BIOLOGY

▲ State assessed indicators

Science Inquiry and Process

Standard 1: Benchmark 1: Students will demonstrate the abilities necessary to do scientific inquiry.

Indicator 1: Develops an understanding of the natural world through experience in order to ask and evaluate research questions.

1. Read scientific information
2. Know that science changes

To develop these skills, students might be involved in such activities as: investigating mass, length, volume, and density; neutralizing acids/bases; simulating half-lifes of radioactive isotopes; investigating velocity and acceleration with paper airplanes; developing student-build models for friction and motion; investigating models that demonstrate knowledge of Newton's laws of motion.

▲Indicator 2: Identifies and utilizes concepts that guide scientific investigations, including developing questions, gathering data, and design and conducting research

1. Understand and use the scientific method (1. state the problem; 2. research; 3. form a hypothesis; 4. gather materials; 5. carry, out a procedure; 6. gather data; 7. form conclusions and report)
2. Design and conduct investigations
3. Analyze and explain data; then modify the procedure to get better results (e.g. the scientific method is not always a linear process)
4. Utilizing variables, such as independent, dependent, and controls
5. Determining methods for gathering data that is observable, measurable, and replicable

▲Indicator 3: Uses technological tools and mathematics in scientific investigations.

1. Interpret and communicate scientific results using mathematics and technology
2. Choose appropriate tools for measurement; measure accurately with proper metric units
3. Investigate phenomena using technology appropriately and safely (such as balance scales, spring scales, thermometers, stopwatches, graduated cylinders, beakers, flasks and other glassware)
4. Uses common mathematical functions (linear, exponential, etc.) to analyze and describe data

5. Recognizes that the accuracy and precision of the data, and therefore the quality of the investigation, depends on the instruments used.

▲Indicator 4: As part of conducting an inquiry, formulates and revises his or her scientific explanations and models (physical, conceptual, or mathematical) using logic and evidence, recognizing that potential alternative explanations and models should be considered.

1. Evaluates personal preconceptions and biases with respect to his/her conclusions.

Indicator 5: Communicates and defends the design, results, and conclusion of his/her investigation.

1. Writes procedures, expresses concepts, reviews information, summarizes data, and uses language appropriately
2. Develops diagrams and charts to summarize and analyze data
3. Presents information clearly and logically, both orally and in writing
4. Constructs reasoned arguments
5. Responds appropriately to critical comments
6. Apply concepts and skills to everyday experiences

Cellular Biology

Standard 3: Benchmark 1: Students will demonstrate an understanding of the structure and function of the cell.

Indicator 1: Cells are composed of a variety of specialized structures that carry out specific functions.

1. Given a description or a picture, distinguish between prokaryotes and Eukaryotes
2. Given a diagram, identify the organelles in cells
3. Recognize the functions and descriptions of the organelles
4. Recognize the difference between Hype, Hyper, and Isotonic Solutions
5. Identify the properties of the cell membrane and its functions

▲Indicator 2: Cell functions involve specific chemical reactions.

1. Differentiate between aerobic and anaerobic respiration, and photosynthesis
2. Food molecules taken into cells provide the chemicals needed to synthesize other molecules.
3. Enzymes catalyze both breakdown and synthesis in the cell.
4. Differentiate between passive and active transport
5. Identify the cycle of ATP and its importance as an energy storing molecule

Indicator 3: Cells function and replicate as a result of information stored in DNA and RNA molecules.

1. Recognize the relationship between DNA, RNA, and protein synthesis

2. Explain the composition and overall structure of chromosomes
3. Compare mitosis with meiosis

Indicator 4: Some plant cells contain chloroplasts, which are the sites of photosynthesis.

1. Recognize the functions and descriptions of the organelles
2. Differentiate between aerobic and anaerobic respiration, and photosynthesis
3. Discuss the role of plants and their importance to us
4. Identify plant processes and their importance to our environment

Indicator 5: Cells can differentiate, thereby enabling complex multicellular organisms to form.

1. In the development of most multicellular organisms, a fertilized cell forms an embryo that differentiates into an adult.
2. Differentiation is regulated through expression of different genes
3. Differentiation leads to the formation of specialized cells, tissues, and organisms, which have different functions.
4. Recognize the relationship between cells, tissues, organs and organ systems

Genetics

Standard 3: Benchmark 2: Students will demonstrate an understanding of chromosomes, genes, and the molecular basis of heredity.

▲Indicator 1: All living organisms contain DNA or RNA as their genetic material, which provides the instructions that specify the characteristics of organisms.

1. Describe the, individual components, overall structure, location in body, and function of the DNA molecule.
2. Recognize the relationship between DNA, RNA, and protein synthesis.
3. Explain the composition and overall structure of chromosomes.
4. Nucleotides (Adenine, Thymine, Guanine, Cytosine and Uracil) make up DNA and RNA molecules.
5. Sequences of nucleotides that either determine or contribute to a genetic trait are called genes.
6. DNA is replicated by using a template process that usually results in identical copies.
7. DNA is coiled in chromosomes during cell replication.

Indicator 2: Organisms usually have a characteristic numbers of chromosomes; one pair of these may determine the sex of individuals.

1. Explain the composition and overall structure of chromosomes.
2. Most cells in humans contain 23 pairs of chromosomes; the 23rd pair usually contains the XX for female or XY for male

▲Indicator 3: Hereditary information is contained in genes, located in the chromosomes of each cell.

1. Compare mitosis with meiosis.
2. Identify contributions of Gregor Mendel to genetics (work with the pea plant; pollination vs. crosspollination; monohybrid vs. dihybrid crosses; dominance and recessiveness).
3. Distinguish between genotype and phenotype.
4. Distinguish between homozygous and heterozygous.
5. Set up and complete Punnet Squares for various traits

Indicator 4: Gametes carry the genetic information to the next generation

1. Identify the contributions of Gregor Mendel to genetics (work with the pea plant; pollination vs. crosspollination; monohybrid vs. dihybrid crosses; dominance and recessiveness).
2. Gametes contain only the Haploid number of chromosomes, and that the joining of the gametes produces offspring carrying the Diploid number of chromosomes

Indicator 5: Mutations occur in DNA at very low rates.

1. Mutations are typically harmful, but they can be neutral or beneficial.
2. Only mutations in gametes can be passed on to offspring and thus affect future generations.
3. Mutations in other cells can affect the individual organism, but not its offspring.

Evolution

Standard 3: Benchmark 3: Students will understand the major concepts of the theory of biological evolution.

▲Indicator 3: Biologists recognize that the primary mechanisms of evolution are natural selection and genetic drift.

1. Explain how Darwin came up with his natural selection theory.
2. Discuss the role fossils have played in expanding the evolutionary theory.
3. Recognize the current theory of human evolution.
4. Heritable variation exists in every species; some heritable traits are more advantageous to reproduction and/or survival than are others.
5. There is a finite supply of resources required for life; not all progeny survive; individuals with advantageous traits generally survive to reproduce; the advantageous heritable traits increase in the population through time.

Ecology

Standard 3: Benchmark 4: Students will understand the interdependence of organisms and their interactions with the physical environment

▲Indicator 1: Atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.

1. Recognize that matter cycles among the biotic and abiotic components of the environment

Indicator 2: Energy is received, transformed, and expended in ecosystems

1. Explain the interdependence between organisms within an ecosystem (including humans).
2. Radiant energy that enters the earth's surface is balanced by the energy that leaves the earth's surface.
3. Organisms and ecosystems expend energy, much of which is released as heat, to maintain a high state of internal order

▲Indicator 3: Living organisms produce more offspring than environmental resources can support, resulting in a competition for resources

1. Distinguish what is happening in different areas around the world as they reach their "carrying capacity"

Indicator 4: Organisms cooperated and compete in complex set of interdependent relationships

1. Explain the interdependence between organisms within an ecosystem (including humans).
2. Symbiotic relationships (parasitism, mutualism, commensalisms.)

Indicator 5: Human beings live within and impact ecosystems

1. Discuss current changes in our environment that have been influenced by humans

Standard 3: Benchmark 5: Students will develop an understanding of matter, energy, and organization in living systems

Indicator 1: Living systems require a continuous input of energy to maintain their chemical and physical organization.

1. All matter tends toward more disorganized states. With death and the cessation of energy intake, living systems rapidly disintegrate.

▲Indicator 2: The sun is the primary source of energy for life through the process of photosynthesis.

1. Differentiate between aerobic, anaerobic respiration, and photosynthesis.
2. The energy in these compounds is used to assemble larger molecules with biological activity, including proteins, DNA, carbohydrates, and fats.
3. These molecules serve as sources of energy for the plants themselves and for many other organisms through food webs.

▲Indicator 3: Food molecules contain biochemical energy, which is then available for cellular respiration

1. Energy is released when the food molecules are broken down into simpler compounds.
2. Most biochemical reactions, fueled by ATP, are catalyzed by enzymes.

Standard 3: Benchmark 6: Students will understand the behavior of animals

▲Indicator 1: Animals have behavioral responses to internal changes and external stimuli

1. Explain that all organisms must be able to maintain and regulate stable internal conditions to survive in a constantly changing external environment.
2. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes.
3. Animals often live in unpredictable environments, and so their behavior must be flexible enough to deal with uncertainty and change.

Indicator 2: Most multicellular organisms have nervous systems that underlie behavior

1. Explain the relationships between the body's systems.
2. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves.
3. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules.
4. Sense organs, specialized cells that detect light, sound, touch and specific chemicals, enable animals to monitor what is going on in the world around them.

Indicator 3: Behaviors are often adaptive when viewed in terms of survival and reproductive success.

1. Common behaviors include seeking food, seeking mates, raising young, avoiding predators, and regulating body temperature.
2. Some organisms live in groups and have social behaviors that benefit both the individual and the group.

Standard 3: Benchmark 7: Students will demonstrate an understanding of the diversity of structure and function in organisms.

▲Indicator 1: There is a wide diversity of organisms, which exhibit differences in structure and function

1. Compare major structural differences in vertebrates and invertebrates.
2. Distinguish between autotrophs and heterotrophs.
3. Given a description or a picture, distinguish between plant and animal cells.
4. Given a description or a picture, distinguish between prokaryotes and Eukaryotes

Indicator 2: Taxonomy is the systematic way in which organism are placed into a hierarchical classification system, according to their physical and genetic characteristics *[and their evolutionary history.]*

1. Discuss the role fossils have played in expanding the evolutionary theory.
2. Explain the importance of using Latin and binomial nomenclature in identifying organisms.
3. Classify organisms based on the current five-kingdom system

Standard 6: Benchmark 2: : Students will demonstrate an understanding of population growth.

Indicator 1: Populations have limits to growth

1. The rate of change in populations is determined by the combined effects of birth, death, emigration, and immigration.
2. A variety of factors influence birth rates and fertility rates.
3. Populations can increase through exponential growth.
4. Population growth changes resource availability and changes environmental conditions.

Standard 6: Benchmark 3: Students will understand that human populations use natural resources and influence environmental quality.

Indicator 1: Natural resources from the lithosphere and ecosystems are required to sustain human populations.

1. These processes of ecosystems include maintenance of the atmosphere, generation of soils, control of the hydrologic cycle, and recycling of nutrients. Humans are altering many of these processes, and the changes may be detrimental, beneficial, or both to ecosystem function.
2. Natural systems can reuse waste, but this capacity is limited. Recycling and environmentally sound decisions improve the quality of human life.

Science and Technology

Standard 5: Benchmark 1: Students will develop an understanding that technology is applied science

Indicator 1: Technology is the application of scientific knowledge for functional purposes.

1. Creativity, imagination, and a broad science knowledge base are all required to produce useful results. i.e., engineering.
2. Science advances new technologies. New technologies open new areas for scientific inquiry.

3. Scientific knowledge is made public through presentations at professional meetings and publications in scientific journals.
4. Scientific inquiry is driven by the desire to understand the natural world. *Technology being applied science,* is driven by the need to meet human needs and solve human problems. Science and technology are pursued for different purposes. *Engineering is the practical application of science to commerce or industry.*
5. *T*echnological knowledge may be kept secret because of the financial and military potential of the idea or invention.
6. Invention which produces a new device, method or process is developed from study and experimentation often utilizing technology.

Chemistry

Standard 2A: Benchmark 1: The student will understand the structure of an atom

▲Indicator 1: Atoms, the fundamental organizational unit of matter, are composed of subatomic particles, organized in a small, dense, positively charged nucleus (containing protons and neutrons which determines the atomic mass) and surrounded by a negatively charged electron cloud (containing electrons, which determines the size of the atom).

1. Isotopes are atoms with the same atomic number (same number of protons) but different numbers of neutrons. The nuclei of some atoms are radioactive isotopes that spontaneous release radioactive energy.
2. Understand, identify, and correlate chemistry to life
3. Identify Ph factors and how they relate to biology

Standard 2A: Benchmark 2: The students will understand the states and properties of matter.

Indicator 1: Chemists use kinetic and potential energy to explain the physical and chemical properties of matter on earth that may exist in any of these three states; solids, liquids, and gases.

1. Elements and molecules may exist as gasses, liquids or solids; Ionic compounds most commonly exist as solids.
2. Intermolecular attraction (attraction between molecules) determines the state of the molecule. Gases have the weakest and solids have the greatest intermolecular attraction. The hydrogen bond is an intermolecular attraction responsible for the properties of water and many biological molecules.

Physics

Not addressed