

# DoDEA Science Standards Grades 9-12 Overview

## Key Scientific Concepts

In each DoDEA high school science course, students further the development of major concepts and processes including:

- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, equilibrium and measurement
- Theories of evolution such as biological, chemical and geological
- Form and function

## Standards Included in Every Course

Included in every high school science course are the strands of scientific inquiry, the history and nature of science, science in personal and social perspectives, science and technology, and specific content standards. These standards provide all students with a facility in scientific investigations and an ability to make connections across the sciences, mathematics, and technology.

Each science course contributes to the student's content knowledge, the development of process skills, and the development of science literacy, to make the study of science a worthwhile lifetime endeavor. Specific courses engage students in deepening their knowledge, skills and understandings related to the standards.

## DoDEA High School Science Courses

Courses that directly address and support the DoDEA high school science standards and provide students with optional and expanded opportunities for learning in specific science areas are:

**Biology**, Human Anatomy & Physiology, Marine Biology, Oceanography, AP Biology, Environmental Science

Introduction to Physics; **Physics**; AP Physics B, AP Physics C

Chemistry Applications in the Community; **Chemistry**, AP Chemistry

**Earth and Space Science**, Astronomy

Science Technology Society, Science Research

## **S1: Scientific Inquiry**

The student extends their understanding of scientific inquiry and their ability to conduct scientific investigations; that is, the student:

- S1a:** constructs questions that initiate and guide scientific investigations.
- S1b:** designs and conducts scientific investigations using established procedures that are safe, humane, and ethical.
- S1c:** uses technology and mathematics to systematically gather, record, analyze, explain, and interpret data.
- S1d:** formulates and revises scientific conclusions, explanations and models (physical, conceptual, mathematical) based on scientific knowledge, logic, and evidence.
- S1e:** recognizes, analyzes and evaluates alternative explanations and models.
- S1f:** evaluates and defends scientific arguments, acknowledging references and contributions of others.
- S1g:** communicates the scientific inquiry process using appropriate scientific language and mathematics.

## **S2: History and Nature of Science**

The student demonstrates understanding of science as a human endeavor, examining the nature of scientific knowledge and historical perspectives; that is, the student:

- S2a:** describes how the work of scientists is influenced by their ethical standards and by societal, cultural, and personal beliefs, and how scientists use the habits of mind such as: (reasoning, insight, creativity, intellectual honesty, tolerance for ambiguity and openness to new ideas) in their work.
- S2b:** compares and contrasts the difference between science and other ways of knowing through use of empirical standards, logical arguments, and skepticism.
- S2c:** assesses the work of scientists showing that all scientific ideas depend on experimental and observational confirmation and are subject to change as new evidence becomes available.
- S2d:** describes the contributions of diverse cultures to scientific knowledge and the changes to scientific thinking that evolve over time, building upon earlier knowledge.

## **S3: Science in Personal and Social Perspectives**

The student demonstrates an understanding of the impact each individual, community, and human enterprise has on natural conditions and resources from local, national, and global perspectives; that is, the student:

- S3a:** employs the tenets of personal and community health, safety and resource conservation.

- S3b:** identifies, accesses and uses data to construct explanations about the characteristics, rates, and sources of changes in populations, natural resources, and environmental quality.
- S3c:** assesses potential danger and risk of natural and human-induced hazards.
- S3d:** analyzes the relationships among technological, social, political, and economic changes and the impact on humans and the environment.

#### **S4: Science and Technology**

The student demonstrates abilities of technological design and understandings about science, engineering and technology; that is, the student:

- S4a:** uses technology to perform scientific investigations to secure valid and reliable results.
- S4b:** identifies and/or constructs a problem or need in relation to technological designs; proposes new designs and chooses between alternative solutions.
- S4c:** constructs understandings about the fields of science and engineering, the interrelationships between science and technology, and explains their contribution to society.
- S4d:** analyzes innovations in science and technology with respect to alternatives, risks, costs and benefits to society and the environment.

#### **S5: Biology**

The student demonstrates a conceptual understanding of the organization of life on Earth; that is, the student:

- S5a:** describes, analyzes and compares structure, function, and organization of various cells.
- S5b:** communicates an understanding of the biochemistry of life including organic compounds, enzymes, respiration and photosynthesis.
- S5c:** describes the behavior of organisms and hypothesizes the relationship to nervous and endocrine systems and various external stimuli.
- S5d:** elaborates on the principles of genetics and explains the role of DNA, genes, chromosomes, and mutation in reproduction and heredity.
- S5e:** relates theories of biological evolution to geologic time and addresses speciation, biodiversity, natural selection, and biological classification.
- S5f:** examines ecology as interrelationships of biotic and abiotic factors and explains the transfer of matter and energy within ecosystems.

## **S6: Physics**

The student demonstrates a conceptual understanding of the organization and interaction of matter and energy, and motion and forces; that is, the student:

- S6a:** communicates an understanding of atomic and subatomic structure, addressing parts and properties of the atom, electron configuration, nuclear forces, radioactivity, and nuclear reactions.
- S6b:** analyzes and explains the relationship between structure and properties of matter (ions, molecules, compounds, elements, isotopes) and uses those relationships to predict chemical properties of elements and placement on the periodic table.
- S6c:** articulates and demonstrates the principles of motions and forces and applies them to examples of impact on objects.
- S6d:** analyzes the distinctions among thermal, potential, and kinetic energy and explains conservation of energy and its associated increase in disorder.
- S6e:** differentiates the interactions between matter and energy and uses waves and wave properties (including light, sound, transverse, longitudinal and electromagnetic waves) to identify matter.

## **S7: Chemistry**

The student demonstrates a conceptual understanding of the organization and behavior of matter; that is, the student:

- S7a:** communicates an understanding of atomic structure, addressing parts and properties of the atom, electron configuration and nuclear forces.
- S7b:** analyzes and demonstrates the relationship between structure and properties of matter (ions, molecules, compounds, elements) and uses those relationships to predict chemical properties of elements and their placement on the periodic table.
- S7c:** assesses interactions of matter focusing on chemical reactions and bonds and applies the concept of conservation of matter to those interactions.
- S7d:** distinguishes the interactions of matter and energy and demonstrates the impact of variables (temperature, time, etc.) on those interactions.
- S7e:** summarizes and illustrates the conservation of energy, the increase in disorder, and the different types of energy.

## **S8: Earth and Space Sciences**

The student demonstrates a conceptual understanding of the organization of Earth and other celestial bodies; that is, the student:

- S8a:** categorizes the sources and types of energy in the Earth system, identifies the geologic activity (such as volcanoes, plate tectonics, and earthquakes) resulting from or causing that energy, and illustrates the impact of such activity on the inhabitants and the environment.
- S8b:** compares and contrasts the composition of Earth materials and the processes within the geochemical cycle that govern their formation (including rocks, minerals, fossils, and other natural resources).
- S8c:** investigates and displays the relationships among weather, cloud cover, land features, atmosphere and oceans.
- S8d:** presents and critiques theories on origin and evolution of the Earth's systems and other celestial bodies.
- S8e:** accesses information about significant space explorations and assesses the value of such explorations.