NEW YORK STATE TEACHER CERTIFICATION EXAMINATIONS™

FIELD 160: BIOLOGY

TEST DESIGN AND FRAMEWORK

June 2018

Authorized for Distribution by the New York State Education Department

This test design and framework document is designed to provide information about the content and format of a test for the New York State Teacher Certification Examinations™ (NYSTCE®) program. Education faculty and administrators at teacher preparation institutions may also find the information in this framework useful as they discuss the test with candidates. All test components may differ from those presented here. Furthermore, review of this framework, in whole or in part, does not guarantee an increased likelihood of success on any of the New York State Teacher Certification Examinations. The NYSTCE program is subject to change at the sole discretion of the New York State Education Department, and any changes will fully supersede the information presented in this document. As a reminder, candidates are responsible for contacting their certification officer(s) regarding any changes to the New York State Teacher Certification Examinations.

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FIELD 160: BIOLOGY

TEST DESIGN

This test consists of selected-response items measuring content knowledge and one extended constructed-response item measuring pedagogical content knowledge. The constructed-response item is scenario-based and requires candidates to describe an instructional strategy to guide all students in achieving a specific learning goal, assess student understanding, and identify students' strengths and needs.

The selected-response items count for 80% of the total test score and the constructed-response item counts for 20% of the total test score, as indicated in the table that follows. Each selected-response item counts the same toward the total test score. The percentage of the total test score derived from the constructed-response item is also indicated in the table that follows.

The total testing time is 195 minutes. Candidates are free to set their own pace during the test administration. The following estimates were used to determine the total test time:

- The selected-response items are designed with the expectation of a response time up to 135 minutes.
- The constructed-response item is designed with the expectation of a response time up to 60 minutes.

Further information regarding the content of each competency can be found in the test framework.

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Competency	Selected-Response		Constructed-Response	
	Approximate Number of Items	Approximate Percentage of Test Score	Number of Items	Approximate Percentage of Test Score
0001 Structure and Function of Cells and Molecules	15	13%	--	--
0002 Structure and Function of Organisms	15	14%	--	--
0003 Matter and Energy	15	13%	--	--
0004 Interdependent Relationships in Ecosystems	15	13%	--	--
0005 Inheritance and Variation of Traits	15	14%	--	--
0006 Evolution and the Unity and Diversity of Life	15	13%	--	--
0007 Pedagogical Content Knowledge	--	--	1	20%
Total	**90**	**80%**	**1**	**20%**

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Structure and Function of Cells and Molecules
Structure and Function of Organisms
Matter and Energy
Interdependent Relationships in Ecosystems
Inheritance and Variation of Traits
Evolution and the Unity and Diversity of Life
Pedagogical Content Knowledge

The New York State biology teacher has the knowledge and skills necessary to teach effectively in New York State schools. The biology teacher understands and applies current education research on how students learn science. The biology teacher demonstrates mastery of the content and concepts of biology, is a skilled problem solver, and demonstrates strong mathematics and literacy skills. The biology teacher applies the three-dimensional approach (i.e., disciplinary core ideas, crosscutting concepts, science and engineering practices) to science instruction in order to explain phenomena, solve real-world problems, and make informed decisions. The biology teacher has a broad understanding of the disciplinary core ideas in biology and the crosscutting concepts between science disciplines. In addition, the biology teacher understands science and engineering practices and applies scientific concepts, principles, and theories to develop and use models; plan and carry out investigations; analyze and interpret data; engage in argument from evidence; and obtain, evaluate, and communicate scientific and technical information from a variety of source types. The biology teacher knows, demonstrates, and implements policies and procedures to ensure laboratory safety and ethical practices.

As used in this document, the term "research-based" refers to those practices that have been shown to be effective in improving learner outcomes through systematic observation or experiment, rigorous data analysis, ability to replicate results, and publication in a peer-reviewed journal.

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COMPETENCY 0001—STRUCTURE AND FUNCTION OF CELLS AND MOLECULES

Performance Expectations

The New York State biology teacher understands and applies the disciplinary core ideas of structure and function as they relate to cells and biomolecules. The teacher understands the characteristics of living things and the characteristics of different types of cells. The teacher demonstrates knowledge of cellular components and their roles in cell processes and overall cell functioning. The teacher understands active and passive transport processes and the movement of materials through cell membranes. The teacher understands the cell cycle and the processes and outcomes of mitosis, meiosis, fertilization, and cell differentiation. The teacher understands basic principles of chemistry and the structures, properties, and functions of major classes of biomolecules and other biologically important molecules. The teacher analyzes the structure and function of enzymes and factors that affect enzyme action. The teacher applies models to describe the structures and functions of cells, organelles, and biomolecules. In addition, the teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to the structure and function of cells and molecules.

Performance Indicators

a. demonstrates knowledge of the characteristics of living things (e.g., the cellular basis of life, the ability to respire) and of the structures and functions of different types of cells (e.g., prokaryotic, eukaryotic, plant, specialized cells) and compares, contrasts, and interprets models of various types of cells

b. analyzes the primary functions, processes, products, and interactions of various cellular structures (e.g., endoplasmic reticulum, cell wall, cell membrane) and uses models to describe the function of a cell as a whole and ways in which components of cells contribute to cell function

c. analyzes the processes of movement of matter and use of energy during active and passive transport and their importance in maintaining homeostasis in cells and in moving materials through cell membranes, including positive and negative feedback mechanisms involved in regulating a cellular system, and cellular communication (e.g., endocrine system, embryonic development)

d. demonstrates knowledge of the cell cycle and the significance of normal and abnormal cell division in unicellular and multicellular organisms and analyzes processes that lead to and factors that influence cell differentiation

e. understands and compares the stages, processes, and outcomes of mitosis and meiosis and uses and interprets models of mitosis and meiosis

f. analyzes the significance of meiosis and fertilization in increasing genetic diversity and contributing to the evolution of multicellular organisms

g. demonstrates knowledge of basic chemistry and biochemistry, including types and properties of bonds and how they are formed and broken; the structures, properties, and functions of major biomolecules (i.e., carbohydrates, proteins, lipids, and nucleic acids); and the use of models to represent chemical structures and reactions

h. analyzes the unique properties of water and the significance of these properties to living organisms

i. analyzes the structure and function of enzymes, including models of enzyme function and their role in chemical reactions, and factors that affect enzyme structure and activity

j. demonstrates knowledge of the engineering design process as related to the structure and function of cells and molecules, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations (e.g., pharmaceutical development, commercial use of enzymes); and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

k. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into the structure, function, and processes of cells and molecules (e.g., examining and comparing living and nonliving things under various types of microscopes, observing changes to cells exposed to hypotonic and hypertonic solutions, identifying factors that affect enzyme activity)

l. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to the structure, function, and processes of cells and molecules

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COMPETENCY 0002—STRUCTURE AND FUNCTION OF ORGANISMS

Performance Expectations

The New York State biology teacher understands and applies the disciplinary core ideas of structure and function as they relate to unicellular organisms, fungi, plants, and animals, including humans. The teacher understands the organization, structures, functions, and interactions of body systems. The teacher demonstrates knowledge of human reproduction, growth, and development, as well as reproductive technologies. The teacher applies knowledge of homeostatic mechanisms in organisms. The teacher understands causes and characteristics of disease and the mechanisms that organisms use to prevent and fight disease, including technologies employed by humans. The teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to the structure and function of organisms. In addition, the teacher applies knowledge of the safe, proper, and ethical use of organisms, equipment, and materials in school science investigations.

Performance Indicators

a. demonstrates knowledge of the general characteristics, structures, and functions of viruses, prokaryotes, and protists

b. demonstrates knowledge of the hierarchical organization, functions, and interactions of systems that provide specific functions (e.g., nutrient uptake, water delivery, response to stimuli, reproduction) in plants and fungi

c. demonstrates knowledge of the hierarchical organization and function of systems that perform specific processes (e.g., digestion, circulation, excretion, movement, response to stimuli) and interactions between different body systems in animals, including humans

d. demonstrates knowledge of the structures, functions, and disorders of the human reproductive systems and their interactions with other body systems and the role of reproduction and development in sustaining the continuity of life

e. demonstrates knowledge of reproductive technologies (e.g., in vitro fertilization, cloning, embryonic and adult stem cell research) and their applications

f. demonstrates knowledge of the pattern, characteristics, and processes of human growth and development from fertilization through the life span (e.g., cell division and differentiation, aging) and factors that influence growth and development

g. analyzes feedback mechanisms that maintain homeostasis and mediate behaviors in plants and animals, including humans, and factors that may disturb homeostasis and destabilize an organism or body system

h. demonstrates knowledge of the link between a failure of homeostasis and disease; the causes and characteristics of types of disease; the variety of mechanisms that organisms use to prevent and fight disease, including responses of the human immune system to infection; and technological developments (e.g., vaccinations, antibiotics) used to prevent and treat disease

i. demonstrates knowledge of the engineering design process as related to the structure and function of organisms, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations; and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

j. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into the structures and functions of an organism or body system (e.g., investigating homeostatic mechanisms in animals and plants, analyzing the response of an animal or plant body system to various stimuli, carrying out dissections)

k. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to the structure and function of an organism or body system

l. demonstrates knowledge of appropriate resources regarding the safe and proper use of scientific equipment and materials (e.g., inventory, handling, storage, disposal), including accurately interpreting provided information; applies knowledge of guidelines for the proper use of materials and scientific equipment in field, laboratory, and classroom settings and of ethical considerations when working with living organisms; and understands proper procedures for maintaining safety and responding to accidents and injuries during school science investigations

COMPETENCY 0003—MATTER AND ENERGY

Performance Expectations

The New York State biology teacher understands the transfer of matter and energy in cells, organisms, and ecosystems. The teacher understands the processes of photosynthesis and cellular respiration and their roles in providing energy for life processes and transferring matter and energy. The teacher demonstrates knowledge of biochemical pathways involved in the metabolism of biomolecules. The teacher understands, models, and can use mathematical representations to describe the cycling of matter and flow of energy through the trophic levels of an ecosystem, including the inefficiency of the transfers from one level to the next. The teacher demonstrates knowledge of biogeochemical cycles. The teacher analyzes and uses models to illustrate molecule formation, energy transfer, and the cycling of matter and flow of energy. In addition, the teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to matter and energy.

Performance Indicators

a. demonstrates and applies knowledge of the inputs, products, and processes of photosynthesis and cellular respiration

b. analyzes the transfer of energy in living systems as chemical elements are recombined in different ways to form various products, including modeling the conservation of matter

c. compares and contrasts aerobic and anaerobic respiration and fermentation

d. demonstrates knowledge of ATP production through chemiosmosis in both photosynthesis and cellular respiration

e. demonstrates knowledge of the relationship between chloroplast structure and function in photosynthesis and the relationship between mitochondrial structure and function in respiration

f. demonstrates knowledge of the biochemical pathways involved in the anabolism and catabolism of major biomolecules (i.e., carbohydrates, proteins, lipids, and nucleic acids) to support growth or release energy

g. uses and analyzes models to illustrate how molecules are formed and energy is stored and transferred at the molecular and cellular level

h. demonstrates knowledge of the significance of photosynthesis and respiration in providing energy for life processes and in the cycling of matter and flow of energy into, out of, and within ecosystems

i. analyzes the cycling of matter and flow of energy through the trophic levels in an ecosystem, including the roles of organisms (producers, consumers, decomposers) and the inefficiency of energy transfer between trophic levels

j. uses graphical and mathematical models (e.g., pyramids of biomass or energy) related to the cycling of matter and flow of energy among organisms

k. demonstrates knowledge of how chemical elements and molecules (e.g., carbon, nitrogen, water) are transferred between abiotic and biotic components of ecosystems through biogeochemical cycles and evaluates implications of the distribution and availability of elements and molecules

l. demonstrates knowledge of the engineering design process as related to the transfer of matter and energy in cells, organisms, or ecosystems, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations; and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

m. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into the transfer of matter and energy in cells, organisms, or ecosystems (e.g., measuring and graphing consumption of oxygen in cellular respiration, identifying how environmental factors affect transpiration rate, simulating the steps of the nitrogen cycle through student role-playing)

n. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to the transfer of matter and energy in cells, organisms, and ecosystems

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COMPETENCY 0004—INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Performance Expectations

The New York State biology teacher understands and applies the disciplinary core ideas of ecosystem dynamics, functioning, and interactions. The teacher applies knowledge of carrying capacity and factors that affect the sizes and growth rates of populations. The teacher applies knowledge of the interactions and dependencies between organisms in an ecosystem and analyzes evidence of ecosystem functioning and relationships. The teacher understands the influence of individual and group behaviors on organisms' survival. The teacher understands natural and human factors that influence biodiversity in ecosystems. The teacher understands ecosystem stability and resilience and how an ecosystem may respond to minor disturbances and to extreme changes in conditions. The teacher evaluates proposed solutions for reducing human impacts on the environment and on biodiversity and demonstrates the ability to analyze cost-benefit trade-offs. In addition, the teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to the interdependent relationships in ecosystems.

Performance Indicators

a. analyzes the biotic and abiotic factors that affect the carrying capacity of an ecosystem, including using graphs, charts, and data of population changes

b. demonstrates knowledge of characteristics of populations and factors that affect biodiversity, population sizes, and growth rates of species in an ecosystem (e.g., disease, resource availability, generation length), including using empirical evidence to relate specific causes and effects

c. analyzes patterns of interactions and dependencies between organisms in an ecosystem (e.g., competition, predation, symbiosis)

d. analyzes claims, evidence, and reasoning related to ecosystem functioning and relationships within an ecosystem

e. analyzes the influence of individual and group behaviors (e.g., hunting, herding, migrating) on an individual's or a species's chances to survive and reproduce

f. demonstrates knowledge of biodiversity and scientific explanations of how natural events and human activities can disrupt an ecosystem and adversely affect biodiversity (e.g., climate change)

g. demonstrates knowledge of the concepts of stability and resilience as they apply to ecosystems and predicts how an ecosystem is likely to respond to modest biological or physical disturbances and to extreme changes in conditions (e.g., ecological succession)

h. evaluates and designs practical solutions for reducing the impacts of human activities (e.g., urbanization, introduction of invasive species) on the environment and biodiversity, taking into account scientific knowledge and constraints such as cost, safety, reliability, and aesthetics

i. demonstrates knowledge of the engineering design process as related to the interdependent relationships in ecosystems, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations; and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

j. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into the characteristics of populations and ecosystem functions (e.g., analyzing changes in algal population density under differing nutrient conditions, constructing a self-contained ecosystem, analyzing the effect of acid rain on seedlings)

k. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to the characteristics of populations and ecosystem functions

COMPETENCY 0005—INHERITANCE AND VARIATION OF TRAITS

Performance Expectations

The New York State biology teacher understands and applies the disciplinary core ideas of the inheritance and variation of traits. The teacher demonstrates knowledge of the genetic code; the structures of DNA and RNA; and the processes of replication, transcription, translation, and protein synthesis. The teacher applies knowledge of mutations and their effects. The teacher understands the relationships between DNA, genes, alleles, and chromosomes and the control of gene expression. The teacher understands sources of heritable genetic variation and applies principles of heredity and probability and statistics to solve inheritance problems. The teacher demonstrates knowledge of genetic engineering techniques and tools. The teacher understands the historical development of scientific understanding of genetic inheritance. In addition, the teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to inheritance and variation of traits.

Performance Indicators

a. demonstrates knowledge of the structures and functions of DNA and the mechanism of DNA replication

b. demonstrates knowledge of the structures and functions of RNA and analyzes the processes of transcription and translation in protein synthesis, including the roles of DNA and mRNA, rRNA, and tRNA

c. applies knowledge of the characteristics and functioning of the genetic code and the universality of the genetic code among organisms

d. demonstrates knowledge of types, causes, and effects of mutations on DNA molecules and the implications for protein structure and function

e. analyzes the control of gene expression in cells, including internal and external factors, and the implications of the fact that not all genes are expressed in all cells

f. demonstrates knowledge of the roles of and relationships between DNA, genes, alleles, and chromosomes and the relationship of the behavior of chromosomes during meiosis to patterns of inheritance

g. analyzes processes that may produce heritable genetic variations, including recombination during meiosis, replication errors, mutations, and genetic engineering, and recognizes evidence of these processes

h. applies the laws of classical genetics (i.e., dominance, segregation, and independent assortment) and basic principles of heredity (e.g., codominance, sex-linkage, multiple alleles)

i. applies probability and statistics and graphical representations to analyze genetic inheritance problems involving genotypic and phenotypic frequencies

j. demonstrates knowledge of the historical development of scientific understanding about the patterns and mechanisms of inheritance, from classical to molecular genetics, including evaluating claims based on evidence about inheritance

k. demonstrates knowledge of technological developments in genetic engineering (e.g., restriction enzymes, PCR, gel electrophoresis, production of transgenic plants and animals), applications of genetic engineering in basic and applied research (e.g., medicine, agriculture), and the societal implications (e.g., ethical, legal, social, economic) of genetic engineering

l. demonstrates knowledge of the engineering design process as related to the inheritance and variation of traits, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations; and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

m. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into gene expression, inheritance, and the variation of traits (e.g., analyzing DNA extracted from food, examining fruit fly phenotypes across generations to infer genotypes, evaluating the emergence of bacterial colonies of different colors in the presence of mutagens)

n. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to gene expression, inheritance, and the variation of traits

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COMPETENCY 0006—EVOLUTION AND THE UNITY AND DIVERSITY OF LIFE

Performance Expectations

The New York State biology teacher understands and applies the disciplinary core ideas of evolution and the unity and diversity of life. The teacher demonstrates knowledge of the variety of evidence that supports biological evolution and evolutionary relationships between diverse organisms. The teacher understands the mechanisms of evolution, including natural selection, and the conditions under which evolution and speciation are likely to occur. The teacher applies the principles of population genetics to predict and explain shifts in allelic frequencies. The teacher understands events that may cause speciation and compares alternative patterns of evolution. The teacher understands the historical development of scientific understanding about how organisms change over time. The teacher demonstrates knowledge of the basic principles of taxonomy and representations of evolutionarily related species. The teacher recognizes that diverse organisms may share varying degrees of common structures and processes. The teacher demonstrates knowledge of the general distinguishing characteristics of organisms in the domains and kingdoms into which life is organized. In addition, the teacher understands how to plan and safely carry out scientific investigations, understands the process of engineering design in refining a solution to a problem, interprets scientific information, and evaluates specific claims made about scientific phenomena related to evolution and the unity and diversity of life.

Performance Indicators

a. analyzes empirical evidence from various areas of biology (e.g., embryology, biochemistry, anatomy, molecular biology) that explains the origin of life, common ancestry, and biological evolution and assesses the significance of geologic and fossil records in determining evolutionary histories and relationships of given organisms

b. demonstrates knowledge of the interacting factors that may result in evolution (i.e., potential for population growth, heritable genetic variation, competition for limited resources, and differential survival and reproduction based on traits)

c. demonstrates knowledge of sources of variation of heritable traits in a population on which natural selection can act, how natural selection leads to adaptation of populations, and how differences in traits (structural, physiological, behavioral) affect the probability of successful reproduction among individuals in a population

d. demonstrates knowledge of the principles of population genetics; the interactions between heredity and the environment; conditions that affect allelic frequency in a gene pool; and how changes in the environment can lead to speciation, extinction, or a change in allelic frequencies

e. applies knowledge of the Hardy-Weinberg principle to determine the frequency of genotypes in a population

f. analyzes environmental factors and events that may cause speciation (e.g., geographic and reproductive isolation, genetic drift), species decline, or extinction

g. compares alternative patterns of evolution (e.g., gradualism, punctuated equilibrium) and related evidence

h. demonstrates knowledge of the historical development of explanations of how organisms change over time and of the theory of evolution by natural selection, including evaluating claims based on evidence of how species change over time

i. demonstrates knowledge of basic principles of taxonomy and criteria used to classify organisms (e.g., morphology, biochemical and molecular biological comparisons)

j. interprets data and representations (e.g., phylogenetic tree, cladogram) of evolutionarily related species

k. demonstrates knowledge of the unity and diversity of life, recognizing that all organisms share common components and structures (e.g., cell membrane, carbon-based molecules, DNA) and functions (e.g., synthesizing proteins, obtaining nutrients, eliminating wastes, reproduction, transport), yet vary in physical form and means of carrying out life functions

l. compares organisms and how they are classified into major taxa based on their traits

m. demonstrates knowledge of the engineering design process as related to evolution and the unity and diversity of life, including criteria, modeling, use of technology and mathematical thinking, and applications to real-world situations; and evaluates an engineering design or solution, taking into account a range of constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts

n. demonstrates knowledge of how to plan, construct, and safely and ethically carry out investigations into evolution and the unity and diversity of life (e.g., analyzing and comparing the amino acid sequences of cytochrome *c* in various organisms, simulating genetic drift and analyzing allelic frequencies, observing preserved and live specimens to make and justify a claim based on evidence regarding appropriate classification)

o. analyzes and draws inferences from scientific and technical texts and graphics; interprets graphs and data; applies mathematical and computational thinking in analyzing data; and evaluates the hypotheses, data, analyses, and conclusions in a scientific or technical text related to evolution and the unity and diversity of life

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COMPETENCY 0007—PEDAGOGICAL CONTENT KNOWLEDGE

Performance Expectations

The New York State biology teacher effectively applies pedagogical content knowledge to design culturally relevant instruction to guide all students in achieving a specific learning goal using an effective three-dimensional approach (i.e., disciplinary core idea, crosscutting concept, science or engineering practice). The teacher also applies knowledge of current education research on how students learn science in order to develop safe and effective performance tasks that will guide all students, including diverse learners, in achieving a specific learning goal. The teacher appropriately assesses student knowledge and understanding and identifies potential and apparent student strengths and needs.

Performance Indicators

a. demonstrates knowledge of how to assess student readiness for a specific new learning goal related to a biology concept or science or engineering practice

b. applies knowledge of how to design culturally relevant instruction using appropriate and effective instructional strategies that connect students' prior understanding and real-world experiences to new knowledge for all students, including diverse learners

c. applies knowledge of how to design appropriate and effective three-dimensional instruction (i.e., disciplinary core ideas, crosscutting concepts, science or engineering practices) to support students in applying and developing understanding of biology concepts

d. applies knowledge of appropriate and effective research-based strategies to guide all students to engage safely in biology concepts or science and engineering practices

e. applies knowledge of appropriate and effective assessment to evaluate and promote learning and growth for all students, including diverse learners