# Keystone Exams: Biology

## Assessment Anchors and Eligible Content

with Sample Questions and Glossary

*Pennsylvania Department of Education*

www.education.state.pa.us

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# PENNSYLVANIA DEPARTMENT OF EDUCATION

## General Introduction to the Keystone Exam Assessment Anchors

### Introduction

Since the introduction of the Keystone Exams, the Pennsylvania Department of Education (PDE) has been working to create a set of tools designed to help educators improve instructional practices and better understand the Keystone Exams. The Assessment Anchors, as defined by the Eligible Content, are one of the many tools the Department believes will better align curriculum, instruction, and assessment practices throughout the Commonwealth. Without this alignment, it will not be possible to significantly improve student achievement across the Commonwealth.

### How were Keystone Exam Assessment Anchors developed?

Prior to the development of the Assessment Anchors, multiple groups of PA educators convened to create a set of standards for each of the Keystone Exams. Enhanced standards, derived from a review of existing standards, focused on what students need to know and be able to do in order to be college and career ready.

Additionally, the Assessment Anchors and Eligible Content statements were created by other groups of educators charged with the task of clarifying the standards assessed on the Keystone Exams. The Assessment Anchors, as defined by the Eligible Content, have been designed to hold together or *anchor* the state assessment system and curriculum/instructional practices in schools.

Assessment Anchors, as defined by the Eligible Content, were created with the following design parameters:

- **Clear:** The Assessment Anchors are easy to read and are user friendly; they clearly detail which standards are assessed on the Keystone Exams.
- **Focused:** The Assessment Anchors identify a core set of standards that could be reasonably assessed on a large-scale assessment, which will keep educators from having to guess which standards are critical.
- **Rigorous:** The Assessment Anchors support the rigor of the state standards by assessing higher-order and reasoning skills.
- **Manageable:** The Assessment Anchors define the standards in a way that can be easily incorporated into a course to prepare students for success.

### How can teachers, administrators, schools, and districts use these Assessment Anchors?

The Assessment Anchors, as defined by the Eligible Content, can help focus teaching and learning because they are clear, manageable, and closely aligned with the Keystone Exams. Teachers and administrators will be better informed about which standards will be assessed. The Assessment Anchors and Eligible Content should be used along with the Standards and the Curriculum Framework of the Standards Aligned System (SAS) to build curriculum, design lessons, and support student achievement.

The Assessment Anchors and Eligible Content are designed to enable educators to determine when they feel students are prepared to be successful on the Keystone Exams. An evaluation of current course offerings, through the lens of what is assessed on those particular Keystone Exams, may provide an opportunity for an alignment to ensure student preparedness.

**How are the Assessment Anchors organized?**

The Assessment Anchors, as defined by the Eligible Content, are organized into cohesive blueprints, each structured with a common labeling system that can be read like an outline. This framework is organized first by module, then by Assessment Anchor, followed by Anchor Descriptor, and then finally, at the greatest level of detail, by an Eligible Content statement. The common format of this outline is followed across the Keystone Exams.

Here is a description of each level in the labeling system for the Keystone Exams:

- **Module:** The Assessment Anchors are organized into two thematic modules for each of the Keystone Exams. The module title appears at the top of each page. The module level is important because the Keystone Exams are built using a module format, with each of the Keystone Exams divided into two equally sized test modules. Each module is made up of two or more Assessment Anchors.
- **Assessment Anchor:** The Assessment Anchor appears in the shaded bar across the top of each Assessment Anchor table. The Assessment Anchors represent categories of subject matter that anchor the content of the Keystone Exams. Each Assessment Anchor is part of a module and has one or more Anchor Descriptors unified under it.
- **Anchor Descriptor:** Below each Assessment Anchor is a specific Anchor Descriptor. The Anchor Descriptor level provides further details that delineate the scope of content covered by the Assessment Anchor. Each Anchor Descriptor is part of an Assessment Anchor and has one or more Eligible Content unified under it.
- **Eligible Content:** The column to the right of the Anchor Descriptor contains the Eligible Content statements. The Eligible Content is the most specific description of the content that is assessed on the Keystone Exams. This level is considered the assessment limit and helps educators identify the range of the content covered on the Keystone Exams.
- **Enhanced Standard:** In the column to the right of each Eligible Content statement is a code representing one or more Enhanced Standards that correlate to the Eligible Content statement. Some Eligible Content statements include annotations that indicate certain clarifications about the scope of an Eligible Content.

    - "e.g." ("for example")—sample approach, but not a limit to the eligible content.
    - "i.e." ("that is")—specific limit to the eligible content.

Standards Aligned System—www.pdesas.org

Pennsylvania Department of Education—www.education.state.pa.us

## MODULE A—CELLS AND CELL PROCESSES

| ASSESSMENT ANCHOR<br>BIO.A.1 Basic Biological Principles | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.1.1** | Explain the characteristics common to all organisms. | **BIO.A.1.1.1** | Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. | **3.1.B.A1**<br>**3.1.B.C2**<br>**4.1.3.A**<br>**4.1.4.A** |

## Sample Exam Question

**Standard** BIO.A.1.1.1

Which characteristic is shared by **all** prokaryotes and eukaryotes?

A. ability to store hereditary information

B. use of organelles to control cell processes

C. use of cellular respiration for energy release

D. ability to move in response to environmental stimuli

## MODULE A—CELLS AND CELL PROCESSES

| ASSESSMENT ANCHOR<br>BIO.A.1 Basic Biological Principles *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.1.2** | Describe relationships between structure and function at biological levels of organization. | **BIO.A.1.2.1** | Compare cellular structures and their functions in prokaryotic and eukaryotic cells. | **3.1.B.A1**<br>**3.1.B.A5**<br>**3.1.B.C2**<br>**4.1.4.A** |

## Sample Exam Question

**Standard** BIO.A.1.2.1

Living organisms can be classified as prokaryotes or eukaryotes. Which two structures are common to both prokaryotic and eukaryotic cells?

A. cell wall and nucleus

B. cell wall and chloroplast

C. plasma membrane and nucleus

D. plasma membrane and cytoplasm

| ASSESSMENT ANCHOR<br>BIO.A.1 Basic Biological Principles *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.1.2** | Describe relationships between structure and function at biological levels of organization. | **BIO.A.1.2.1** | Compare cellular structures and their functions in prokaryotic and eukaryotic cells. | **3.1.B.A1**<br>**3.1.B.A5**<br>**3.1.B.C2**<br>**4.1.4.A** |

## Sample Exam Question

**Standard** BIO.A.1.2.1

Prokaryotic cells are generally much smaller than eukaryotic cells.

**Part A:** Identify a structural difference between prokaryotic cells and eukaryotic cells that is directly related to their difference in size.

**Part B:** Based on the structural difference, explain why prokaryotic cells can be much smaller than eukaryotic cells.

Continued next page

## MODULE A—CELLS AND CELL PROCESSES

**Standard** BIO.A.1.1

***Continued.*** Please refer to the previous page for task explanation.

**Part C:** Describe one similarity between prokaryotic cells and eukaryotic cells that is independent of size.

## MODULE A—CELLS AND CELL PROCESSES

| ASSESSMENT ANCHOR<br>BIO.A.1 Basic Biological Principles *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.1.2** | Describe relationships between structure and function at biological levels of organization. | **BIO.A.1.2.2** | Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms). | **3.1.B.A5**<br>**3.1.B.A6**<br>**3.1.B.A1** |

## Sample Exam Question

**Standard** BIO.A.1.2.2

Alveoli are microscopic air sacs in the lungs of mammals. Which statement **best** describes how the structure of the alveoli allows the lungs to function properly?

A. They increase the amount of energy transferred from the lungs to the blood.

B. They increase the flexibility of the lungs as they expand during inhalation.

C. They increase the volume of the lungs, allowing more oxygen to be inhaled.

D. They increase the surface area of the lungs, allowing efficient gas exchange.

| ASSESSMENT ANCHOR<br>BIO.A.2 The Chemical Basis for Life | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.2.1** | Describe how the unique properties of water support life on Earth. | **BIO.A.2.1.1** | Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion). | **3.1.B.A8**<br>**3.1.B.A5**<br>**4.2.5.C** |

## Sample Exam Question

**Standard** BIO.A.2.1.1

Which statement **best** describes an effect of the low density of frozen water in a lake?

A. When water freezes, it contracts, decreasing the water level in a lake.

B. Water in a lake freezes from the bottom up, killing most aquatic organisms.

C. When water in a lake freezes, it floats, providing insulation for organisms below.

D. Water removes thermal energy from the land around a lake, causing the lake to freeze.

| ASSESSMENT ANCHOR<br>BIO.A.2 The Chemical Basis for Life *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.2.2** | Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules). | **BIO.A.2.2.1** | Explain how carbon is uniquely suited to form biological macromolecules. | **3.1.B.A7**<br>**3.2.C.A2** |
| | | **BIO.A.2.2.2** | Describe how biological macromolecules form from monomers. | **3.1.B.A7**<br>**3.1.B.A8**<br>**3.1.B.A2**<br>**3.1.C.A2**<br>**3.1.C.A7** |

## Sample Exam Questions

**Standard** BIO.A.2.2.1

Which statement correctly describes how carbon's ability to form four bonds makes it uniquely suited to form macromolecules?

A. It forms short, simple carbon chains.

B. It forms large, complex, diverse molecules.

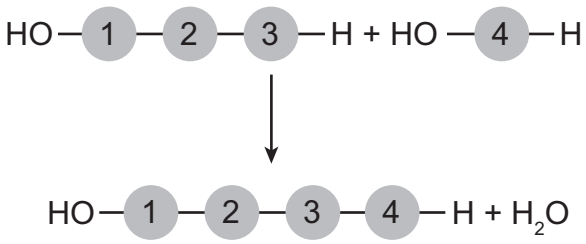
C. It forms covalent bonds with other carbon atoms.

D. It forms covalent bonds that can exist in a single plane.

**Standard** BIO.A.2.2.2

**Use the diagram below to answer the question.**

**Chemical Reaction**




The diagram shows a reaction that forms a polymer from two monomers. What is this type of reaction called?

A. glycolysis

B. hydrolysis

C. photosynthesis

D. dehydration synthesis

| ASSESSMENT ANCHOR<br>BIO.A.2 The Chemical Basis for Life *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.2.2** | Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules). | **BIO.A.2.2.3** | Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. | **3.1.B.A7**<br>**3.1.B.A2**<br>**3.1.C.A2**<br>**3.1.C.A7** |

## Sample Exam Question

**Standard** BIO.A.2.2.3

Carbohydrates and proteins are two types of macromolecules. Which functional characteristic of proteins distinguishes them from carbohydrates?

A. large amount of stored information

B. ability to catalyze biochemical reactions

C. efficient storage of usable chemical energy

D. tendency to make cell membranes hydrophobic

| ASSESSMENT ANCHOR<br>BIO.A.2 The Chemical Basis for Life *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.2.2** | Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules). | **BIO.A.2.2.3** | Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. | **3.1.B.A7**<br>**3.1.B.A2**<br>**3.1.C.A2**<br>**3.1.C.A7** |

## Sample Exam Question

**Standard** BIO.A.2.2.3

Proteins are a major part of every living cell and have many different functions within each cell. Carbohydrates also perform numerous roles in living things.

**Part A:** Describe the general composition of a protein molecule.

Continued next page

## MODULE A—CELLS AND CELL PROCESSES

***Continued.*** Please refer to the previous page for task explanation.

**Part B:** Describe how the structures of proteins differ from the structures of carbohydrates.

**Part C:** Describe how the functions of proteins differ from the functions of carbohydrates.

| ASSESSMENT ANCHOR<br>BIO.A.2 The Chemical Basis for Life *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.2.3** | Explain how enzymes regulate biochemical reactions within a cell. | **BIO.A.2.3.1** | Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. | **3.1.B.A2**<br>**3.1.B.A7** |
| | | **BIO.A.2.3.2** | Explain how factors such as pH, temperature, and concentration levels can affect enzyme function. | **3.1.B.A2**<br>**3.1.B.A7** |

## Sample Exam Questions

**Standard** BIO.A.2.3.1

Substance A is converted to substance B in a metabolic reaction. Which statement **best** describes the role of an enzyme during this reaction?

A. It adjusts the pH of the reaction medium.

B. It provides energy to carry out the reaction.

C. It dissolves substance A in the reaction medium.

D. It speeds up the reaction without being consumed.

**Standard** BIO.A.2.3.2

A scientist observes that, when the pH of the environment surrounding an enzyme is changed, the rate the enzyme catalyzes a reaction greatly decreases. Which statement **best** describes how a change in pH can affect an enzyme?

A. A pH change can cause the enzyme to change its shape.

B. A pH change can remove energy necessary to activate an enzyme.

C. A pH change can add new molecules to the structure of the enzyme.

D. A pH change can cause an enzyme to react with a different substrate.

## MODULE A—CELLS AND CELL PROCESSES

| ASSESSMENT ANCHOR<br>BIO.A.3 Bioenergetics | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.3.1** | Identify and describe the cell structures involved in processing energy. | **BIO.A.3.1.1** | Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations. | **3.1.B.A2**<br>**3.1.B.A5**<br>**3.1.C.A1** |

## Sample Exam Question

**Standard** BIO.A.3.1.1

Using a microscope, a student observes a small, green organelle in a plant cell. Which energy transformation **most likely** occurs first within the observed organelle?

A. ATP to light

B. light to chemical

C. heat to electrical

D. chemical to chemical

| ASSESSMENT ANCHOR<br>BIO.A.3 Bioenergetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.3.2** | Identify and describe how organisms obtain and transform energy for their life processes. | **BIO.A.3.2.1** | Compare the basic transformation of energy during photosynthesis and cellular respiration. | **3.1.B.A2**<br>**3.1.B.A5**<br>**3.1.C.A1**<br>**4.1.10.C** |

## Sample Exam Question

**Standard** BIO.A.3.2.1

Photosynthesis and cellular respiration are two major processes of carbon cycling in living organisms. Which statement correctly describes one similarity between photosynthesis and cellular respiration?

A. Both occur in animal and plant cells.

B. Both include reactions that transform energy.

C. Both convert light energy into chemical energy.

D. Both synthesize organic molecules as end products.

| ASSESSMENT ANCHOR<br>BIO.A.3 Bioenergetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.3.2** | Identify and describe how organisms obtain and transform energy for their life processes. | **BIO.A.3.2.2** | Describe the role of ATP in biochemical reactions. | **3.1.B.A2**<br>**3.1.C.A1**<br>**3.1.C.A2** |

## Sample Exam Question

**Standard** BIO.A.3.2.2

A protein in a cell membrane changed its shape to move sodium and potassium ions against their concentration gradients. Which molecule was **most likely** used by the protein as an energy source?

A. ATP

B. ADP

C. catalase

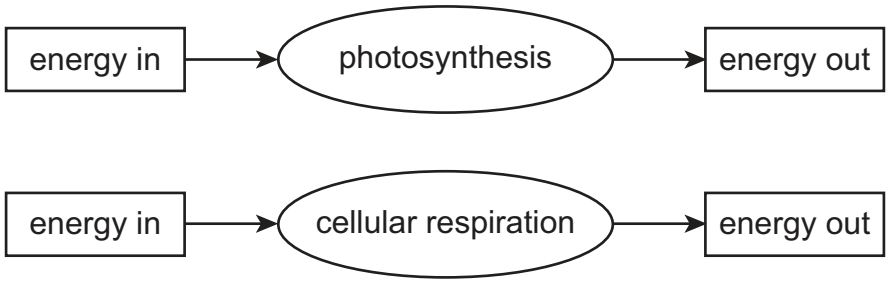
D. amylase

| ASSESSMENT ANCHOR<br>BIO.A.3 Bioenergetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.3.2** | Identify and describe how organisms obtain and transform energy for their life processes. | **BIO.A.3.2.1** | Compare the basic transformation of energy during photosynthesis and cellular respiration. | **3.1.B.A2**<br>**3.1.B.A5**<br>**3.1.C.A1**<br>**4.1.10.C** |

## Sample Exam Question

**Standard** BIO.A.3.2.1

**Use the diagrams below to answer the question.**




**Part A:** Complete the chart below by describing energy transformations involved in each process.

| Process | Energy Transformations |
|---|---|
| **photosynthesis** | |
| **cellular respiration** | |

Continued next page

## MODULE A—CELLS AND CELL PROCESSES

***Continued.*** Please refer to the previous page for task explanation.

**Part B:** Describe how energy transformations involved in photosynthesis are related to energy transformations involved in cellular respiration.

## MODULE A—CELLS AND CELL PROCESSES

| ASSESSMENT ANCHOR<br>BIO.A.4 Homeostasis and Transport | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.4.1** | Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell. | **BIO.A.4.1.1** | Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. | **3.1.B.A5**<br>**3.1.B.A2**<br>**3.1.B.A4**<br>**3.1.B.A7**<br>**3.2.C.A1**<br>**3.2.P.B6** |

## Sample Exam Question

**Standard** BIO.A.4.1.1

Carbon dioxide and oxygen are molecules that can move freely across a plasma membrane. What determines the direction that carbon dioxide and oxygen molecules move?

A. orientation of cholesterol in the plasma membrane

B. concentration gradient across the plasma membrane

C. configuration of phospholipids in the plasma membrane

D. location of receptors on the surface of the plasma membrane

| ASSESSMENT ANCHOR<br>BIO.A.4 Homeostasis and Transport *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.4.1** | Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell. | **BIO.A.4.1.2** | Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis). | **3.1.B.A5**<br>**3.1.B.A2**<br>**3.1.B.A7**<br>**3.2.C.A1**<br>**3.2.P.B6** |

## Sample Exam Question

**Standard** BIO.A.4.1.2

A sodium-potassium pump within a cell membrane requires energy to move sodium and potassium ions into or out of a cell. The movement of glucose into or out of a cell does not require energy. Which statement **best** describes the movement of these materials across a cell membrane?

A. Sodium and potassium ions move by active transport, and glucose moves by osmosis.

B. Sodium and potassium ions move by active transport, and glucose moves by facilitated diffusion.

C. Sodium and potassium ions move by facilitated diffusion, and glucose moves by osmosis.

D. Sodium and potassium ions move by facilitated diffusion, and glucose moves by active transport.

| ASSESSMENT ANCHOR<br>BIO.A.4 Homeostasis and Transport *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.4.1** | Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell. | **BIO.A.4.1.2** | Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis). | **3.1.B.A5**<br>**3.1.B.A2**<br>**3.1.B.A7**<br>**3.2.C.A1**<br>**3.2.P.B6** |

## Sample Exam Question

**Standard** BIO.A.4.1.2

Some animals can produce a potassium ion concentration inside their cells that is twenty times greater than that of their environment. This ion concentration gradient is maintained by the plasma membrane.

**Part A:** Identify the process in the cell membrane that produces this difference in concentration.

**Part B:** Explain the process that occurs as the cell produces the ion concentration gradient.

Continued next page

## MODULE A—CELLS AND CELL PROCESSES

***Continued.*** Please refer to the previous page for task explanation.

**Part C:** Compare the process of potassium ion transport to another mechanism that moves material across the plasma membrane.

| ASSESSMENT ANCHOR<br>BIO.A.4 Homeostasis and Transport *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.4.1** | Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell. | **BIO.A.4.1.3** | Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell. | **3.1.B.A5**<br>**3.1.B.A2** |

## Sample Exam Question

**Standard** BIO.A.4.1.3

The rough endoplasmic reticulum and Golgi apparatus work together in eukaryotic cells. What is one way that the rough endoplasmic reticulum assists the Golgi apparatus?

A. It assembles nucleic acids from monomers.

B. It breaks down old, damaged macromolecules.

C. It packages new protein molecules into vesicles.

D. It determines which protein molecules to synthesize.

| ASSESSMENT ANCHOR<br>BIO.A.4 Homeostasis and Transport *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.A.4.2** | Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments. | **BIO.A.4.2.1** | Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation). | **3.1.B.A8**<br>**3.1.B.A5**<br>**4.5.4.D**<br>**4.2.4.C** |

## Sample Exam Question

**Standard** BIO.A.4.2.1

Which example is an activity that a fish **most likely** uses to maintain homeostasis within its body?

A. using camouflage to avoid predators

B. feeding at night to regulate body temperature

C. moving to deeper water to regulate metabolic wastes

D. exchanging gases through its gills to regulate oxygen levels

## MODULE B—CONTINUITY AND UNITY OF LIFE

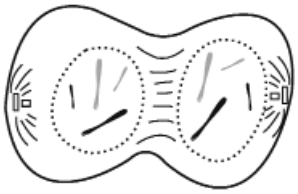
| ASSESSMENT ANCHOR<br>BIO.B.1 Cell Growth and Reproduction | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.1.1** | Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis. | **BIO.B.1.1.1** | Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. | **3.1.B.A4**<br>**3.1.B.A5**<br>**3.1.B.B2**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.B.C2**<br>**3.1.C.C2** |

## Sample Exam Question

**Standard** BIO.B.1.1.1

**Use the illustration below to answer the question.**

**Cell Division**



Which statement **best** describes the phase of the cell cycle shown?

A. The cell is in prophase of mitosis because the number of chromosomes has doubled.

B. The cell is in prophase I of meiosis because the number of chromosomes has doubled.

C. The cell is in telophase of mitosis because the cell is separating and contains two copies of each chromosome.

D. The cell is in telophase of meiosis because the cell is separating and contains two copies of each chromosome.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.1 Cell Growth and Reproduction *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.1.1** | Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis. | **BIO.B.1.1.2** | Compare the processes and outcomes of mitotic and meiotic nuclear divisions. | **3.1.B.A4**<br>**3.1.B.A5**<br>**3.1.B.B2**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.B.C2**<br>**3.1.C.C2** |

## Sample Exam Question

**Standard** BIO.B.1.1.2

Mitosis and meiosis are processes by which animal and plant cells divide. Which statement **best** describes a difference between mitosis and meiosis?

A. Meiosis is a multi-step process.

B. Mitosis occurs only in eukaryotic cells.

C. Meiosis is used in the repair of an organism.

D. Mitosis produces genetically identical daughter cells.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.1 Cell Growth and Reproduction *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.1.1** | Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis. | **BIO.B.1.1.2** | Compare the processes and outcomes of mitotic and meiotic nuclear divisions. | **3.1.B.A4**<br>**3.1.B.A5**<br>**3.1.B.B2**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.B.C2**<br>**3.1.C.C2** |

## Sample Exam Question

**Standard** BIO.B.1.1.2

Patau syndrome can be a lethal genetic disorder in mammals, resulting from chromosomes failing to separate during meiosis.

**Part A:** Identify the step during the process of meiosis when chromosomes would **most likely** fail to separate.

_____

**Part B:** Describe how chromosome separation in meiosis is different from chromosome separation in mitosis.

_____

_____

_____

_____

_____

_____

Continued next page

## MODULE B—CONTINUITY AND UNITY OF LIFE

***Continued.*** Please refer to the previous page for task explanation.

**Part C:** Compare the effects of a disorder caused by chromosomes failing to separate during meiosis, such as Patau syndrome, to the effects of chromosomes failing to separate during mitosis.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.1 Cell Growth and Reproduction *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.1.2** | Explain how genetic information is inherited. | **BIO.B.1.2.1** | Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. | **3.1.B.B1**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.B.C2**<br>**3.1.C.C2** |
| | | **BIO.B.1.2.2** | Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance. | **3.1.B.B1**<br>**3.1.B.B5**<br>**3.1.B.B2**<br>**3.1.B.B3**<br>**3.1.C.C2** |

## Sample Exam Questions

**Standard** BIO.B.1.2.1

Which process helps to preserve the genetic information stored in DNA during DNA replication?

A. the replacement of nitrogen base thymine with uracil

B. enzymes quickly linking nitrogen bases with hydrogen bonds

C. the synthesis of unique sugar and phosphate molecules for each nucleotide

D. nucleotides lining up along the template strand according to base pairing rules

**Standard** BIO.B.1.2.2

In a flowering plant species, red flower color is dominant over white flower color. What is the genotype of any red-flowering plant resulting from this species?

A. red and white alleles present on one chromosome

B. red and white alleles present on two chromosomes

C. a red allele present on both homologous chromosomes

D. a red allele present on at least one of two homologous chromosomes

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.1** | Compare Mendelian and non-Mendelian patterns of inheritance. | **BIO.B.2.1.1** | Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). | **3.1.B.B5** |

## Sample Exam Question

**Standard** BIO.B.2.1.1

**Use the table below to answer the question.**

**Blood Types**

| Genotype(s) | Phenotype |
|---|---|
| ii | O |
| $I^AI^A$, $I^Ai$ | A |
| $I^BI^B$, $I^Bi$ | B |
| $I^AI^B$ | AB |

Blood type is inherited through multiple alleles, including $I^A$, $I^B$, and i. A child has type A blood. If the father has type AB blood, what are all the possible phenotypes of the mother?

A. phenotypes O or A

B. phenotypes A or AB

C. phenotypes A, B, AB

D. phenotypes O, A, B, AB

## MODULE B—CONTINUITY AND UNITY OF LIFE

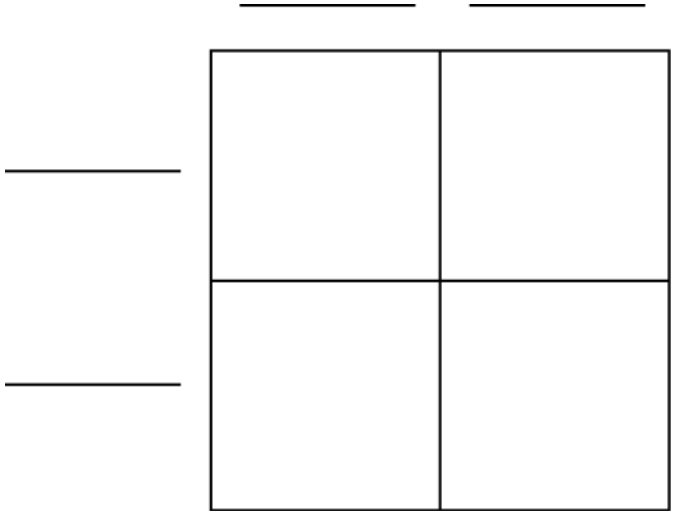
| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.1** | Compare Mendelian and non-Mendelian patterns of inheritance. | **BIO.B.2.1.1** | Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). | **3.1.B.B5** |

## Sample Exam Question

**Standard** BIO.B.2.1.1

A cattle farmer genetically crosses a cow (female) with a white coat with a bull (male) with a red coat. The resulting calf (offspring) is roan, which means there are red and white hairs intermixed in the coat of the calf. The genes for coat color in cattle are co-dominant.

**Part A:** Although a farm has cattle in all three colors, the farmer prefers roan cattle over white or red cattle. Use the Punnett square to show a cross that would produce only roan offspring.



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## MODULE B—CONTINUITY AND UNITY OF LIFE

***Continued.*** Please refer to the previous page for task explanation.

**Part B:** Explain how a roan calf results from one white- and one red-coated parent. In your explanation, use letters to represent genes. Be sure to indicate what colors the letters represent.

**Part C:** Predict the possible genotypes and phenotypes of the offspring produced from two roan cattle.

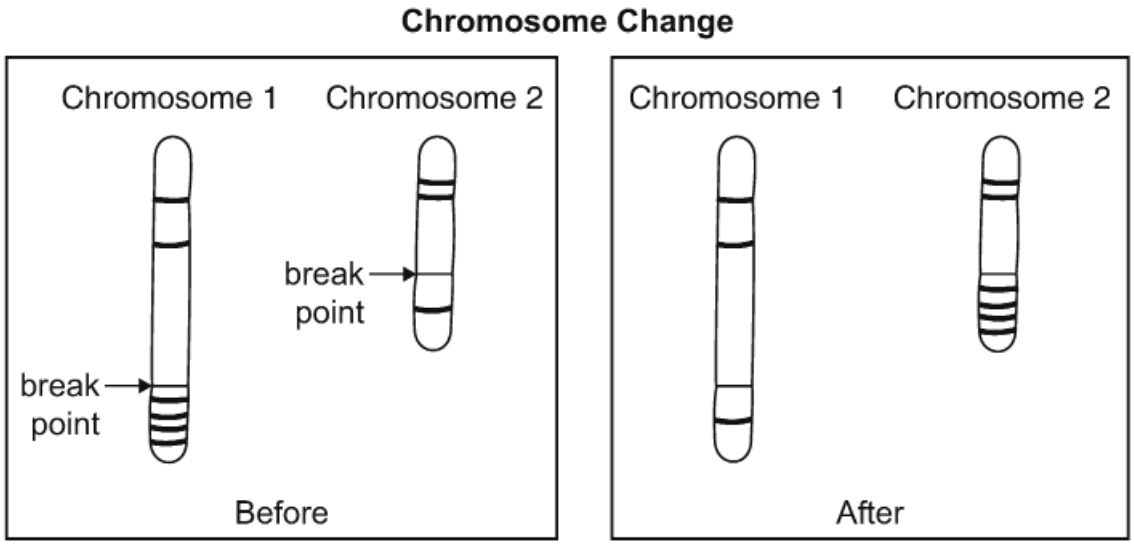
## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.1** | Compare Mendelian and non-Mendelian patterns of inheritance. | **BIO.B.2.1.2** | Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). | **3.1.B.B1**<br>**3.1.B.B2**<br>**3.1.B.B3**<br>**3.1.C.C2** |

## Sample Exam Question

**Standard** BIO.B.2.1.2

**Use the diagram below to answer the question.**




Which type of change in chromosome composition is illustrated in the diagram?

A. deletion

B. insertion

C. inversion

D. translocation

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.2** | Explain the process of protein synthesis (i.e., transcription, translation, and protein modification). | **BIO.B.2.2.1** | Describe how the processes of transcription and translation are similar in all organisms. | **3.1.B.B1**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.C.B3**<br>**3.1.C.C2** |
| | | **BIO.B.2.2.2** | Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. | **3.1.B.A5**<br>**3.1.B.B3**<br>**3.1.B.B5**<br>**3.1.C.B3** |

## Sample Exam Questions

**Standard** BIO.B.2.2.1

Which statement describes a cell process that is common to both eukaryotic and prokaryotic cells?

A. Both cell types carry out transcription in the nucleus.

B. Both cell types use ribosomes to carry out translation.

C. Both cell types assemble amino acids to carry out transcription.

D. Both cell types carry out translation in the endoplasmic reticulum.

**Standard** BIO.B.2.2.2

The endoplasmic reticulum is a network of membranes within the cell, and it is often classified as rough or smooth, depending on whether there are ribosomes on its surface. Which statement **best** describes the role of rough endoplasmic reticulum in the cell?

A. It stores all proteins for later use.

B. It provides an attachment site for larger organelles.

C. It aids in the production of membrane and secretory proteins.

D. It stores amino acids required for the production of all proteins.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.3** | Explain how genetic information is expressed. | **BIO.B.2.3.1** | Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). | **3.1.B.B1**<br>**3.1.B.B3**<br>**3.1.B.C2**<br>**3.1.C.B3**<br>**3.1.C.C2** |

## Sample Exam Question

**Standard** BIO.B.2.3.1

A genetic mutation resulted in a change in the sequence of amino acids of a protein, but the function of the protein was not changed. Which statement **best** describes the genetic mutation?

A. It was a silent mutation that caused a change in the DNA of the organism.

B. It was a silent mutation that caused a change in the phenotype of the organism.

C. It was a nonsense mutation that caused a change in the DNA of the organism.

D. It was a nonsense mutation that caused a change in the phenotype of the organism.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.2 Genetics *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.2.4** | Apply scientific thinking, processes, tools, and technologies in the study of genetics. | **BIO.B.2.4.1** | Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy). | **3.1.B.B4**<br>**4.4.7.A**<br>**4.4.10.A**<br>**4.4.12.A**<br>**4.4.7.B**<br>**4.4.10.B**<br>**4.4.12.B** |

## Sample Exam Question

**Standard** BIO.B.2.4.1

Genetic engineering has led to genetically modified plants that resist insect pests and bacterial and fungal infections. Which outcome would **most likely** be a reason why some scientists recommend caution in planting genetically modified plants?

A. unplanned ecosystem interactions

B. reduced pesticide and herbicide use

C. improved agricultural yield and profit

D. increased genetic variation and diversity

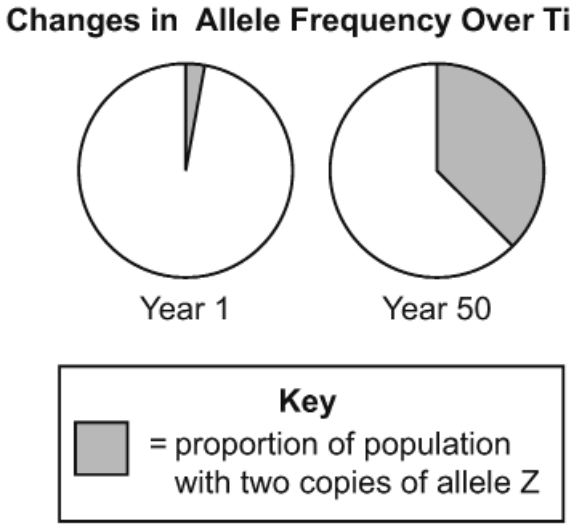
## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.3 Theory of Evolution | | | |
|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | **Enhanced Standard** |
| **BIO.B.3.1** Explain the mechanisms of evolution. | **BIO.B.3.1.1** | Explain how natural selection can impact allele frequencies of a population. | **3.1.B.C1** |
| | **BIO.B.3.1.2** | Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration). | **3.1.B.C1**<br>**3.1.B.C2** |
| | **BIO.B.3.1.3** | Explain how genetic mutations may result in genotypic and phenotypic variations within a population. | **3.1.B.C2**<br>**3.1.B.B1** |

## Sample Exam Questions

**Standard** BIO.B.3.1.1

**Use the circle graphs below to answer the question.**




The graphs illustrate change in a lizard population over time. Which process **most likely** led to the change in the lizard population?

A. natural selection acting on a harmful trait

B. natural selection acting on a beneficial trait

C. natural selection acting on a dominant trait

D. natural selection acting on a recessive trait

**Standard** BIO.B.3.1.2

In North America, the eastern spotted skunk mates in late winter, and the western spotted skunk mates in late summer. Even though their geographic ranges overlap, the species do not mate with each other. What **most likely** prevents these two species from interbreeding?

A. habitat isolation

B. gametic isolation

C. geographic isolation

D. reproductive isolation

**Standard** BIO.B.3.1.3

A mutation occurs in the genes that code for coat color in deer. Which change will **most likely** result from this mutation?

A. a change in the selection pressures acting on coat color

B. a change in the coat-color genes of deer predator species

C. an increase in coat-color diversity in the population

D. an increase in the number of genes for coat color in the population

## MODULE B—CONTINUITY AND UNITY OF LIFE

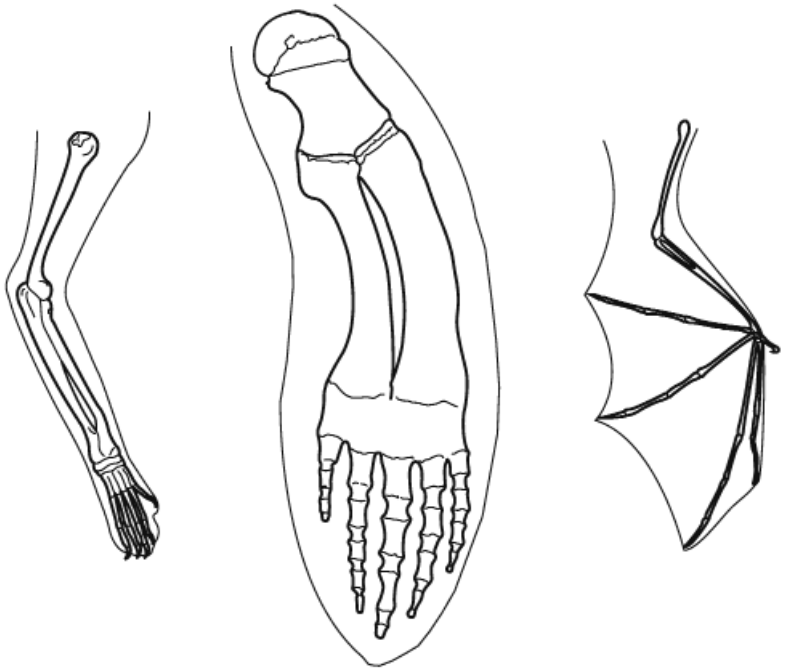
| ASSESSMENT ANCHOR<br>BIO.B.3 Theory of Evolution *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.3.2** | Analyze the sources of evidence for biological evolution. | **BIO.B.3.2.1** | Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code). | **3.1.B.C3**<br>**3.1.B.C1**<br>**3.1.B.B3** |

## Sample Exam Question

**Standard** BIO.B.3.2.1

**Use the illustrations below to answer the question.**

**Mammalian Forelimbs**



cat whale bat

The skeletons of mammalian forelimbs represent variations of a structure that was present in their common ancestor. What has **most likely** caused the variation in forelimbs?

A. changes in muscle structure

B. changes in the genetic codes

C. trait formation due to behaviors

D. development of vestigial structures

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.3 Theory of Evolution *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.3.2** | Analyze the sources of evidence for biological evolution. | **BIO.B.3.2.1** | Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code). | **3.1.B.C3**<br>**3.1.B.C1**<br>**3.1.B.B3** |

## Sample Exam Question

**Standard** BIO.B.3.2.1

**Use the table below to answer the question.**

**Sequence Differences between COII Genes in Some Animals**

| Animal | Number of Base Differences from a Rat |
|---|---|
| mouse | 101 |
| cow | 136 |

The gene COII is in the genome of many organisms. A comparison of the number of base differences between the COII gene in a rat and that of two other animals is shown.

**Part A:** Based on the data, describe a possible evolutionary relationship between rats, mice, and cows.

Continued next page

## MODULE B—CONTINUITY AND UNITY OF LIFE

***Continued.*** Please refer to the previous page for task explanation.

**Part B:** Describe how different organisms having a common gene such as COII supports the theory of evolution.

**Part C:** The COII gene of a monkey has 203 base differences from the same gene in a rat and 210 base differences from the same gene in a mouse. Compare the evolutionary relationships between the monkey, the rat, and the mouse.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.3 Theory of Evolution *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.3.3** | Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution. | **BIO.B.3.3.1** | Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation. | **3.1.B.A9** |

## Sample Exam Question

**Standard** BIO.B.3.3.1

**Use the table below to answer the question.**

**Student's Observations of a Pond Ecosystem**

| Quantitative | Qualitative |
|---|---|
| 37 fish and 3 frogs | Leaves lie on the bottom of the pond. |
| 2 types of aquatic grass | Water insects move along the water's surface. |
| 12 small rocks and 1 medium rock | All 3 frogs are sitting on a pond bank. |
| sand | |

A group of students measured a ten-square-meter section of a pond ecosystem and recorded observations. Which statement is a testable hypothesis?

A. The frogs living in the pond represent a population.

B. Water is an abiotic component in the pond ecosystem.

C. If the fish are given more food, then they will be happier.

D. If the frogs are startled, then they will jump into the water.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.4.1** | Describe ecological levels of organization in the biosphere. | **BIO.B.4.1.1** | Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere). | **4.1.4.A 4.1.7.C 4.1.7.A 4.4.6.A 4.1.10.A 4.5.3.D** |
| | | **BIO.B.4.1.2** | Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. | **4.1.7.A 4.1.4.C 4.1.3.A 4.4.5.C 4.1.4.B 4.4.3.C 4.2.10.A** |

## Sample Exam Questions

**Standard** BIO.B.4.1.1

**Use the list below to answer the question.**

**Observations**

- two grey wolves
- five moose
- several species of conifer trees
- large granite rock
- shallow pond

A student wrote several observations in a field notebook. Which term **best** classifies all of the student's observations?

A. population

B. food chain

C. ecosystem

D. community

**Standard** BIO.B.4.1.2

A researcher observing an ecosystem describes the amount of sunlight, precipitation, and type of soil present. Which factors is the researcher **most likely** describing?

A. biotic factors in a forest

B. biotic factors in a tundra

C. abiotic factors in a prairie

D. abiotic factors in an ocean

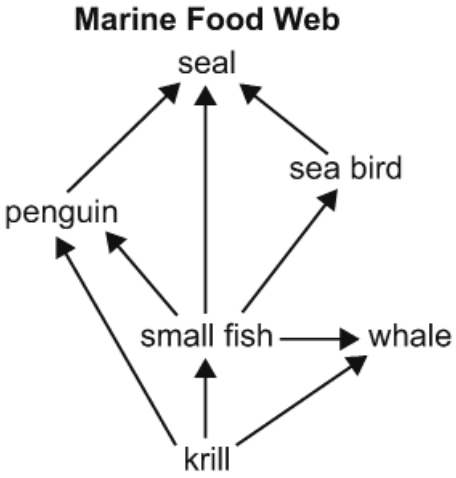
## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology *(continued)* | | | |
|---|---|---|---|
| **Anchor Descriptor** | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.4.2** Describe interactions and relationships in an ecosystem. | **BIO.B.4.2.1** | Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids). | **4.1.4.C 4.1.3.C 4.1.7.C 4.1.5.C 4.1.10.C 4.1.5.A 4.1.12.C** |
| | **BIO.B.4.2.2** | Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis). | **4.1.7.A 4.5.6.D 4.1.10.A 4.5.3.D** |

## Sample Exam Questions

**Standard** BIO.B.4.2.1

**Use the diagram below to answer the question.**




Which sequence correctly describes the flow of energy between organisms in the marine food web?

A. from seals to penguins to krill

B. from whales to krill to small fish

C. from sea birds to seals to penguins

D. from small fish to penguins to seals

**Standard** BIO.B.4.2.2

A species of snapping turtles has a tongue that resembles a worm. The tongue is used to attract small fish. Which **best** describes the interaction between the fish and the snapping turtle?

A. predation

B. symbiosis

C. parasitism

D. competition

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology *(continued)* | | | | | |
|---|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** | |
| **BIO.B.4.2** | Describe interactions and relationships in an ecosystem. | **BIO.B.4.2.3** | Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle). | **4.1.4.B**<br>**4.1.7.B**<br>**4.2.5.A**<br>**4.2.7.A**<br>**4.3.12.A** | **4.4.3.C**<br>**4.5.4.C**<br>**4.5.8.C**<br>**4.3.4.D**<br>**3.1.B.A2** |

## Sample Exam Question

**Standard** BIO.B.4.2.3

Which statement correctly describes how nitrogen in the soil returns to the atmosphere?

A. Soil bacteria convert nitrates into nitrogen gas.

B. Decomposers directly convert ammonium into nitrogen gas.

C. Plants assimilate nitrites and convert them into nitrogen gas.

D. Nitrogen-fixing bacteria in plant roots convert nitrates into nitrogen gas.

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology *(continued)* | | | | | |
|---|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** | |
| **BIO.B.4.2** | Describe interactions and relationships in an ecosystem. | **BIO.B.4.2.4** | Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires). | **4.1.10.A**<br>**4.1.10.B**<br>**4.1.12.A**<br>**4.1.4.A**<br>**4.1.12.C**<br>**4.1.4.E**<br>**4.1.7.E**<br>**4.1.10.E**<br>**4.5.10.D**<br>**4.2.8.A**<br>**4.2.10.A** | **4.2.12.A**<br>**4.2.10.B**<br>**4.2.12.B**<br>**4.2.10.C**<br>**4.2.12.C**<br>**4.3.12.A**<br>**4.3.10.B**<br>**4.5.10.B**<br>**4.5.12.B**<br>**4.5.4.C**<br>**4.5.7.C** |

## Sample Exam Question

**Standard** BIO.B.4.2.4

Agricultural runoff can carry fertilizers into lakes and streams. This runoff can cause algae populations to greatly increase. Which effect does this change in the algae population sizes **most likely** have on affected lakes and streams?

A. an increase in water level

B. an increase in water clarity

C. a reduction in dissolved oxygen needed by fish and shellfish

D. a reduction in temperature variations near the water's surface

## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology *(continued)* | | | | | |
|---|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** | |
| **BIO.B.4.2** | Describe interactions and relationships in an ecosystem. | **BIO.B.4.2.5** | Describe the effects of limiting factors on population dynamics and potential species extinction. | **4.1.4.A**<br>**4.1.10.A**<br>**4.1.12.A**<br>**4.1.7.E**<br>**4.1.10.E**<br>**4.1.4.E**<br>**4.2.10.C**<br>**4.5.3.D**<br>**4.5.5.D**<br>**4.5.6.D**<br>**4.5.10.D** | **4.2.10.A**<br>**4.2.7.A**<br>**4.2.8.A**<br>**4.2.10.B**<br>**4.4.6.A**<br>**4.4.6.B**<br>**4.4.3.C**<br>**4.4.5.C**<br>**4.5.7.B**<br>**4.5.7.C** |

## Sample Exam Question

**Standard** BIO.B.4.2.5

A farmer observed that an increase in a field's soil nitrogen content was followed by an increase in producer productivity. What does this observation **most likely** indicate about the relationship between nitrogen and the producers in the field?

A. Nitrogen was a biotic factor.

B. Nitrogen was a limiting factor.

C. Nitrogen became a surplus resource.

D. Nitrogen became a selection pressure.

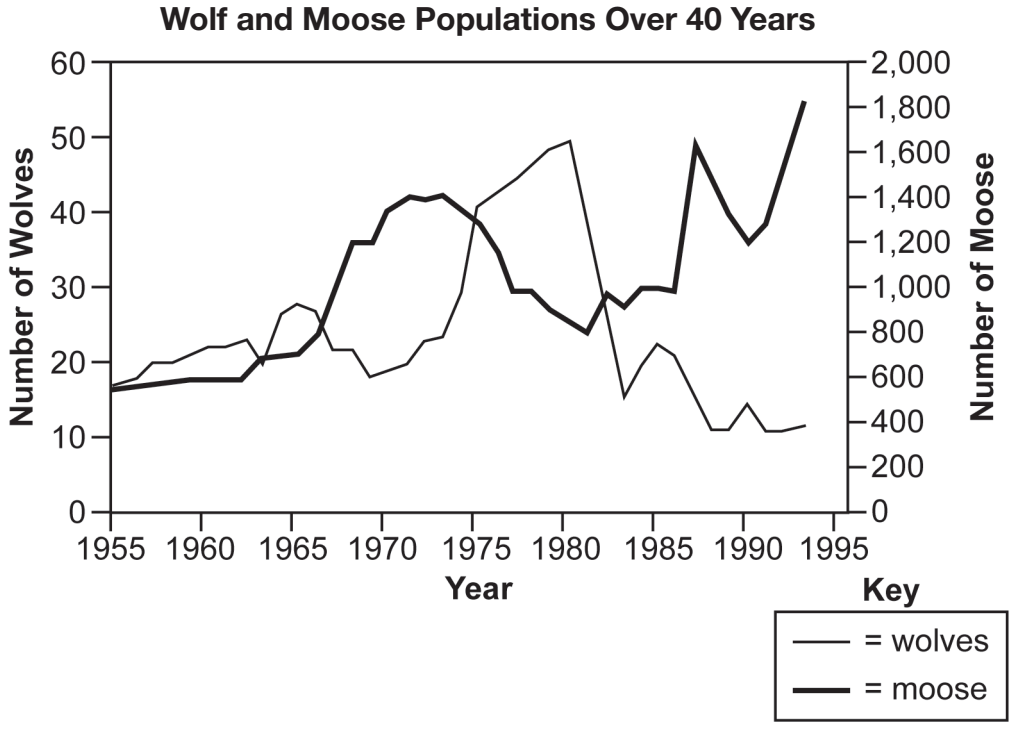
## MODULE B—CONTINUITY AND UNITY OF LIFE

| ASSESSMENT ANCHOR<br>BIO.B.4 Ecology *(continued)* | | | | |
|---|---|---|---|---|
| **Anchor Descriptor** | | **Eligible Content** | | **Enhanced Standard** |
| **BIO.B.4.2** | Describe interactions and relationships in an ecosystem. | **BIO.B.4.2.5** | Describe the effects of limiting factors on population dynamics and potential species extinction. | **4.1.4.A 4.2.10.A 4.1.10.A 4.2.7.A 4.1.12.A 4.2.8.A 4.1.7.E 4.2.10.B 4.1.10.E 4.4.6.A 4.1.4.E 4.4.6.B 4.2.10.C 4.4.3.C 4.5.3.D 4.4.5.C 4.5.5.D 4.5.7.B 4.5.6.D 4.5.7.C 4.5.10.D** |

## Sample Exam Question

**Standard** BIO.B.4.2.5

**Use the graph below to answer the question.**




Isle Royale is located in Lake Superior. Isle Royale is home to populations of wolves and moose. The interactions between the wolves and moose, as well as the individual population sizes, have been studied since 1958. The graph shows the population sizes over time for both wolves and moose.

Continued next page

## MODULE B—CONTINUITY AND UNITY OF LIFE

**Standard** BIO.B.4.2.5

***Continued.*** Please refer to the previous page for task explanation.

**Part A:** Describe one limiting factor for the moose population.

**Part B:** Explain one likely reason why the wolf population rapidly increased between 1975 and 1980.

Continued next page

## MODULE B—CONTINUITY AND UNITY OF LIFE

**Standard** BIO.B.4.2.5

***Continued.*** Please refer to the previous page for task explanation.

**Part C:** Predict what will happen to the moose population's size after 1994 by describing the shape of the curve. In your answer, be sure to explain the reasoning behind your prediction.

## KEYSTONE BIOLOGY ASSESSMENT ANCHORS
## KEY TO SAMPLE MULTIPLE-CHOICE ITEMS

### Biology

| Eligible Content | Key |
|---|---|
| BIO.A.1.1.1 | A |
| BIO.A.1.2.1 | D |
| BIO.A.1.2.2 | D |

| Eligible Content | Key |
|---|---|
| BIO.A.2.1.1 | C |
| BIO.A.2.2.1 | B |
| BIO.A.2.2.2 | D |
| BIO.A.2.2.3 | B |
| BIO.A.2.3.1 | D |
| BIO.A.2.3.2 | A |

| Eligible Content | Key |
|---|---|
| BIO.A.3.1.1 | B |
| BIO.A.3.2.1 | B |
| BIO.A.3.2.2 | A |

| Eligible Content | Key |
|---|---|
| BIO.A.4.1.1 | B |
| BIO.A.4.1.2 | B |
| BIO.A.4.1.3 | C |
| BIO.A.4.2.1 | D |

| Eligible Content | Key |
|---|---|
| BIO.B.1.1.1 | C |
| BIO.B.1.1.2 | D |
| BIO.B.1.2.1 | D |
| BIO.B.1.2.2 | D |

| Eligible Content | Key |
|---|---|
| BIO.B.2.1.1 | D |
| BIO.B.2.1.2 | D |
| BIO.B.2.2.1 | B |
| BIO.B.2.2.2 | C |
| BIO.B.2.3.1 | A |
| BIO.B.2.4.1 | A |

| Eligible Content | Key |
|---|---|
| BIO.B.3.1.1 | B |
| BIO.B.3.1.2 | D |
| BIO.B.3.1.3 | C |
| BIO.B.3.2.1 | B |
| BIO.B.3.3.1 | D |

| Eligible Content | Key |
|---|---|
| BIO.B.4.1.1 | C |
| BIO.B.4.1.2 | C |
| BIO.B.4.2.1 | D |
| BIO.B.4.2.2 | A |
| BIO.B.4.2.3 | A |
| BIO.B.4.2.4 | C |
| BIO.B.4.2.5 | B |

# Keystone Exams: Biology

# Glossary to the Assessment Anchor & Eligible Content

**The Keystone Glossary includes terms and definitions associated with the Keystone Assessment Anchors and Eligible Content. The terms and definitions included in the glossary are intended to assist Pennsylvania educators in better understanding the Keystone Assessment Anchors and Eligible Content. The glossary does not define all possible terms included on an actual Keystone Exam, and it is not intended to define terms for use in classroom instruction for a particular grade level or course.**

*Pennsylvania Department of Education*

**www.education.state.pa.us**

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|---|---|
| **Abiotic** | A term that describes a nonliving factor in an ecosystem. |
| **Activation Energy ($E_a$)** | The minimum energy required to initiate a specific chemical reaction. |
| **Active Transport** | The movement of particles from an area of low concentration to an area of high concentration that uses energy provided by ATP or a difference in electrical charges across a cell membrane. |
| **Adenosine Triphosphate (ATP)** | A molecule that provides energy for cellular reactions and processes. ATP releases energy when one of its high-energy bonds is broken to release a phosphate group. |
| **Adhesion** | The intermolecular attraction between unlike molecules. Capillary action results from the adhesive properties of water and the molecules that make up plant cells. |
| **Agriculture** | The artificial cultivation of food, fiber, and other goods by the systematic growing and harvesting of various organisms. |
| **Allele** | A variation of a gene's nucleotide sequence (an alternative form of a gene). |
| **Allele Frequency** | The measure of the relative frequency of an allele at a genetic locus in a population; expressed as a proportion or percentage. |
| **Analogous Structure** | A physical structure, present in multiple species, that is similar in function but different in form and inheritance. |
| **Aquatic** | A term that describes an organism associated with a water environment. |
| **Atom** | The smallest unit of an element that retains the chemical and physical properties of that element. |
| **Biochemical Conversion** | The changing of organic matter into other chemical forms such as fuels. |

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| **Bioenergetics** | The study of energy flow (energy transformations) into and within living systems. |
| **Biogeochemical Cycles** | The movement of abiotic factors between the living and nonliving components within ecosystems; also known as nutrient cycles (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle). |
| **Biological Macromolecules** | A group of biomacromolecules that interact with biological systems and their environments. |
| **Biology** | The scientific study of life. |
| **Biome** | A large area or geographical region with distinct plant and animal groups adapted to that environment. |
| **Biosphere** | The zone of life on Earth; sum total of all ecosystems on Earth. |
| **Biotechnology** | Any procedure or methodology that uses biological systems or living organisms to develop or modify either products or processes for specific use. This term is commonly associated with genetic engineering, which is one of many applications. |
| **Biotic** | A term that describes a living or once-living organism in an ecosystem. |
| **Carbohydrate** | A macromolecule that contains atoms of carbon, hydrogen, and oxygen in a 1:2:1 ratio and serves as a major source of energy for living organisms (e.g., sugars, starches, and cellulose). |
| **Carrier (Transport) Proteins** | Proteins embedded in the plasma membrane involved in the movement of ions, small molecules, and macromolecules into and out of cells; also known as transport proteins. |
| **Carrying Capacity** | The number of individuals in a population that can be supported in an ecosystem given the resources available and other environmental pressures. |

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| **Catalyst** | A substance that enables a chemical reaction to proceed at a usually faster rate or under different conditions (e.g., lower temperature) than otherwise possible without being changed by the reaction. |
| **Cell** | The basic unit of structure and function for all living organisms. Cells have three common components: genetic material, cytoplasm, and a cell membrane. Eukaryotic cells also contain specialized organelles. |
| **Cell Cycle** | The series of events that take place in a cell leading to its division and duplication. The main phases of the cell cycle are interphase, nuclear division, and cytokinesis. |
| **Cellular Respiration** | A complex set of chemical reactions involving an energy transformation where potential chemical energy in the bonds of "food" molecules is released and partially captured in the bonds of adenosine triphosphate (ATP) molecules. |
| **Chloroplast** | An organelle found in plant cells and the cells of other eukaryotic photosynthetic organisms where photosynthesis occurs. |
| **Chromosomal Mutation** | A change in the structure of a chromosome (e.g., deletion, the loss of a segment of a chromosome and thus the loss of segment containing genes; duplication, when a segment of a chromosome is duplicated and thus displayed more than once on the chromosome; inversion**,** when a segment of a chromosome breaks off and reattaches in reverse order; and translocation, when a segment of one chromosome breaks off and attaches to a nonhomologous chromosome). |
| **Chromosomes** | A single piece of coiled DNA and associated proteins found in linear forms in the nucleus of eukaryotic cells and circular forms in the cytoplasm of prokaryotic cells; contains genes that encode traits. Each species has a characteristic number of chromosomes. |
| **Cloning** | A process in which a cell, cell product, or organism is copied from an original source (e.g., DNA cloning, the transfer of a DNA fragment from one organism to a self-replicating genetic element such as a bacterial plasmid; reproductive cloning, the transfer of genetic material from the nucleus of a donor adult cell to an egg cell that has had its nucleus removed for the purpose of creating an embryo that can produce an exact genetic copy of the donor organism; or therapeutic cloning, the process of taking undifferentiated embryonic cells [STEM cells] for use in medical research). |

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| **Co-dominance** | A pattern of inheritance in which the phenotypic effect of two alleles in a heterozygous genotype express each phenotype of each allele fully and equally; a phenotype which would not be expressed in any other genotypic combination. |
| **Cohesion** | The intermolecular attraction between like molecules. Surface tension results from the cohesive properties of water. |
| **Community (Ecological)** | Different populations of organisms interacting in a shared environment. |
| **Competition** | When individuals or groups of organisms compete for similar resources such as territory, mates, water, and food in the same environment. |
| **Concentration** | The measure of the amount or proportion of a given substance when combined with another substance. |
| **Concentration Gradient** | The graduated difference in concentration of a solute per unit distance through a solution. |
| **Consumer (Ecological)** | An organism that obtains energy by feeding on other organisms or their remains. |
| **Crossing-over** | An exchange of genetic material between homologous chromosomes during prophase I of meiosis; contributes to the genetic variability in gametes and ultimately in offspring. |
| **Cytokinesis** | The final phase of a cell cycle resulting in the division of the cytoplasm. |
| **Decomposer** | An organism that obtains nutrients by consuming dead and decaying organic matter which allows nutrients to be accessible to other organisms. |
| **Dehydration Synthesis** | A chemical reaction in which monomers are linked together by removing one water molecule from each linked pair of monomers to form polymers. |

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| **Deletion Mutation** | A genetic mutation in which one or more nucleotides are removed from a section of DNA. |
| **Deoxyribonucleic Acid (DNA)** | A biological macromolecule that encodes the genetic information for living organisms and is capable of self-replication and the synthesis of ribonucleic acid (RNA). |
| **Diffusion** | The movement of particles from an area of high concentration to an area of low concentration; a natural result of kinetic molecular energy. |
| **Diploid Cell** | A cell containing two homologous pairs of chromosomes (2n). |
| **DNA Replication** | The process in which DNA makes a duplicate copy of itself. |
| **Dominant Inheritance** | A pattern of inheritance in which the phenotypic effect of one allele is completely expressed within a homozygous and heterozygous genotype. |
| **Duplication Mutation** | A genetic mutation in which a region that contains a gene or an entire chromosome is duplicated, which results in multiple copies of that region or nucleotide. |
| **Ecology** | The study of the relationships between organisms and their interactions with the environment. |
| **Ecosystem** | A system composed of organisms and nonliving components of an environment. |
| **Embryology** | The branch of zoology studying the early development of living things. |
| **Endemic Species** | A species that is found in its originating location and is generally restricted to that geographic area. |
| **Endocytosis** | A process in which a cell engulfs extracellular material through an inward folding of its plasma membrane. |

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| **Endoplasmic Reticulum (ER)** | An organelle, containing folded membranes and sacs, responsible for the production, processing, and transportation of materials for use inside and outside a eukaryotic cell. There are two forms of this organelle: rough ER that has surface ribosomes and participates in the synthesis of proteins mostly destined for export by the cell and smooth ER that has no ribosomes and participates in the synthesis of lipids and steroids as well as the transport of synthesized macromolecules. |
| **Endosymbiosis** | A theorized process in which early eukaryotic cells were formed from simpler prokaryotes. |
| **Energy Pyramid** | A model that illustrates the biomass productivity at multiple trophic levels in a given ecosystem. |
| **Energy Transformation** | A process in which energy changes from one form to another form while some of the energy is lost to the environment. |
| **Environment** | The total surroundings of an organism or a group of organisms. |
| **Enzyme** | A protein that increases the rate of a chemical reaction without being changed by the reaction; an organic catalyst. |
| **Eukaryote** | A type of organism composed of one or more cells containing a membrane-bound nucleus, specialized organelles in the cytoplasm, and a mitotic nuclear division cycle. |
| **Evolution** | A process in which new species develop from preexisting species (biological evolution or macroevolution); a change in the allele frequencies of a population of organisms from generation to generation (genetic evolution or microevolution). |
| **Exocytosis** | A process in which a cell releases substances to the extracellular environment by fusing a vesicular membrane with the plasma membrane, separating the membrane at the point of fusion and allowing the substance to be released. |
| **Extinction** | A term that typically describes a species that no longer has any known living individuals. |
| **Extracellular** | Located outside a cell. |

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| **Facilitated Diffusion** | A process in which substances are transported across a plasma membrane with the concentration gradient with the aid of carrier (transport) proteins; does not require the use of energy. |
| **Food Chain** | A simplified path illustrating the passing of potential chemical energy (food) from one organism to another organism. |
| **Food Web** | A complex arrangement of interrelated food chains illustrating the flow of energy between interdependent organisms. |
| **Forensics** | The science of tests and techniques used during the investigation of crimes. |
| **Fossils** | The preserved remains or traces of organisms that once lived on Earth. |
| **Founder Effect** | A decrease in genetic variation caused by the formation of a new population by a small number of individuals from a larger population. |
| **Frame-shift Mutation** | The addition (insertion mutation) or removal (deletion mutation) of one or more nucleotides that is not divisible by three, therefore resulting in a completely different amino acid sequence than would be normal. The earlier in the sequence that nucleotides are added or removed, the more altered the resulting protein will be. |
| **Freezing Point** | The temperature at which a liquid changes state to a solid. |
| **Gamete** | A specialized cell (egg or sperm) used in sexual reproduction containing half the normal number of chromosomes of a somatic cell. |
| **Gene** | A sequence of nucleotides composing a segment of DNA that provides a blueprint for a specific hereditary trait. |
| **Gene Expression** | The process in which a nucleotide sequence of a gene is used to make a functional product such as protein or RNA. |

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| **Gene Mutation** | A permanent alteration that changes a segment of DNA within a gene. |
| **Gene Recombination** | A natural process in which a nucleic acid molecule (usually DNA but can be RNA) is broken and then joined to a different molecule; a result of crossing-over. |
| **Gene Splicing** | A type of gene recombination in which the DNA is intentionally broken and recombined using laboratory techniques. |
| **Gene Therapy** | The intentional insertion, alteration, or deletion of genes within an individual's cells and tissues for the purpose of treating a disease. |
| **Genetic Drift** | A change in the allele frequency of a population as a result of chance events rather than natural selection. |
| **Genetic Engineering** | A technology that includes the process of manipulating or altering the genetic material of a cell resulting in desirable functions or outcomes that would not occur naturally. |
| **Genetically Modified Organism** | An organism whose genetic material has been altered through some genetic engineering technology or technique. |
| **Genetics** | The scientific study of inheritance. |
| **Genotype** | The genetic composition of an organism with reference to a single trait, a set of traits, or the entire complement of traits of an organism. |
| **Golgi Apparatus** | An organelle found in eukaryotic cells responsible for the final stages of processing proteins for release by the cell. |
| **Gradualism** | A proposed explanation in evolutionary biology stating that new species arise from the result of slight modifications (mutations and resulting phenotypic changes) over many generations. |

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| **Habitat** | An area that provides an organism with its basic needs for survival. |
| **Haploid Cell** | A cell containing one chromosome (n) from each homologous pair, typically observed in somatic cells. |
| **Homeostasis** | The regulatory process in which an organism regulates its internal environment. |
| **Homeostatic Mechanism** | A regulatory mechanism that contributes to maintaining a state of equilibrium (e.g., thermoregulation, water regulation, and oxygen regulation). |
| **Homologous Structure** | A physical characteristic in different organisms that is similar because it was inherited from a common ancestor. |
| **Hydrolysis** | A chemical reaction in which chemical bonds in polymers are broken through the addition of water, decomposing the polymers into simpler units. |
| **Hypothesis** | A proposed, scientifically testable explanation for an observed phenomenon. |
| **Impermeable** | Not permitting passage of a substance or substances. |
| **Incomplete Dominance** | A pattern of inheritance in which two alleles, inherited from the parents, are neither dominant nor recessive. The resulting offspring have a phenotype that is a blending of the parental traits. |
| **Inference** | An idea based on evidence, observation, and/or known information applied to a situation or phenomena. |
| **Inheritance** | The process in which genetic material is passed from parents to their offspring. |
| **Insertion Mutation** | A genetic mutation in which one or more nucleotides are inserted into a genetic sequence. |

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| **Interphase** | The longest-lasting phase of the cell cycle in which a cell performs the majority of its functions, such as preparing for nuclear division and cytokinesis. |
| **Intracellular** | Located inside a cell. |
| **Inversion Mutation** | A genetic mutation in which the order of a segment of genetic material is reversed. This type of mutation can involve a small number of nucleotides as well as larger sections of a chromosome containing more than one gene. |
| **Isolating Mechanisms** | Features of behaviors, morphology, or genetics that prevent mating or breeding between two different species (e.g., temporal isolation, in which individuals are active at different times of the day, seasons, or mating periods; geographical isolation, in which individuals only mate in their specific habitat; behavioral isolation, when there are no sexual cues between representatives of the species; mechanical isolation, when there is no gamete transfer during an attempted mating; and gametic incompatibility, when there is sperm transfer without fertilization occurring). |
| **Law (Scientific)** | A law that generalizes a body of observations. At the time it is made, no exceptions have been found to a law. It explains things but does not describe them; serves as the basis of scientific principles. |
| **Limiting Factor** | Chemical, physical, or biological factor that limits the existence, growth, abundance, or distribution of an individual organism or a population. |
| **Lipids** | A group of organic compounds composed mostly of carbon and hydrogen including a proportionately smaller amount of oxygen; are insoluble in water, serve as a source of stored energy, and are a component of cell membranes. |
| **Locus (gene locus)** | The specific location of a gene or DNA sequence on a chromosome or linkage map. |
| **Macromolecule** | A polymer with a high molecular mass. Within organisms there are four main groups: carbohydrates, lipids, proteins, and nucleic acids. |

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| **Mechanism (Scientific)** | The combination of components and processes that serve a common function. |
| **Meiosis** | A two-phase nuclear division that results in the eventual production of gametes with half the normal number of chromosomes. |
| **Migration (Genetics)** | The permanent movement of genes into or out of a population resulting in a change in allele frequencies. |
| **Missense Mutation** | A genetic mutation in which a point mutation of a single nucleotide changes the existing code to a sequence that codes for a different amino acid, which results in a nonfunctional protein. (If the amino acid remains the same after the point mutation, this mutation is considered to be a silent mutation. If the resulting amino acid is a premature stop codon, this mutation is considered to be a nonsense mutation.) |
| **Mitochondrion** | A membrane-bound organelle found in most eukaryotic cells; site of cellular respiration. |
| **Mitosis** | A nuclear division resulting in the production of two somatic cells having the same genetic complement as the original cell. |
| **Molecule** | The smallest particle of a substance that retains the chemical and physical properties of the substance and is composed of two or more atoms held together by chemical forces. |
| **Monomer** | A molecule of any compound that can react with other molecules of the same or different compound to form a polymer. Each biological macromolecule has characteristic monomers. |
| **Multicellular** | Made up of more than one cell. |
| **Multiple Alleles** | More than two forms of a gene controlling the expression of a trait. |
| **Mutation** | A permanent transmissible change of genetic material (e.g., chromosomal mutations and gene mutations). |

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| **Natural Selection** | A process in nature in which organisms possessing certain inherited traits are better able to survive and reproduce compared to others of their species. |
| **Nondisjunction** | The process in which homologous chromosomes or sister chromatids fail to separate during meiosis. |
| **Nonnative Species** | A species typically living outside a distribution range that has been introduced through either deliberate or accidental human activity; also known as introduced, alien, nonindigenous, or exotic species. |
| **Nonsense Mutation** | A genetic mutation, which is typically the result of a point mutation, that causes the sequence of nucleotides to code for a premature stop codon. This type of mutation usually results in a protein product that is shortened, incomplete, and often nonfunctional. |
| **Nucleic Acid** | A biological macromolecule (DNA or RNA) composed of the elements C, H, N, O, and P that carries genetic information. |
| **Nucleus** | A membrane-bound organelle in eukaryotic cells functioning to maintain the integrity of the genetic material and, through the expression of that material, controlling and regulating cellular activities. |
| **Organ** | An anatomical unit composed of tissues serving a common function. |
| **Organ System** | An anatomical system composed of a group of organs that work together to perform a specific function or task. |
| **Organelle** | A subunit within a cell that has a specialized function. |
| **Organic Molecule** | A molecule containing carbon that is a part of or produced by living systems. |
| **Organism** | A form of life; an animal, plant, fungus, protist or bacterium. |

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| **Osmosis** | The movement of water or another solvent through permeable membranes from an area of higher water concentration (dilute) to an area of lower water concentration (concentrated). |
| **Passive Transport** | The transportation of materials across a plasma membrane without using energy. |
| **pH** | The measure of acidity or alkalinity (basicity) of an aqueous solution scaling from 1 (highly acidic) to 14 (highly alkaline) with a midpoint of 7 (neutral). |
| **Phenotype** | The observable expression of a genotype. |
| **Photosynthesis** | A process in which solar radiation is chemically captured by chlorophyll molecules through a set of controlled chemical reactions resulting in the potential chemical energy in the bonds of carbohydrate molecules. |
| **Plasma Membrane** | A thin, phospholipid and protein molecule bilayer that encapsulates a cell and controls the movement of materials in and out of the cell through active or passive transport. |
| **Plasmid** | Circular DNA molecules that are separate from chromosomal DNA and can replicate independently. |
| **Plastids** | A group of membrane-bound organelles commonly found in photosynthetic organisms and mainly responsible for the synthesis and storage of food. |
| **Point Mutation** | A single-base substitution causing the replacement of a single-base nucleotide with another nucleotide (e.g., silent mutation, in which there is no change in an amino acid; missense mutation, in which there is a different amino acid; and nonsense mutation, in which there is an insertion of a stop codon in the amino acid which stops protein synthesis). |
| **Polygenic Trait** | A trait in which the phenotype is controlled by two or more genes at different loci on different chromosomes. |

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| **Population** | A group of individuals of the same species living in a specific geographical area and reproducing. |
| **Population Dynamics** | The study of short- and long-term changes in the number of individuals for a given population, as affected by birth, death, immigration, and emigration. |
| **Principle (Scientific)** | A concept based on scientific laws and axioms (rules assumed to be present, true, and valid) where general agreement is present. |
| **Producer (Ecological)** | An organism that uses a primary energy source to conduct photosynthesis or chemosynthesis. |
| **Prokaryote** | A single-celled organism that lacks a membrane-bound nucleus and specialized organelles. |
| **Protein** | A macromolecule that contains the principal components of organisms: carbon, hydrogen, oxygen, and nitrogen; performs a variety of structural and regulatory functions for cells. |
| **Protein Synthesis** | The process in which amino acids are arranged in a linear sequence through the processes of transcription of DNA to RNA and the translation of RNA to a polypeptide chain. |
| **Pumps (Ion or Molecular)** | Any of several molecular mechanisms in which ions or molecules are transported across a cellular membrane requiring the use of an energy source (e.g., glucose, sodium [Na+], calcium [Ca+], and potassium [K+]). |
| **Punctuated Equilibrium** | A proposed explanation in evolutionary biology stating that species are generally stable over long periods of time. Occasionally there are rapid changes that affect some species which can quickly result in a new species. |
| **Recessive Inheritance** | A pattern of inheritance in which the phenotypic effect of one allele is only expressed within a homozygous genotype. In a heterozygous condition with a dominant allele, it is not expressed in the phenotype. |
| **Ribosome** | A cellular structure composed of RNA and proteins that is the site of protein synthesis in eukaryotic and prokaryotic cells. |

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| **Science** | A body of evidence-based knowledge gained through observation and experimentation related to the natural world and technology. |
| **Selective Breeding** | The process of breeding organisms that results in offspring with desired genetic traits. |
| **Semiconservative Replication** | The process in which the DNA molecule uncoils and separates into two strands. Each original strand becomes a template on which a new strand is constructed, resulting in two DNA molecules identical to the original DNA molecule. |
| **Sex-linked Trait** | A trait associated with a gene that is located on one of the sex chromosomes (e.g., color blindness, hemophilia). |
| **Silent Mutation** | A genetic mutation that results in a codon that does not change the amino acid sequence that occurs, codes for the same amino acid, or codes for a different amino acid that does not cause any functional change in the proteins that are produced. |
| **Speciation** | A process typically caused by the genetic isolation from a main population resulting in a new genetically distinct species. |
| **Species** | The lowest taxonomic level of biological classification consisting of organisms capable of reproduction that results in fertile offspring. |
| **Specific Heat** | The measure of the heat energy required to increase the temperature of a unit quantity of a substance by a certain temperature interval. |
| **Substrate** | A substance on which an enzyme acts. |
| **Succession** | A series of predictable and orderly changes within an ecosystem over time. |

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| **Symbiotic Relationship** | A relationship between two organisms (i.e., mutualism, in which both organisms benefit; parasitism, in which one organism benefits and the other organism is harmed; and commensalism, in which one organism benefits and the other organism does not benefit or is not harmed). |
| **System** | A set of interacting or interdependent components, real or abstract, that form an integrated whole. An open system is able to interact with its environment. A closed system is isolated from its environment. |
| **Temperature** | A measure of the average kinetic energy (energy of motion) of particles in a sample of matter. This physical property can determine the rate and extent to which chemical reactions can occur within living systems. It is commonly measured in degrees Celsius (°C) or Fahrenheit (°F). |
| **Terrestrial** | A term that can describe an organism associated with a land environment. |
| **Theory (Scientific)** | An explanation of observable phenomena based on available empirical data and guided by a system of logic that includes scientific laws; provides a system of assumptions, accepted principles, and rules of procedure devised to analyze, predict, or otherwise explain the nature or behavior of a specific set of phenomena. |
| **Thermoregulation** | The maintenance of internal homeostasis by keeping an organism's body temperature within a certain range, even when external environmental temperatures vary. |
| **Tissue** | An anatomical unit composed of cells organized to perform a similar function. |
| **Transcription** | The process in which a strand of messenger RNA (mRNA) is synthesized by using the genetic information found on a strand of DNA as a template. |
| **Translation** | The process in which the messenger RNA (mRNA) molecule on a ribosome is decoded to produce a sequence of amino acids for protein synthesis. |
| **Translocation** | The process in which a segment of a chromosome breaks off and attaches to another chromosome. |

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| **Transpiration** | The movement of water from within a plant, typically through the leaves and stems, to the atmosphere in the form of water vapor. |
| **Trophic Level** | The position of an organism in relation to the flow of energy and inorganic nutrients through an ecosystem (e.g., producer, consumer, and decomposer). |
| **Unicellular** | Made up of a single cell. |
| **Vestigial Structure** | A physical characteristic in organisms that appears to have lost its original function as a species has changed over time. |

# Keystone Exams: Biology

## Assessment Anchors and Eligible Content with Sample Questions and Glossary

April 2014



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