will describe the factors related to matter and energy in an ecosystem that both influence fluctuations in population size and determine the carrying capacity of a population.**
2. **The student will explain how adaptations of species and co-evolution with other species are related to success in an ecosystem.**
3. The student will identify examples of mutualism, commensalism, and parasitism in a stable ecosystem.
4. **The student will predict and analyze how a change in an ecosystem, resulting from natural causes, changes in climate, human activity or introduction of invasive species, can affect both the number of organisms in a population and the biodiversity of species in the ecosystem.**

D. HEREDITY

The student will explain how inherited characteristics are encoded by genes.

Benchmarks:

1. The student will explain that the instructions for the characteristics of all organisms are carried in nucleic acids.
2. **The student will define the relationship between DNA, genes and chromosomes.**
3. **The student will describe the structure and function of DNA and distinguish between replication, transcription and translation.**
4. The student will know that different species of multicellular organisms have a characteristic number of chromosomes, and that in typical humans there are 22 autosomal pairs and 2 sex chromosomes.
5. **The student will describe how genetic information is transmitted from parents to offspring through the processes of meiosis and fertilization as they relate to chromosome recombination and sexual reproduction.**
6. **The student will use Mendel's laws of segregation and independent assortment to determine the genotype and phenotype of a monohybrid cross.**
7. **The student will differentiate between dominant, recessive, co- dominant, incompletely dominant, polygenic and sex-linked traits.**

E. BIOLOGICAL POPULATIONS CHANGE OVER TIME

The student will understand how biological evolution provides 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.

Benchmarks:

1. The student will understand that species change over time and the term biological evolution is used to describe this process.
2. **The student will use the principles of natural selection to explain the differential survival of groups of organisms as a consequence of:**
 - The potential for a species to increase its numbers;
 - The genetic variability of offspring due to mutation and recombination of genes;
 - A finite supply of the resources required for life; and,
 - The ensuing selection based on environmental factors of those offspring better able to survive and produce reproductively successful offspring.
3. The student will describe how genetic variation between populations is due to different selective pressures acting on each population, which can lead to a new species.
4. The student will use biological evolution to explain the diversity of species.
5. *The student will understand that the same processes that are responsible for biological evolution of plants and animals on earth are also responsible for evolution of the human species.*

F. FLOW OF MATTER AND ENERGY

The student will describe and explain the cycling of matter and flow of energy through an ecosystem's living and non-living components.

Benchmarks:

1. **The student will explain the relationship between abiotic and biotic components of an ecosystem in terms of the cycling of water, carbon, oxygen and nitrogen.**
2. **The student will know that all matter tends to become more disorganized over time, and that living systems require a continuous input of energy in order to maintain their chemical and physical organizations and prevent death.**
3. The student will explain that sunlight is transformed into chemical energy by photosynthetic organisms.
4. The student will explain that respiration releases chemical energy through the breakdown of molecules.
5. **The student will understand that matter and energy flow through different levels of organization of living systems, from cells to communities, as well as between living systems and the physical environment as chemical elements are recombined in different ways. Each recombination results in both storage and dissipation of energy.**

G. HUMAN ORGANISM

The student will understand how all organ systems, including the nervous system, interact to maintain homeostasis.

Benchmarks:

1. The student will understand and describe the basic anatomy and physiology of the nervous system and sense organs.
2. The student will describe how the functions of individual organ systems are integrated to maintain a homeostatic balance in the body.

I. HISTORY AND NATURE OF SCIENCE**A. SCIENTIFIC WORLD VIEW**

The student will understand the ways of scientific thinking and that scientific knowledge changes and accumulates over time.

Benchmarks:

1. The student will be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.
2. The student will be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease and big bang theory.
3. The student will recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and, be falsifiable and open to criticism.
4. The student will explain how traditions of ethics, peer review, conflict and general consensus influences the conduct of science.
5. The student will recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances.

B. SCIENTIFIC INQUIRY

The student will design and conduct a scientific investigation.

Benchmarks:

1. The student will design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation

with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.

2. **The student will distinguish between qualitative and quantitative data.**
3. **The student will apply mathematics and models to analyze data and support conclusions.**
4. **The student will identify possible sources of error and their effects on results.**
5. The student will know that professional scientists and engineers have ethical codes.
6. The student will give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions.

C. SCIENTIFIC ENTERPRISE

The student will understand the relationship between science and technology and how both are used.

Benchmarks:

1. The student will compare and contrast the purposes and career opportunities of engineering, technology and science.
2. **The student will provide an example of a need or problem identified by science and solved by engineering or technology.**
3. **The student will provide an example of how technology facilitates new discoveries and the development of scientific knowledge.**
4. The student will know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes.
5. The student will recognize that science and technology are influenced by cultural backgrounds and beliefs and by social needs, attitudes, values and limitations.

D. HISTORIC PERSPECTIVE

The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.

Benchmarks:

1. **The student will be able to trace the development of a scientific advancement, invention or theory and its impact on society.**
2. The student will provide examples of scientific advancements contributed by other civilizations and cultures.
3. **The student will compare and contrast the differences between scientific theories and theories from other bodies of knowledge, and the importance of each in a science discussion.**

