STATE OF SOUTH CAROLINA

DEPARTMENT OF EDUCATION

ELLEN E. WEAVER
STATE SUPERINTENDENT OF EDUCATION

Assessment Specifications for EOCEP Biology 1

for the
South Carolina College- and Career-Ready Science Standards 2021

2025–2026

Contents

Purpose and Use

- Provides guidelines for item writers for the state assessment
- Provides supporting key content vocabulary used in the state assessment
- Identifies specific state assessment limits on foundational knowledge

Note to Teachers:

This document is intended as a guide for item developers working in and with the Office of Assessment and Standards and not as a curriculum or instructional guide. The information found within the *End-of-Course Examination Program Biology 1 Item Specifications and Content Limits for the South Carolina College and Career-Ready Science Standards 2021* reflects the relevant terminology and content limits used to develop the items found on the state assessment.

Each item is developed using the three dimensions as set forth by the *South Carolina College- and Career–Ready Science Standards* and will assess science and engineering practices (SEPs) and crosscutting concepts (CCCs) and the Disciplinary Core Ideas (DCIs) found in
A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas."

Required field-test item characteristics:

- CCC, DCI, and SEP within one item (3D).
- DCI and CCC **or** a DCI and SEP within one item (2D).
- 2D items may not assess a CCC and SEP within a single item.
- Items may not assess any single dimension.
- Stimulus sets will be 3D, meaning that within the body of items associated with that stimulus, all three dimensions will be assessed.

"**Can**", "**could,**" “**e.g.**,” and "**may**" are terms that infer information that is **not exhaustive.**

Acknowledgement:

Office of Assessment and Standards science team greatly appreciates the input received from the committee members of the EOCEP Biology 1 Alignment Study, July 2022 Content Review, and the EOCEP Biology 1 Item Specification and Performance Target Review Committee.

EOCEP Biology 1 Item Specification Revisions for the 2025-2026 School Year

General note:

Terminology that could be used in this document may apply to more than one PE. If it is a listed term, students are expected to be able to use and apply the term in any context.

The revisions for the 2025-2026 school year are highlighted under the specific Performance Expectations as well.

B-LS1-6

Added terminology: peptide

For State Assessment Purposes:

- Students are expected to know how the main biomolecules (i.e., amino acids, carbohydrates, lipids, nucleic acids, and proteins) function to support organisms.

B-LS2-1

Added terminology: autotroph, consumer, heterotroph, producer

For State Assessment Purposes:

- Students are expected to interact with a variety of models that communicate data/information on carrying capacity and limiting factors.

B-LS2-5

Added terminology: autotroph, heterotroph, zooplankton

For State Assessment Purposes:

- Students are expected to understand how organisms (e.g., autotrophs, consumers, heterotrophs, phytoplankton, producers, zooplankton) contribute to the carbon cycle.

B-LS3-3

For the state assessment, items may not:

- require students to construct/complete a dihybrid cross.

For State Assessment Purposes:

- Students could be required to calculate rations and/or probabilities (i.e., percentage) of monohybrid and dihybrid crosses.

B-LS4-2

Added terminology: allele frequency

For the state assessment, items may not:

- require students to calculate allele frequency,

From Molecules to Organisms: Structures and Processes

B-LS1-1

Performance Expectation: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.

Clarification Statement: None

State Assessment Boundary: Assessment does not include identification of specific cells
or tissue types, whole body systems, specific protein structures and functions,
or the biochemistry of protein synthesis.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS1-1 and **not** to any other Performance Expectation.

DCI: B-LS1.A.1-5 / B-LS3.A.1,2 **SEP:** B-VI.a **CCC:** B.SF.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS1-1

- adenine
- amino acid
- anticodon
- chromosome
- codon
- cytoplasm
- cytosine
- deoxyribose
- differentiation
- DNA
- double helix
- endoplasmic reticulum (SER & RER)
- enzyme
- gene
- Golgi apparatus
- guanine
- mRNA
- mutation
- nuclear membrane
- nucleic acid
- nucleotide
- nucleus
- peptide bond
- polypeptide
- protein synthesis
- ribose
- ribosome
- RNA
- rRNA
- start codon
- stop codon
- thymine
- transcription
- translation
- tRNA
- uracil
- vesicle

(Continued on next page.)

B-LS1-1 On the state assessment, items may not:

- ask students to identify specific cell types/proteins. If mentioned in the stimulus, a description of the cell type/protein and its function must be provided,
- refer to protein structures beyond primary structure (sequence of amino acids).
- require student knowledge of post-translational modification,
- require students to recall which codons produce specific amino acids,
- require students to identify the biochemistry of protein synthesis, e.g., RNA polymerase
- use or reference the codon wheel, or
- use the terms intron, exon, 3'/5', Okazaki fragment. initiation, elongation, termination.

B-LS1-1 For state assessment purposes

- A codon chart will be included in an item when needed as a reference.
- Students are expected to understand and apply the base pair rule for DNA and RNA.
- Students are expected to understand and translate codon sequences using the codon chart.
- Students are expected to understand the general steps/process of protein synthesis
- Students are expected to know the roles of the ER and Golgi apparatus in protein production: i.e., ER modifies proteins and the Golgi apparatus packages them for transport.
- Students may be expected to show understanding of the role of differentiation in the functioning of specialized systems of cells (i.e., the results of the process of differentiation). The process of differentiation is more deeply explored in B-LS1-4.

B-LS1-4
Performance Expectation: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing, and maintaining, complex organisms.
Clarification Statement: Emphasis is on normal cell division as well as instances in which cell division is uncontrolled (e.g., cancer).
State Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS1-4 and **not** to any other Performance Expectation.

DCI: B-LS1.B.1-3 **SEP:** B-II.a **CCC:** B.SSM.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS1-4

- anaphase
- carcinogen
- cancer
- cell cycle
- cell plate
- centromere
- centrosome
- checkpoint
- chromosome
- cleavage furrow
- cytokinesis
- cytoplasm
- daughter cell
- differential gene expression
- differentiation
- diploid
- DNA (deoxyribonucleic acid)
- egg cell
- embryo
- fertilize
- gap 1 (G_1)
- gap 2 (G_2)
- gene
- genome
- haploid
- interphase
- metaphase
- mitosis
- mitotic phase (M)
- nucleus
- parent cell
- prophase
- protein
- replication
- sister chromatid
- somatic cell
- sperm cell
- spindle fibers
- stem cell
- synthesis phase (S)
- tumor (benign and malignant)
- telophase
- zygote

(Continued on next page.)

B-LS1-4 For the state assessment, items may not

- ask students to differentiate multipotent, pluripotent, and totipotent stem cells,
- require students to define or identify the names of phases in mitosis (e.g., prophase, metaphase, etc.), or
- require students to demonstrate knowledge of the biochemical steps of DNA replication
  (i.e., initiation, elongation, termination) or the associated enzymes and their functions (e.g., helicase, DNA polymerase, etc.)

B-LS1-4 For State Assessment Purposes

- A codon chart will be included in an item when needed as a reference.
- Students could be asked to differentiate between embryonic and adult stem cell function and application.
- Students could be asked to distinguish between animal and plant cell mitosis.
- Students are expected to interpret models related to cell differentiation and the cell cycle.
- Students are expected to sequence models illustrating the various stages of mitosis.
- Students are expected to understand the role of checkpoints but not the names of regulating factors (e.g., enzymes, hormones, proteins, etc.).
- While students are not expected to sequence phases by name, they are expected to explain and/or identify the sequence of events occurring during the cell cycle and mitosis.

B-LS1-5
Performance Expectation: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
Clarification Statement: Emphasis is on explaining inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.
State Assessment Boundary: Assessment does not include specific biochemical steps.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS1-5 and **not** to any other Performance Expectation.

DCI: B-LS1.C.1 **SEP:** B-II.b **CCC:** B.EM.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS1-5

- ADP (adenosine diphosphate)
- ATP (adenosine triphosphate)
- Calvin cycle
- carbon dioxide
- carbon fixation
- chlorophyll
- chloroplasts
- glucose
- input
- light-dependent
- light-independent
- NADP+
- NADPH
- output
- oxygen
- photosynthesis
- product
- reactant
- simple sugar
- water

B-LS1-5 For the state assessment, items may not:
- include the details of an electron transport chain,
- include the discrete structures of the chloroplasts, (e.g., grana, stroma, thylakoid), or
- require students to identify the steps of the Calvin cycle.

B-LS1-5 For state assessment purposes
- Models of photosynthesis could include—but are not limited to—any of the following: chemical equations (e.g., $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$), diagrams, graphs, and tables.
- Scenarios referencing algae could be used in items or item clusters.

B-LS1-6

Performance Expectation: Construct and revise an explanation based on evidence from how carbon dioxide, hydrogen, and sugar molecules may combine with other elements to form amino acids and other large carbon-based molecules necessary for essential life processes.

Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations of how the products of photosynthesis can be used to form the molecules of life.

State Assessment Boundary: Assessment does not include the details of the specific chemical reactions or molecular identification of macromolecules.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS1-6 and **not** to any other Performance Expectation.

DCI: B-LS1.C.2,3 **SEP:** B-VI.b **CCC:** B.EM.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS1-6

- amino acid
- ATP (adenosine triphosphate)
- carbohydrate
- carbon (C)
- carbon dioxide (CO_2)
- cellular respiration
- cellulose
- fatty acid
- glucose
- hydrocarbon
- hydrogen (H)
- lipid
- macromolecule
- nitrogen (N)
- nucleic acid
- nucleotide
- organic
- organic molecules
- oxygen (O_2)
- peptide
- phosphorus (P)
- photosynthesis
- protein
- starch
- sulfur (S)

B-LS1-6 For the state assessment, items may not

- require students to describe the bond formation between carbon, hydrogen, and oxygen atoms in molecule formation, or
    - require students to explain or identify the steps in photosynthesis or cellular respiration. These processes are explored in B-LS1-5 and B-LS1-7 respectively.

(Continued on next page.)

B-LS1-6 For state assessment purposes

- Students could be asked to use labeled models of macromolecule structure.
- Students could be asked to evaluate data related to the chemical composition (e.g., C,H,O,N,P,S) of proteins, sugars, or other molecules.
- Student understanding of cellular respiration for this PE is limited to the relationship between the energy released by cellular respiration and the building of other macromolecules. (Cellular respiration is explored more deeply in B-LS1-7.)
- Students are expected to know how the main biomolecules (i.e., amino acids, carbohydrates, lipids, nucleic acids, and proteins) function to support organisms.

B-LS1-7

Performance Expectation: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the processes of aerobic and anerobic cellular respiration.

State Assessment Boundary: Assessment should not include identification of steps or specific processes involved in cellular respiration nor specific types of fermentation. Assessment should be limited to comparing the efficiency of aerobic and anerobic cellular respiration.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS1-7 and **not** to any other Performance Expectation.

DCI: B-LS1.C.3-7 **SEP:** B-II.b **CCC:** B.EM.2

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS1-7

- aerobic cellular respiration
- ADP (adenosine diphosphate)
- anaerobic cellular respiration
- ATP (adenosine triphosphate)
- carbon dioxide (CO_2)
- cellular respiration
- cytosol
- electron transport chain
- fermentation
- glucose
- glycolysis
- input
- Krebs cycle
- lactic acid
- mitochondria
- organic molecules
- output
- NADH
- NAD+
- phosphorous (P)
- pyruvate (pyruvic acid)

B-LS1-7 For the state assessment, items may not

- require students to differentiate between lactic acid and alcoholic fermentation processes, or
- require students to identify the steps of glycolysis (i.e., the ten steps), the Krebs cycle (i.e., the eight steps) or the steps of the electron transport chain (ETC).

(Continued on next page.)

B-LS1-7 For State Assessment Purposes

- As stated in the DCI foundation box, “[a] result of these chemical reactions, energy is transferred from one system of interacting molecules to another.” The systems of interacting molecules are defined as glycolysis, Krebs's cycle, ETC, and/or fermentation.
    - Students are expected to know that glycolysis (breaks apart glucose), the Krebs cycle (releases energy for use by the ETC and 2 ATP) and the ETC (produces ATP for cell work) are processes that occur during cellular respiration.
    - Students are expected to know that when oxygen is not available, the products of glycolysis are used in fermentation
- Students are expected to recognize and use the chemical equation for aerobic cellular respiration.
- Students could be required to compare models of aerobic and anaerobic cellular respiration (including fermentation).
- Students could be required to explain that glycolysis occurs in the cytoplasm and the Krebs cycle occurs in the mitochondrion.
- Students could be required to identify relative ATP output.

Ecosystems: Interactions, Energy, and Dynamics

B-LS2-1

Performance Expectation: Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales.

Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and challenges. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. Examples of scales could be a pond versus an ocean.

State Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS2-1 and **not** to any other Performance Expectation.

DCI: B-LS2.A.1,2 **SEP:** B-V.a **CCC:** B.SPQ.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS2-1

- abiotic factor(s)
- autotroph
- biotic factor(s)
- carrying capacity
- commensalism
- community
- competition
- consumer
- density-dependent
- density-independent
- disease
- ecosystem
- environment
- exponential growth
- heterotroph
- limiting factor
- logistic growth
- mutualism
- parasitism
- population
- population growth model
- predation
- producer
- species
- symbiosis

B-LS2-1 For the state assessment, items may not:

- require students to manipulate algebraic calculations, or
- require students to manipulate/use exponential or logarithmic equations in a calculation.

B-LS2-1 For State Assessment Purposes

- Students may be required to perform simple arithmetic calculations.
- Students are expected to interact with a variety of models that communicate data/information on carrying capacity and limiting factors.

B-LS2-5
Performance Expectation: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
Clarification Statement: None
State Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS2-5 and **not** to any other Performance Expectation.

DCI: [B-LS2.B.1] / [2°B-PS3.D.1] **SEP:** [B-II.c] **CCC:** [B.SSM.1]

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS2-5

- atmosphere
- autotroph
- biomass
- biosphere
- carbon cycle
- carbon dioxide (CO_2)
- carbon fixation
- carbon sink
- climate change
- combustion
- consumer
- decomposition
- Earth materials
- fossil fuels
- geosphere
- glucose/sugar
- greenhouse gas
- heterotroph
- hydrocarbon
- hydrosphere
- methane
- organic matter
- photosynthesis
- phytoplankton
- producer
- respiration
- transpiration
- zooplankton

B-LS2-5 For the state assessment, items may not:

- require students to differentiate between lactic acid and alcoholic fermentation processes,
- require students to identify the steps of the Calvin cycle, or
- require students to identify the steps of glycolysis (i.e., the ten steps), the Krebs cycle (i.e., the eight steps) or the steps of the ETC.

B-LS2-5 For State Assessment Purposes

- Earth materials may be referenced in a model and are considered rocks, minerals, soil, water, etc.
- Students are expected to recognize the chemical formulae for the reactants and products of photosynthesis and cellular respiration.
- Students are expected to understand how organisms (e.g., autotrophs, consumers, heterotrophs, phytoplankton, producers, zooplankton) contribute to the carbon cycle.

B-LS2-7
Performance Expectation: Design, evaluate, and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.
Clarification Statement: None
State Assessment Boundary: None

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS2-5 and **not** to any other Performance Expectation.

DCI: B-LS2.C.1 / 2°B-LS4.D.1-5 / 2°B-ETS1.B.1 **SEP:** B-VI.c **CCC:** B.SC.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS2-7

- abiotic
- anthropogenic
- biotic
- climate change
- captive breeding
- conservation
- biodiversity
- ecological restoration
- ecosystem
- ecosystem diversity
- ecotourism
- endangered species
- extinction
- genetic diversity
- habitat
- habitat destruction
- human population growth
- habitat fragmentation
- habitat restoration
- invasive species
- overharvesting
- pollution
- species diversity
- sustainable development

B-LS2-7 For the state assessment, items may not:

- reference threatened or endangered species or genetic variation of organisms for multiple species as a context. These are limited to B-LS4-6 in Biology 2.

B-LS2-7 For State Assessment Purposes

- Items may refer to habitat destruction, pollution, introduction of invasive species, overexploitation, or climate change.

Heredity: Inheritance and Variation of Traits

B-LS3-2

Performance Expectation: Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combination through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.

State Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS3-2 and **not** to any other Performance Expectation.

DCI: B-LS3.B.1-4 **SEP:** B-VII.b **CCC:** B.CE.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS3-2

- allele
- centromere
- chromatid
- chromosome
- codon (chart)
- crossing over
- daughter cell
- deletion
- diploid
- DNA
- fertilization
- frameshift
- gamete
- gene
- gene mutation
- genetic code
- genetic variation
- haploid
- homologous chromosome
- independent assortment
- insertion
- meiosis
- meiosis I
- meiosis II
- monosomy
- mutagen
- mutation
- nondisjunction
- offspring
- parent cell
- point mutation
- replication
- sexual reproduction
- somatic cell
- substitution
- trisomy
- trait

B-LS3-2 For the state assessment, items may not:

- require students to define, identify, or sequence the names of phases in meiosis I and II (e.g., prophase I, metaphase I, etc.), or
- require students to use the codon wheel.

B-LS3-2 For State Assessment Purposes

- A codon chart will be provided, when necessary.
- References to "viable errors occurring during replication" are defined as errors that bypass DNA proofreading (the cell cycle successfully moves past G_2).
- Students are required to use models of meiosis to construct explanations of new genetic combinations.
- Students must be able to recognize and sequence the events represented in models of meiosis.

B-LS3-3
Performance Expectation: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.
State Assessment Boundary: Assessment does not include Hardy-Weinberg calculations or Chi-square analysis.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS3-3 and **not** to any other Performance Expectation.

DCI: B-LS3.B.4 **SEP:** B-IV.a **CCC:** B.SPQ.2

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS3-3

- allele
- autosomal
- codominance
- complete dominance
- dihybrid cross
- dominant
- F_1 (first filial)
- F_2 (second filial)
- gamete
- gene expression
- genetic variability
- genotype
- genotypic ratio
- heredity
- heterozygous
- homozygous
- incomplete dominance
- monohybrid cross
- P (parental)
- pedigree
- phenotype
- phenotypic ratio
- polygenic inheritance
- probability
- Punnett square
- ratio
- recessive
- sex linked
- trait

B-LS3-3 For the state assessment, items may not:
- require students to construct/complete a pedigree,
- require students to construct/complete a dihybrid cross,
- require students to demonstrate knowledge of specific genetic disorders (e.g., hemophilia, sex-linked color blindness), or
- require student knowledge of Hardy-Weinberg or Chi-square.

B-LS3-3 For State Assessment Purposes
- Information on genetic disorders will be provided when used in a scenario or item.
- Students are expected to analyze/interpret pedigrees through F_2.
- Students could be required to analyze a completed dihybrid cross.
- Students could be required to calculate ratios and/or probabilities (i.e., percentages) of monohybrid and dihybrid crosses.
- Students could be required to construct/complete a monohybrid cross.

Biological Evolution: Unity and Diversity

B-LS4-1

Performance Expectation: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of evidence.

Clarification Statement: Emphasis is students' conceptual understanding of the role each line could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.

State Assessment Boundary: Assessment is limited to conceptual explanations of the evidence for biological evolution and is not extended to the lines of evidence for specific species. Assessment does not include classification of organisms.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS4-1 and **not** to any other Performance Expectation.

DCI: B-LS4.A.1-3 / B-ETS2.B.1 **SEP:** B-VIII.a **CCC:** B.P.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS4-1

- amino acid sequencing
- analogous structure
- anatomy
- biochemical evidence
- biogeography
- cladogram
- common ancestry
- decent with modification
- DNA sequencing
- electrophoresis
- embryo
- embryology
- evolutionary tree
- fossil record
- homologous structure
- homology
- paleontology
- phenotypic similarity
- phylogeny
- phylogenic tree
- vestigial
- sedimentary layers

B-LS4-1 For the state assessment, items may not:

- require students to identify the taxonomic classification of organisms.

B-LS4-1 For state assessment purposes

None identified at this PE.

B-LS4-2

Performance Expectation: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction; (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on the number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as distribution graphs and proportional reasoning.

State Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and coevolution.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS4-2 and **not** to any other Performance Expectation.

DCI: B-LS4.B.1 / B-LS4.C.1 **SEP:** B-VI.a **CCC:** B.CE.1

Phenomenon-Related Terminology That Could Be Used in Items or Clusters Specific to B-LS4-2

- adaptation
- allele frequency
- behavior
- competition
- fitness
- gene pool
- genetic variation
- geographic isolation
- morphology
- natural selection
- phenotypic expression
- physiology
- population
- reproductive isolation
- sexual selection
- speciation
- species
- trait

B-LS4-2 For the state assessment, items may not:

- expect students to demonstrate knowledge of chi-square analysis,
- expect students to demonstrate knowledge of Hardy-Weinberg equilibrium,
- include references to genetic drift,
- require students to calculate allele frequency,
- require students to demonstrate knowledge of coevolution, or
- use examples of gene flow through migration.

B-LS4-2 For state assessment purposes

- Students are expected to differentiate between the terms “population” and “species.”

B-LS4-4
Performance Expectation: Construct an explanation based on evidence for how natural selection leads
to adaptation of populations.
Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.
State Assessment Boundary: Assessment does not include allele frequency calculations.*

*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS4-4 and **not** to any other Performance Expectation.

DCI: B-LS4.C.2,3 **SEP:** B-VI.a **CCC:** B.CE.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS4-4

- abiotic
- adaptation
- advantageous trait
- biotic
- coevolution
- convergent evolution
- distribution
- diverge
- ecosystem
- fitness
- gene
- gene frequency
- gene pool
- geographic isolation
- natural selection
- phenotypic variation
- population
- survival rate
- variation
- trait

B-LS4-4 For the state assessment, items may not:
- require students to calculate allele frequencies, or
- require student knowledge of Hardy-Weinberg or Chi-square.

B-LS4-4 For state assessment purposes
None identified for this PE.

B-LS4-5
Performance Expectation: Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.
State Assessment Boundary: None
*The State Assessment Boundary applies **only** to items developed for EOCEP Biology 1 that directly measure B-LS2-5 and **not** to any other Performance Expectation.

DCI: B-LS4.C.4-6 **SEP:** B-VII.c **CCC:** B.CE.1

Phenomenon-Related Terminology That Could Be Used in Items Specific to B-LS4-5

- abiotic
- adaptation
- abiotic factor
- biotic
- biotic factor
- distribution
- diverge
- ecosystem
- extinction
- fitness
- fossil
- founder effect
- gene
- gene flow
- gene frequency
- gene pool
- genetic drift
- geographic isolation
- geologic record
- natural selection
- phenotypic variation
- population
- species
- speciation
- survival rate
- trait
- variation

B-LS4-5 For the state assessment, items may not:

- require students to demonstrate knowledge of the major extinction events,
- require student knowledge of Hardy-Weinberg or Chi-square,

B-LS4-5 For state assessment purposes
None identified for this PE.

EOCEP Biology1 Condensed Disciplinary Core Ideas Codes

The information below was compiled and modified for the purpose of assessment from:
https://static.nsta.org/ngss/resources/MatrixForK-12ProgressionOfDisciplinaryCoreIdeasInNGSS.8.8.14.pdf

LS1—From Molecules to Organisms: Structures and Processes

LS1:A— Structure and Function

1. Systems of specialized cells within organisms help them perform the essential functions of life. (B-LS1-1)
2. All cells contain genetic information in the form of DNA molecules. (B-LS1-1)
3. Genes are specific regions within the extremely large DNA molecules that form the chromosomes. (B-LS1-1)
4. Genes contain the instructions that code for the formation of molecules called proteins, which carry out most of the work cells to perform the essential functions of life. (B-LS1-1)
5. Proteins provide structural components, serve as signaling devices, regulate cell activities, and determine the performance of cells through their enzymatic actions. (B-LS1-1)

LS1.B—Growth and Development of Organisms

1. In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow (and repair). (B-LS1-4)
2. The organism began as a single cell (fertilized egg) that divides success successively to produce many cells, within each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. (B-LS1-4)
3. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (B-LS1-4)

LS1.C—Organization for Matter and Energy Flow in Organisms

1. The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (B-LS1-5)
2. The sugar molecules thus formed contain carbon, hydrogen, and oxygen: the hydrocarbon backbones are used to make amino acids and other carbon based molecules that can be assembled into larger molecules (such as proteins or DNA), used for essential life functions. (B-LS1-6)
3. As matter and energy flow through organizational levels of living systems, chemical elements are recombined to form different products. (B-LS1-6, B-LS1-7)
4. As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. (B-LS1-7)
5. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken, and new compounds are formed that can transport energy to muscles. (B-LS1-7)

6. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (B-LS1-7)
7. Anaerobic cellular respiration follows a different and less efficient chemical pathway to provide energy and cells. (B-LS1-7)

LS2—Ecosystems: Interactions, Energy, and Dynamics

LS2.A Interdependent Relationships in Ecosystems

1. Ecosystems have carrying capacities, which are limits to the number of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving organisms and from such challenges as predation, competition, and disease. (B-LS2-1)
2. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species and any given ecosystem. (B-LS2-1)

LS2.B—Cycles of Energy and Matter Transfer in Ecosystems

1. Photosynthesis and cellular respiration are important components of the carbon cycle,
in which carbon is exchanged among the biosphere, atmosphere, oceans,
and geosphere through chemical, physical, geological, and biological processes. (B-LS2-5)

LS2.C—Ecosystem Dynamics, Functioning, and Resilience

1. Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change — can disrupt an ecosystem and threaten their survival of some species. (B-LS2-7)

LS3—Heredity: Inheritance and Variation of Traits

LS3.A—Inheritance of Traits

1. The sequence of nucleotides spell out the information in a gene. (B-LS1-1)
2. DNA controls the expression of proteins by being transcribed into a "messenger" RNA, which is translated and turned by the cellular machinery into a protein. (B-LS1-1)

LS3.B—Variation of Traits

1. In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. (B-LS3-2)
2. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. (B-LS3-2)
3. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (B-LS3-2)
4. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors. (B-LS3-2, B-LS3-3)

LS4—Biological Evolution: Unity and Diversity

LS4.A—Evidence of Common Ancestry and Diversity

1. Genetic information, like the fossil record, provides evidence of evolution. (B-LS4-1)
2. DNA sequences vary among species, but they are many overlaps; notably, the ongoing branching that produces multiple lines of descent can be inferred by comparing DNA sequences of different organisms. (B-LS4-1)
3. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (B-LS4-1)

LS4.B—Natural Selection

1. Natural selection occurs only if there is both (1) variation in the genetic information between individuals in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (B-LS4-2)

LS4.C—Adaptation

1. Evolution is driven by the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (B-LS4-2)
2. Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment . (B-LS4-4)
3. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease and the population of individuals that do not . (B-LS4-4)
4. Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—sometimes extinction—of some species. (B-LS4-5)
5. Species become extinct because they can no longer survive and reproduce in their altered environment. (B-LS4-5)
6. If members cannot adjust to the change that is too fast or drastic, the opportunity for species evolution is lost. (B-LS4-5)

LS4-D—Biodiversity and Humans

1. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (2°B-LS2-7)
2. Humans depend on the living world for the resources and other benefits provided by biodiversity. (2°B-LS2-7)
3. Human activity is having adverse impacts on biodiversity through overpopulation, overexploitation , habitat destruction, pollution, introduction of invasive species, and climate change. These problems have the potential to cause biological extinctions which result in decreased biodiversity and the effects may be harmful to human and other living things. (2°B-LS2-7)
4. Sustaining biodiversity so that ecosystem functioning, and productivity are maintained is essential to supporting and enhancing life on Earth. (2°B-LS2-7)
5. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (2°B-LS2-7)

PS3—Energy

PS3-D— Energy in Chemical Processes and Everyday Life

1. The main way that solar energy is captured and stored on earth is through the complex chemical processes known as photosynthesis. (2° B-LS2-5)

ETS1— Engineering and Design

ETS1-B— Developing Possible Solutions

1. When evaluating solutions, it is important to consider a range of constraints including cost, safety, reliability, and aesthetics and to consider social, cultural, and environmental impacts. (2°B-LS2-7)

ETS2—Links among Engineering, Technology, Science, and Society

ETS2.B—Influence of Engineering, Technology, & Science on Society and the Natural World

1. The understanding of evolutionary relationships has recently been greatly accelerated by using new molecular tools to study biology. (B-LS4-1)

EOCEP Biology Condensed Science and Engineering Practice Foundation Statements

The information below contains the specific Science and Engineering Practice foundation statements for EOCEP Biology as found in the *South Carolina College- and Career-Ready Science Standards 2021*.

B-I. Asking Questions and Defining Problems

Asking questions and defining problems in grades 9–12 builds on grades K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Not on any PE for EOCEP Biology 1

B-II. Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

a. Use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. (B-LS1-4)
b. Use a model based on evidence to illustrate the relationships between systems or between components of a system. (B-LS1-5, B-LS1-7)
c. Develop a model based on evidence to illustrate the relationships between systems or components of a system. (B-LS2-5)

B-III. Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Not on any PE for EOCEP Biology 1

B-IV. Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of datasets for consistency, and the use of models to generate and analyze data.

a. Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems using digital tools feasible. (B-LS3-3, B-LS4-3)

B-V. Using Mathematics and Computational Thinking

Mathematical and computational thinking and 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and the computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

a. Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (B-LS2-1)

B-VI. Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions and 9–12 builds on K–8 experiences and progress is to the use of evidence and constructing explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific ideas, principles, and theories.

a. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world will operate today as they did in the past and will continue to do so in the future. (B-LS1-1, B-LS4-2, B-LS4-4)
b. Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students own investigations, models, theories, simulations, peer review) and the assumption that the theories and laws that describe the natural world will operate today as they did in the past and will continue to do so in the future. (B-LS1-6)
c. Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off [sic]considerations. (B-LS2-7)

B-VII. Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

a. Evaluate the claims, evidence, and reasoning behind currently accepted explanations
or solutions to determine the merits of arguments. (B-LS4-5)
b. Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student generated evidence. (B-LS3-2)
c. Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (B-LS4-5)

B-VIII. Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

a. Communicate scientific information (e.g.., about phenomena and/ or the process of development and the design and performance of a proposed processor system) and multiple formats (including orally, graphically, textually, and mathematically). (B-LS4-1)

Biology 1 Condensed Crosscutting Concepts Foundation Statements

The information below contains the specific Crosscutting Concept foundation statements for EOCEP Biology as found in the *South Carolina College- and Career-Ready Science Standards 2021*.

B.P. —Patterns

1. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality and explanations of phenomena. (B-LS4-1)

B.CE. —Cause and Effect: Mechanism and Prediction

1. Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (B-LS3-2, B-LS4-2, B-LS4-4, B-LS4-5)

B.SPQ. —Scale, Proportion, and Quantity

1. The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (B-LS2-1)
2. Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (B-LS3-3)

B.SSM. —Systems and System Models

1. Models (e.g.., physical, mathematical, computer models) can be used to simulate systems and interactions —including energy, matter, and information flows—within and between systems at different scales. (B-LS1-4, B-LS2-5)

B.EM. —Energy and Matter: Flows, Cycles, and Conservation

1. Changes of energy and matter in the system can be described in terms of energy and matter flows into, out of, and within that system. (B-LS1-5, B-LS1-6)
2. Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/ or fields, or between systems. (B-LS1-7)

B.SF. —Structure and Function

1. Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function. (B-LS1-1)

B.SC. —Stability and Change

1. Much of science deals with constructing explanations of how things change and how they remain stable. (B-LS2-7)

References

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education 2014. (2014). *Standards for educational and psychological testing*.

California Department of Education. (2021). *CAST item specifications*.

Campbell, N. A., Reese, J. B., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2008). *Biology* (8th ed.). Pearson Benjamin Cummings.

Children's Word Book (2ed) Alijandra Mogilner & Tayopa Mogiliner. Writer's Digest Books, Cincinnati, Ohio

EDL Core Vocabularies in Reading, Mathematics, Science, and Social Studies. Stanford E. Taylor, Helen Frakenpohl, Catherine E. White, Betty Willmon Niereroda, Carole Livingston Browning, & E. Patricia Birsner. Steck-Vaughn Company P.O. Box 690789, Orlando, FL (1-800-531-5015)

Evidence Statements. (2015). Next Generation Science Standards.

Idaho State Department of Education. (2020). *Idaho elementary school science specifications*.

Item specifications guidelines for the Next Generation Science Standards. (2015). Council of Chief State School Officers.

Marieb, E. N., & Hoehn, K. (2010). *Human anatomy & physiology*. Benjamin-Cummings Publishing Company.

Miller, K. R., & Levine, J. S. (2017). *Miller & Levine biology*. Prentice Hall.

National Council of Research. (2014). *Developing assessments for the Next Generation Science Standards*. Washington, D.C. National Academies Press.

National Research Council. (2012). *A Framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press.

National Science Teachers Association. (2013). *Crosscutting Concepts*. NGSS Hub.

National Science Teachers Association. (2013). *Science and Engineering Practices*. NGSS Hub.

National Science Teachers Association. (2013). *Disciplinary Core Ideas.* NGSS Hub.

Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). *Lehninger principles of biochemistry*. Macmillan.

Nowicki, S. (2015). *Holt McDougal biology*. Holt McDougal.

Pearson Education. (2011). *Campbell biology, AP* edition* (10th ed.). Ingram.

Tobin, A. J. (1996). *Asking about cells*. Harcourt School.

WIDA (2020). *English Language Development Standards Framework Kindergarten–Grade 12.* Board of Regents of the University of Wisconsin System.