NM Public Education Department

SCIENCE:
BIOLOGY

END-OF-COURSE EXAM | GRADE 9-12 | YEAR 18–19

ASSESSMENT BLUEPRINT

Purpose Statement
Biology

The Biology End-of-Course (EOC) exam is intended to measure student proficiency of the New Mexico Science Standards. This course-level exam is provided to all students who have completed Biology or related courses.
This exam can be given for the following STARS course codes:

1711 - Biology-First Year
1712 - Biology Advanced Studies
1715 - AP Biology

Intended as a final exam for the course, this is a summative assessment covering a range of content, skills, and applications. Scores are reported to the teacher, school, district, and state levels for the purposes of student grades, curriculum review, and NMTeach summative reports.

"The EOCs are exams written by New Mexico Teachers for New Mexico Students."
During the 2018 summer, teachers were brought together in person or online as part of the blueprint and exam revision process. The NMPED extends our gratitude to all those who contributed to this improvement process. Although we were unable to implement every suggestion due to conflicting viewpoints at times, this blueprint reflects the best collaborative effort among dedicated peers.

The NMPED would like to especially recognize the following person(s) who led the revision of this blueprint:

- *Katherine Barnett Rivas, La Academia de Esperanza Charter School, Content Lead*
- *Alan Daugherty, Melrose Public Schools*
- *Azza Ezzat, Socorro Consolidated Schools*
- *Janet Bruelhart, Lovington Schools*
- *Kimberly Vigil, Espanola*
- *Melissa Burnett, Artesia*

Explanation of Blueprint Layout & Test Specifications Table

Topics	Topics with Test Item Specifications:
The performance expectations (PEs) identified in this portion of the blueprint are aligned to the New Mexico STEM-Ready! science standards: *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/* *and High School Recommended Discipline-Specific Course Map:* *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/recommended-secondary-course-maps/* *New Mexico Teachers identified the PEs to be measured on the EOC exam using the following criteria: 1) a great deal of instructional time is spent on the PE as identified in the curriculum and/or; 2) the PE is important to subsequent learning.* *It is important to note that the PEs in the blueprint are only a **subset** of PEs to be measured with the understanding that teachers cover more PEs during the course of instruction than what has been selected to be measured.*	● *This portion of the blueprint identifies the DCI students will have to demonstrate during the exam.* ● *Although the PE measures other dimensions, the item specifications may place constraints on portions of the DCI in order to provide more transparency as to what specifically will be measured relative to the PE.* ● *Item specifications provide guidelines for the item writer so they know what topics to specifically focus on when authoring items.* ● *Topics and terms in **bold** will be emphasized on the exam.* **Item Types:** *The item types for this EOC exam are limited to:* *MC = multiple choice with or without stimulus (e.g., picture, graph, chart)* **Sample Question(s):** *Sample questions have been provided to assist teachers to correlate the questions with the performance standards and the test item specification, when applicable.* ● *An * denotes the correct answer* ● *DOK = Depth of Knowledge* ● *Some sample questions may be items released items from prior EOC exams*

Blueprint Table – Biology

<table>
<tr><th>Topic: From Molecules to Organisms: Structures and Processes</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-LS1-1

SEP: Construct an explanation based on evidence for how

DCI: the structure of DNA determines

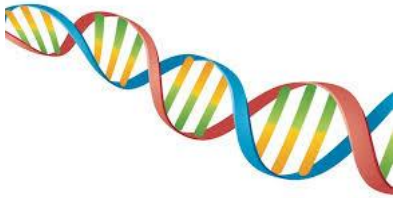
CCC: the structure of proteins, which carry out the essential functions of life through systems of specialized cells

Clarification Statement: None

Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.</td><td>LS1.A: Structure and Function
• Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
• All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)

Essential Questions:
1. How do the structures of organisms enable life’s functions?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 1

What does the figure below represent?

a. DNA *
b. RNA
c. amino acid
d. protein</td></tr>
</table>

Blueprint Table – Biology

<table>
<tr><th>Topic: Matter and Energy in Organisms and Ecosystems</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-LS2-4

SEP: Use mathematical representations to support claims

DCI: for the cycling of matter and flow of energy

CCC: among organisms in an ecosystem

Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.

Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.</td><td>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
Essential Questions:
1. How do matter and energy move through an ecosystem?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 1

Which organisms produce their own food?

a. autotrophs *
b. heterotrophs
c. primary consumers
d. secondary consumers</td></tr>
</table>

Blueprint Table – Biology

Topic: Interdependence in Ecosystems	DCI with Test Item Specifications:
HS-LS2-7 **SEP**: Design, evaluate, and refine a solution for **DCI**: reducing the impacts of human activities **CCC**: on the environment and biodiversity **Clarification Statement:** Examples of human activities can include urbanization, building dams, and dissemination of invasive species **Assessment Boundary:** None	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** 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 the survival of some species. **LS4.D: Biodiversity and Humans** Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary) Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.) **ETS1.B: Developing Possible Solutions** When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary) **Essential Questions:** **1. What happens to ecosystems when the environment changes?** **2. What is biodiversity? How do humans affect it, and how does it affect humans?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: DOK = 2 Which human activity would have the most direct impact on the carbon cycle? a. decreasing the use of water b. destroying large forested areas * c. reducing the rate of ecological succession d. enforcing laws that prevent the use of aerosol cans

Blueprint Table – Biology

<table>
<tr><th>Topic: Inheritance and Variation of Traits</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-LS3-1

SEP: Ask questions to clarify relationships about

DCI: the role of DNA and chromosomes in coding

CCC: the instructions for characteristic traits passed from parents to offspring.

Clarification Statement: None

Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.</td><td>LS1.A: Structure and Function
• All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)

LS3.A: Inheritance of Traits
• Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

Essential Questions:
1. How do the structures of organisms enable life's functions?
2. How are characteristics of one generation related to the previous generation?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 2

What would be the complementary sequence of nucleotides for an mRNA molecule created from the following DNA sequence: CAT GGG?

a. CTU CCC
b. GTA CCC
c. CUA GGG
d. GUA CCC *</td></tr>
</table>

Blueprint Table – Biology

<table>
<tr><th>Topic: Natural Selection and Evolution</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-LS4-1

SEP: Communicate scientific information that

DCI: common ancestry and biological evolution

CCC: are supported by multiple lines of empirical evidence.

Clarification Statement: None

Assessment Boundary: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.</td><td>LS4.A: Evidence of Common Ancestry and Diversity
Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
Essential Questions:
1. What evidence shows that different species are related?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 1

What do the earliest cellular life forms appear to have been?

a. fungi
b. prokaryotes *
c. one-celled plants
d. one-celled animals</td></tr>
</table>

Blueprint Table – Biology

<table>
<tr><th>Topic: Earth's Systems</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-ESS2-4

SEP: Use a model to describe how

DCI: variations in the flow of energy into and out of Earth's systems

CCC: result in changes in climate

Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.

Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.</td><td>ESS1.B: Earth and the Solar System
• Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary)
ESS2.A: Earth Materials and Systems
• The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.
ESS2.D: Weather and Climate
• The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.

Essential Questions:
1. What are the predictable patterns caused by Earth's movement in the solar system?
2. How do Earth's major systems interact?
3. What regulates weather and climate?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 2

What is one effect of the fact that there is more solar radiation hitting Earth at the equator than at the poles?

a. increased surface temperatures at the equator *
b. El Niño precipitation patterns
c. increased surface temperatures at the poles
d. decreased sea levels at the equator</td></tr>
</table>

Blueprint Table – Biology

<table>
<tr><th>Topic: Earth and Human Activity</th><th>DCI with Test Item Specifications:</th></tr>
<tr><td rowspan="3">HS-ESS3-1

SEP: Construct an explanation based on evidence for how

DCI: the availability of natural resources, occurrence of natural hazards, and changes in climate

CCC: have influenced human activity

Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.

Assessment Boundary: None</td><td>ESS3.A: Natural Resources
• Resource availability has guided the development of human society.
ESS3.B: Natural Hazards
• Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.

Essential Questions:
1. How do humans depend on Earth’s resources?
2. How do natural hazards affect individuals and societies?</td></tr>
<tr><td>Item Types:
MC = multiple choice with or without stimulus</td></tr>
<tr><td>Sample Question: DOK = 2

Which of the following could increase the conservation of water in New Mexico?

a. improve the systems of agricultural irrigation
b. reduce the amount of land covered by grass and lawns
c. reduce residential water use
d. all of the above *</td></tr>
</table>

Biology Science – EoC Reporting Category Alignment Framework					
Reporting Category	**Performance Expectation**	**DOK (Count by DOK)**			**Grand Total**
		1	**2**	**3**	
Engineering Design (repeat)	HS-ETS1-1				
	HS-ETS1-2				
	HS-ETS1-3				
	HS-ETS1-4				
From Molecules to Organisms: Structures and Processes	HS-LS1-2		2		**2**
	HS-LS1-2	1			**1**
	HS-LS1-3		1		**1**
Matter and Energy in Organisms and Ecosystems	HS-LS1-5			1	**1**
	HS-LS1-6				
	HS-LS1-7		1		**1**
	HS-LS2-3	1			**1**
	HS-LS2-4			1	**1**
	HS-LS2-5	1			**1**
Interdependence in Ecosystem	HS-LS2-1	1			**1**
	HS-LS2-2	1			**1**
	HS-LS2-6			1	**1**
	HS-LS2-7		2		**2**
	HS-LS2-7 NM				
	HS-LS2-8				
	HS-LS4-6				
Inheritance and Variation of Traits	HS-LS1-4			1	**1**
	HS-LS3-1	1		1	**2**
	HS-LS3-2	4	2		**6**

	HS-LS3-3		1		**1**
Natural Selection and Evolution	HS-LS4-1	3	1		**4**
	HS-LS4-2		3		**3**
	HS-LS4-3		1		**1**
	HS-LS4-4	1	2		**3**
	HS-LS4-5				
	HS-LS4-6		1		**1**
Earth's Systems	HS-ESS2-4		1		**1**
	HS-ESS2-7				
Earth and Human Activity	HS-ESS3-1		2		**2**
	HS-ESS3-3				
	HS-ESS3-4	1			**1**
	Grand Total	**15**	**20**	**5**	**40**