

Grade 9 Integrated Science Standards and Benchmarks Confirmend

Earth and Space Sciences

Standard 1. Understands atmospheric processes and the water cycle **Benchmarks:**

- 1.1 Knows the processes involved in the water cycle

Life Sciences

Standard 5: Understands the structure and function of cells and organisms **Benchmarks:**

- 5.1 Knows the levels of organization in living systems, including cells, tissues, organs, organ systems, whole organisms, ecosystems, and the complementary nature of structure and function at each level
- 5.2 Knows that multicellular organisms have a variety of specialized cells, tissues, organs, and organ systems that perform specialized functions (e.g., digestion, respiration, reproduction, circulation, excretion, movement, control and coordination, protection from disease)
- 5.3 Knows that organisms have a great variety of body plans and internal structures that serve specific functions for survival (e.g., digestive structures in vertebrates, invertebrates, unicellular organisms, and plants)
- 5.4 Knows the structures of different types of cell parts (e.g., cell wall; cell membrane; cytoplasm; cell organelles such as the nucleus, chloroplast, mitochondrion, Golgi apparatus, vacuole) and the functions they perform (e.g., transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal)

Standard 6: Understands relationships among organisms and their physical environment **Benchmarks:**

- 6.1 Knows that as matter and energy flow through different levels of organization in living systems and between living systems and the physical environment, chemical elements are recombined in different ways

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- 6.2 Knows how matter is recycled within ecosystems (e.g., matter is transferred from one organism to another repeatedly, and between organisms and their physical environment; the total amount of matter remains constant, even though its form and location change)
- 6.3 Knows how the interrelationships and interdependencies among organisms generate stable ecosystems that fluctuate around a state of rough equilibrium for hundreds or thousands of years
- 6.4 Knows how energy is transferred through food webs in an ecosystem
- 6.5 Knows ways in which humans can alter the equilibrium of ecosystems, causing potentially irreversible effects

Standard 7: Understands biological evolution and the diversity of life Benchmarks:

- 7.1 Knows how variation of organisms within a species increases the chance of survival of the species, and how the great diversity of species on earth increases the chance of survival of life in the event of a major global changes

Physical Sciences

Standard 8: Understands the structure and properties of matter Benchmarks:

- 8.1 Knows that matter is made up of tiny particles called atoms, and different arrangements of atoms into groups compose all substances.
- 8.2 Knows that states of matter depend on molecular arrangement and motion.
- 8.3 Knows that matter is made up of tiny particles called atoms and different arrangements of atoms into groups compose all substances.

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- 8.5 Understands the conservation of mass in physical and chemical changes
- 8.6 Knows that substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties
- 8.7 Knows the structure of an atom
- 8.8 Knows how the electron configuration of atoms governs the chemical properties of an element as atoms interact with one another by transferring or sharing the outermost electrons
- 8.9 Understands how elements are arranged in the periodic table, and how this arrangement shows repeating patterns among elements with similar properties (e.g., numbers of protons, neutrons, and electrons; relation between atomic number and atomic mass)
- 8.10 Knows that atoms may be bonded together into molecules or crystalline solids, and compounds are formed from chemical bonds between two or more different kinds of atoms
- 8.11 Knows that the number of electrons in an atom determines whether the atom is electrically neutral or an ion (i.e., electrically neutral atoms contain equal numbers of protons and electrons; a positively charged atom has lost one or more electrons; a negatively charged atom has gained one or more electrons)
- 8.13 Knows that most elements have two or more isotopes (i.e., atoms that differ in the number of neutrons in the nucleus); although the number of neutrons has little effect on how the atom interacts with others, it does affect the mass and stability of the nucleus
- 8.14 Knows the variety of structures that may be formed from the bonding of carbon atoms and their roles in chemical reactions including those required for life processes

Standard 9: Understands the sources and properties of energy

Benchmarks:

- 9.1 Knows that waves (sound, light and seismic) have energy and can transfer energy when they interact with matter.
- 9.2 Know that matter and energy are conserved

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Nature of Science

Standard 12: Understands the nature of scientific inquiry

Benchmarks:

- 12.1 Understands the use of hypotheses in science
- 12.2 Designs and conducts scientific investigations
- 12.3 Knows that, when conditions of an investigation cannot be controlled, it may be necessary to discern patterns by observing a wide range of natural occurrences
- 12.4 Uses technology (e.g., hand tools, measuring instruments, calculators, computers) and mathematics (e.g., measurement, formulas, charts, graphs) to perform accurate scientific investigations and communications

Standard 13: Understands the scientific enterprise

Benchmarks:

- 13.5 Understands that science involves different types of work in many different disciplines
- 13.6 Knows that creativity, imagination, and a good knowledge base are all required in the work of science and engineering