

Proficiency Level Descriptors – Biology

Policy

Students who are designated Below Proficient (Level 1) will be able to perform up to the level described by the Proficiency Level Descriptor (PLD). Level 1 is the lowest reported proficiency designation; some student may perform below the provided description.

- Below Proficient – The Level 1 Student is below proficient in applying the science knowledge/skills as specified in the Utah Core State Standards. The Student generally performs significantly below the standard for his or her grade level, is likely able to partially access grade-level content and engage with higher-order thinking skills with extensive support.
- Approaching Proficient – The Level 2 Student is approaching proficient in applying the science knowledge/skills as specified in the Utah Core State Standards. The Student generally performs slightly below the standard for his or her grade level, is likely able to access grade-level content and engage in higher-order thinking skills with some independence and support.
- Proficient - The Level 3 Student is proficient in applying the science knowledge/skills as specified in the Utah Core State Standards. The Student generally performs at the standard for his or her grade level, is able to access grade level content, and engage in higher order thinking skills with some independence and minimal support.
- Highly Proficient - The Level 4 Student is highly proficient in applying the science knowledge/skills as specified in the Utah Core State Standards. The Student generally performs significantly above the standard for his or her grade level, is able to access above grade level content, and engage in higher order thinking skills independently.

Organism Interaction

Objective I.1 Summarize how energy flows through an ecosystem.

- Below Proficient – The Level 1 Student - Given the components of a food chain, identifies feeding relationships. Recognizes that available energy decreases when moving up the steps of the energy pyramid. Recognizes that organisms can modify behavior to obtain energy.
- Approaching Proficient – The Level 2 Student - Places organisms on a food web when given information on feeding relationships. Given an energy pyramid, compares the amount of available energy for

producers and consumers. Given details about an organism, identifies strategies used to obtain energy.

- Proficient – The Level 3 Student - Identifies relationships of organisms on a food web. Given a food chain, creates a graph showing energy available at different trophic levels. Given multiple organisms' feeding strategies, identifies which strategy best balances energy expended to energy obtained. Given an article, cites examples of energy used to produce or obtain food.
- Highly Proficient – The Level 4 Student - Predicts the effect of a disturbance to a food web. Given an energy pyramid, calculates the energy difference between trophic levels. Given multiple organisms' feeding strategies, cites evidence to show which strategy best balances energy expended to energy obtained. Predicts how an organism would change feeding strategies when given information about an environmental change. Given a text, evaluates the pros and cons of a system of food production.

Objective I.2 – Explain relationships between matter cycles and organisms.

- Below Proficient – The Level 1 Student – Labels a diagram of the carbon and water cycles. Identifies water as a limiting factor in ecosystems.
- Approaching Proficient – The Level 2 Student – Given a diagram, identifies how matter cycles into and out of organisms. Using a newspaper, magazine, journal, or Internet article, identifies which statements give evidence based on scientific data. Given a text, identifies ways human activity has affected ecosystems.
- Proficient – The Level 3 Student – Describes how matter cycles into and out of organisms. Recognizes that the amount of matter in a system remains constant. Predicts the effect of a limiting factor on a population. Given a newspaper, magazine, journal, or Internet article, cites instances of inference and evidence and bias. Identifies the cause and effect relationship of personal choices to the cycling of matter within an ecosystem.
- Highly Proficient – The Level 4 Student – Predicts how one matter cycle affects another cycle. Given an ecosystem, distinguishes adaptations that are advantageous when water is limited. Given two articles, evaluates which contains more bias. Evaluates the impact of personal choices in relation to the cycling of matter within an ecosystem. Designs an investigation to analyze the interactions in an ecosystem.

Objective I.3 – Describe how interactions among organisms and their environment help shape ecosystems.

- Below Proficient – The Level 1 Student - Categorizes predator/prey relationships among living things. Differentiates between abiotic and biotic factors. Identifies types of data within an ecosystem. Given text, identifies ways human activity has affected ecosystems.
- Approaching Proficient – The Level 2 Student - Categorizes relationships among living things as predator/prey, competition, or symbiosis. Identifies biotic and abiotic factors within an ecosystem. Determines which is the best procedure to investigate interactions in an ecosystem.
- Proficient – The Level 3 Student - Designs an investigation and tests a hypothesis about the effect of changing a variable in a small ecosystem. Uses data to interpret interactions among biotic and abiotic factors within an ecosystem. Given data, draws conclusions about the interactions within ecosystems. Given text, cites evidence showing how human activities affect ecosystems. Differentiates between qualitative and quantitative data.
- Highly Proficient – The Level 4 Student - Analyzes and critiques an experiment where a claim is made based on changes to only one variable, since ecosystems tend to be more multivariate. Predicts the effects of changing biotic and abiotic factors on an ecosystem. Given texts, evaluates how human activities have affected an ecosystem.

Cells

Objective II.1 – Describe the fundamental chemistry of living cells.

- Below Proficient – The Level 1 Student – Identifies the major chemical elements in cells. Identifies the properties of water. States that enzymes increase reaction rate.
- Approaching Proficient – The Level 2 Student – Matches macromolecules to their uses in the cell. Matches the name of a property of water to a description.
- Proficient – The Level 3 Student – Describes how macromolecules are used in cells. Given a cellular process, identifies which properties of water contribute to the process. Given two graphs, differentiates between enzyme-catalyzed reactions and non-catalyzed reactions.
- Highly Proficient – The Level 4 Student – Identifies which of the elements are in each macromolecule. Given a cellular process, explains how the properties of water contribute to the process. Interprets data from an experiment testing the role of enzymes in cell chemistry.

Objective II.2 – Describe the flow of energy and matter in cellular function.

- Below Proficient – The Level 1 Student – Recognizes the features of autotrophic and heterotrophic cells. Recognizes that the sun provides energy for photosynthesis, which provides energy for cellular respiration.
- Approaching Proficient – The Level 2 Student – Identifies at least one product of photosynthesis that is used by cell respiration and at least one product of cellular respiration that is used by photosynthesis.
- Proficient – The Level 3 Student – Explains the differences between autotrophic and heterotrophic cells. Identifies two products of photosynthesis that are used by cell respiration and at least two products of cellular respiration used by photosynthesis. Given a set of variables, sets up an experiment and collects data about products of photosynthesis.
- Highly Proficient – The Level 4 Student – Recognizes that all cells perform respiration but only autotrophic cells photosynthesize. Given an experiment, analyzes data about the products of photosynthesis.

Objective II.3 – Investigate the structure and function of cells and cell parts.

- Below Proficient – The Level 1 Student – Explains that new cells come from preexisting cells. Identifies that some forms of cellular transport require energy and some do not. States that a cell's structure can differ depending on its function.
- Approaching Proficient – The Level 2 Student – Given pictures, sequences the events of cell division. Identifies the three parts of cell theory. Matches osmosis, diffusion, and active transport with their definitions. Matches an organelle to its function. Recognizes the environmental factors that can influence the growth and reproduction of organisms.
- Proficient – The Level 3 Student – Describes the events of cell division. Given text, identifies scientific discoveries that contributed to the development of cell theory. Given a diagram, describes how the transport of materials in and out of a cell enables cells to maintain homeostasis. Given either a diagram or a description, identifies possible functions of a cell. Given a set of materials, designs an investigation with microorganisms and/or plants of growth and reproduction.
- Highly Proficient – The Level 4 Student – Explains the importance of cell division in unicellular and multicellular organisms. Cites evidence from text of how advancements in technology contributed to the

development of cell theory. Explains how various transport mechanisms maintain homeostasis. Given a description or picture of a cell, identifies an organ in which the cell could be found. Analyzes data from an experiment investigating growth and reproduction of microorganisms and/or plants.

Organ Structure and Function

Objective III.1 – Describe the structure and function of organs.

- Below Proficient – The Level 1 Student – Labels a diagram of an organ, given a word bank. Recognizes that the organs of different organisms are similar. Identifies one technological development related to organs.
- Approaching Proficient – The Level 2 Student – Labels a diagram of an organ, with a word bank. Recognizes that the organs and the organ functions of different organisms are similar. Identifies and explains one technological development related to organs.
- Proficient – The Level 3 Student – Labels a diagram of an organ, with a word bank and matches the function of each part in relation to the organ. Compares the structure and function of organs in one organism to the structure and function of organs in a similar organism (e.g., animal/animal). Identifies and explains some technological development related to organs.
- Highly Proficient – The Level 4 Student – Labels a diagram of an organ, without a word bank and matches the function of the organ in relation to the system. Compares the structure and function of organs in one organism to the structure and function of organs in a different organism (e.g., animal/plant).

Objective III.2 - Describe the relationship between structure and function of organ systems in plants and animals.

- Below Proficient – The Level 1 Student – Labels a diagram of an organ system, with a word bank. Recognizes the organs of different organ systems and how they are similar.
- Approaching Proficient – The Level 2 Student – Labels a diagram of an organ system, with a word bank. Recognizes that the organ system's structure and function of different organisms are similar.
- Proficient – The Level 3 Student – Labels a diagram of an organ system, with a word bank and matches the function of each part in relation to the organ system and different tissues that make up that organ. Compares the structure and function of organ systems in one

organism to the structure and function of organ systems in a similar organism (e.g., animal/animal).

- Highly Proficient – The Level 4 Student – Labels a diagram of an organ system, without a word bank and matches the function of the organ system in relation to the structure and function of a different organ system and how these systems contribute to homeostasis. Compares the structure and function of organ systems in one organism to the structure and function of organ systems in a different organism (e.g., animal/plant).

DNA

Objective IV.1 - Compare sexual and asexual reproduction.

- Below Proficient – The Level 1 Student – Given text, identifies whether the statement is an advantage or disadvantage in relation to both sexual reproduction and asexual reproduction.
- Approaching Proficient – The Level 2 Student – Describes how fertilization mixes genetic material. Compares the advantages and disadvantages of sexual and asexual reproduction.
- Proficient – The Level 3 Student – Explains the significance of meiosis and fertilization in genetic variation. Given data, identifies advantages and disadvantages of sexual and asexual reproduction. Defends an opinion of a bioethical issue related to intentional or unintentional chromosomal mutations.
- Highly Proficient – The Level 4 Student – Describes how the processes of meiosis and fertilization increase genetic variation. Interprets data and draws conclusions about advantages and disadvantages of sexual and asexual reproduction. Formulates, defends, and supports an opinion of a bioethical issue related to intentional or unintentional chromosomal mutations.

Objective IV.2 - Predict and interpret patterns of inheritance in sexually reproducing organisms.

- Below Proficient – The Level 1 Student – Describes in simple terms that genetic information gets shuffled in sexual reproduction. Describes that parents can pass on recessive genes that they do not express.
- Approaching Proficient – The Level 2 Student – Complete a diagram (e.g., Punnett square) to demonstrate possible results of recombination in sexually reproducing organisms using one trait in a

simple dominance/recessive monohybrid cross. Relates Mendelian principles to modern-day practices of plant and animal breeding.

- Proficient – The Level 3 Student – Explains Mendel's laws of segregation and independent assortment. Use a diagram (e.g., Punnett square) to demonstrate possible results of recombination in sexually reproducing organisms using one trait, monohybrid, in a dominance/recessive, incomplete dominance, co-dominance, and sex-linked traits. Identifies current bioethical issues related to genetics.
- Highly Proficient – The Level 4 Student – Given results of a dihybrid cross, relates Mendel's laws of segregation and independent assortment to their roles in genetic inheritance. Analyzes bioethical issues and considers the role of science in determining public policy.

Objective IV.3 – Explain how the structure and replication of DNA are essential to heredity and protein synthesis.

- Below Proficient – The Level 1 Student - Identifies that DNA molecules are double helix. Demonstrates that sequence of DNA is a gene. Identifies genetic technologies that have improved the quality of life.
- Approaching Proficient – The Level 2 Student - Describes the specific chemical make-up of DNA that consists of repeating subunits ATCG. Describes that DNA is replicated prior to cell reproduction. Illustrates that a specific sequence of DNA codes for a specific sequence of RNA, which in turn is decoded into protein. Describes how a mutation affects gene expression. Identifies and explains how a genetic technology may improve the quality of life.
- Proficient – The Level 3 Student - Describes the specific chemical make-up and base pairing (A-T, C-G) of DNA structure. Describes the simple process of DNA replication including the creating of sister chromatids and their role in the cell cycle. Diagrams how the specific sequence of DNA is transcribed into RNA, which is then translated into a protein. Identifies specific types of mutations and mutagens that cause mutations that affect gene expression. Given a text, relates important historical events leading to understanding of DNA. Identifies pros and cons of a specific genetic technology.
- Highly Proficient – The Level 4 Student - Explains key scientific discoveries leading to the discovery of the structure of DNA. Using a sequence of DNA and a codon chart, transcribes, translates, and shows resulting sequences of amino acids. Explains the principle of gene expression and the effects of changing DNA on the protein the gene expressed. Explains the short- and long-term impacts of mutations on

populations. Formulates an argument for or against a form of genetic technology using scientific reasoning and evidence.

Evolution and Diversity

Objective V.1 – Relate principals of evolution to biological diversity.

- Below Proficient – The Level 1 Student – Identifies in a text the effects of environmental factors on natural selection. States that a species can evolve into two new species. Identifies natural selection and selective breeding as two modes of change in a species.
- Approaching Proficient – The Level 2 Student – Relates genetic variability to a species' potential for adaptation to a changing environment. Given text, relates reproductive isolation to speciation. Describes the differences and similarities between selective breeding and natural selection.
- Proficient – The Level 3 Student – Describes the effects of environmental factors on natural selection. Interprets data to describe the variability of a species' potential for adaptation to a changing environment. Given different mechanisms of reproductive isolation, predicts speciation. Compares selective breeding to natural selection and relates the differences to agricultural practices.
- Highly Proficient – The Level 4 Student – Shows or infers, from given data, the effects of environmental factors on natural selection. Performs an experiment and extracts data to show that genetic variability in a species is essential for adaptation to a changing environment. Given data, infers which reproductive isolation mechanism caused speciation. Evaluates pros and cons of selective breeding practices in agricultural practices.

Objective V.2 - Cite evidence for changes in populations over time and use concepts of evolution to explain these changes.

- Below Proficient – The Level 1 Student – Recognizes that species exhibit variations and change over time.
- Approaching Proficient – The Level 2 Student – Given text, cites evidence that supports biological evolution over time. Identifies the role of mutation in evolution.
- Proficient – The Level 3 Student – Identifies in a scientific article the scientific methods used to gather evidence that documents the evolution of a species. Describes the role of mutation and recombination in evolution. Relates the nature of science to the historical development of the theory of evolution.

- Highly Proficient – The Level 4 Student – Distinguishes between observations and inferences in making interpretations related to evolution. Describes the role of mutation and recombination in evolution and relates this to changes in DNA. Reviews a scientific article and identifies the research methods used to gather evidence that documents the evolution of a species.

Objective V.3 – Classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.

- Below Proficient – The Level 1 Student - Recognizes that organisms can be grouped by similarities. Recognizes one way organisms can be classified. Recognizes that classification schemes have changed throughout history.
- Approaching Proficient – The Level 2 Student - Identifies an organism using a classification tool. Identifies two criteria used to classify organisms. Explains that evolutionary relationships are related to classification systems. Identifies ways classification schemes have changed.
- Proficient – The Level 3 Student - Generalizes criteria used to classify organisms. Describes how evolutionary relationships are related to classification systems. Justifies the ongoing changes to classification schemes.
- Highly Proficient – The Level 4 Student - Justifies which classification tool is most accurate to classify organisms. Compares and contrasts criteria used to classify organisms. Creates a classification diagram based on given evolutionary relationships. Gives examples of how classification systems have changed throughout history.