KEYSTONE MODULE A—CELLS AND CELL PROCESSES

_____ 1. Which characteristic is shared by **all** prokaryotes and eukaryotes? **Standard BIO.A.1.1.1**

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

_____ 2. Living organisms can be classified as prokaryotes or eukaryotes. Which two structures are common to both prokaryotic and eukaryotic cells? **Standard BIO.A.1.2.1**

A. cell wall and nucleus
B. cell wall and chloroplast
C. plasma membrane and nucleus
D. plasma membrane and cytoplasm

3. Prokaryotic cells are generally much smaller than eukaryotic cells. **Standard BIO.A.1.2.1**

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

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

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Part C: **Standard BIO.A.1.1**

Describe one similarity between prokaryotic cells and eukaryotic cells that is independent of size.

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_____ 4. 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? **Standard** BIO.A.1.2.2

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.

_____ 5. Which statement **best** describes an effect of the low density of frozen water in a lake? **Standard** BIO.A.2.1.1

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.

_____ 6. Which statement correctly describes how carbon's ability to form four bonds makes it uniquely suited to form macromolecules? **Standard** BIO.A.2.2.1

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.

Use the diagram below to answer the question. **Standard** BIO.A.2.2.2

Chemical Reaction HO-1-2-3-H + HO-4-H

HO-1-2-3-4-H + H_2O

_____ 7. 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

_____ 8. Carbohydrates and proteins are two types of macromolecules. Which functional characteristic of proteins distinguishes them from carbohydrates? **Standard** BIO.A.2.2.3

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

9. 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. **Standard** BIO.A.2.2.3

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

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.

_____ 10. Substance A is converted to substance B in a metabolic reaction. Which statement **best** describes the role of an enzyme during this reaction? **Standard** BIO.A.2.3.1

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.

_____ 11. 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? **Standard** BIO.A.2.3.2

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.

_____ 12. 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? **Standard** BIO.A.3.1.1

A. ATP to light
B. light to chemical
C. heat to electrical
D. chemical to chemical

_____ 13. 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? **Standard** BIO.A.3.2.1

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.

_____ 14. 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? **Standard** BIO.A.3.2.2

A. ATP
B. ADP
C. catalase
D. amylase

15. **Use the diagrams below to answer the question.** **Standard** BIO.A.3.2.1

energy in → photosynthesis → energy out

energy in → cellular respiration → energy out

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

Process	Energy Transformations
photosynthesis	
cellular respiration	

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

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_____ 16. 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? **Standard** BIO.A.4.1.1

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

_____ 17. 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? **Standard** BIO.A.4.1.2

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.

18. 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. **Standard** BIO.A.4.1.2

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

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

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

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_____ 19. 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? **Standard** BIO.A.4.1.3

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.

_____ 20. Which example is an activity that a fish **most likely** uses to maintain homeostasis within its body? **Standard** BIO.A.4.2.1

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

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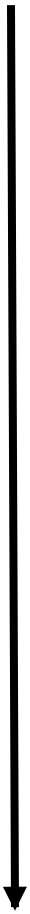
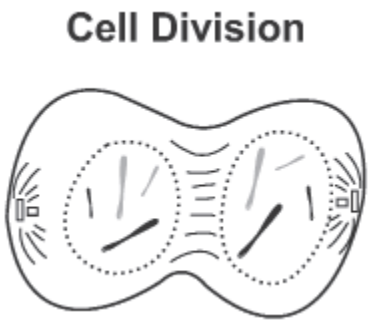
**** Continue on to Keystone Module 2 ****



KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

Use the illustration below to answer the question. **Standard BIO.B.1.1.1**



_____ 21. 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.

_____ 22. Mitosis and meiosis are processes by which animal and plant cells divide. Which statement **best** describes a difference between mitosis and meiosis? **Standard BIO.B.1.1.2**

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.

23. Patau syndrome can be a lethal genetic disorder in mammals, resulting from chromosomes failing to separate during meiosis. **Standard BIO.B.1.1.2**

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

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

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KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

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.

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_____24. Which process helps to preserve the genetic information stored in DNA during DNA replication? **Standard BIO.B.1.2.1**

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

_____ 25. 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? **Standard BIO.B.1.2.2**

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

Use the table below to answer the question. **Standard BIO.B.2.1.1**

Blood Types

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

_____ 26. 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?

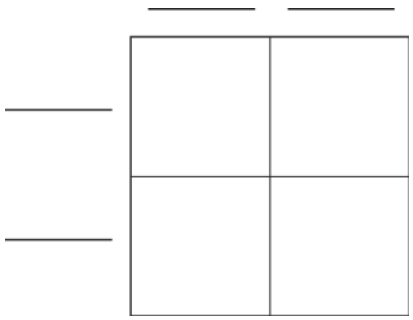
A. phenotypes O or A
B. phenotypes A or AB
C. phenotypes A, B, AB
D. phenotypes O, A, B, AB

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

27. 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.

Standard BIO.B.2.1.1

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.

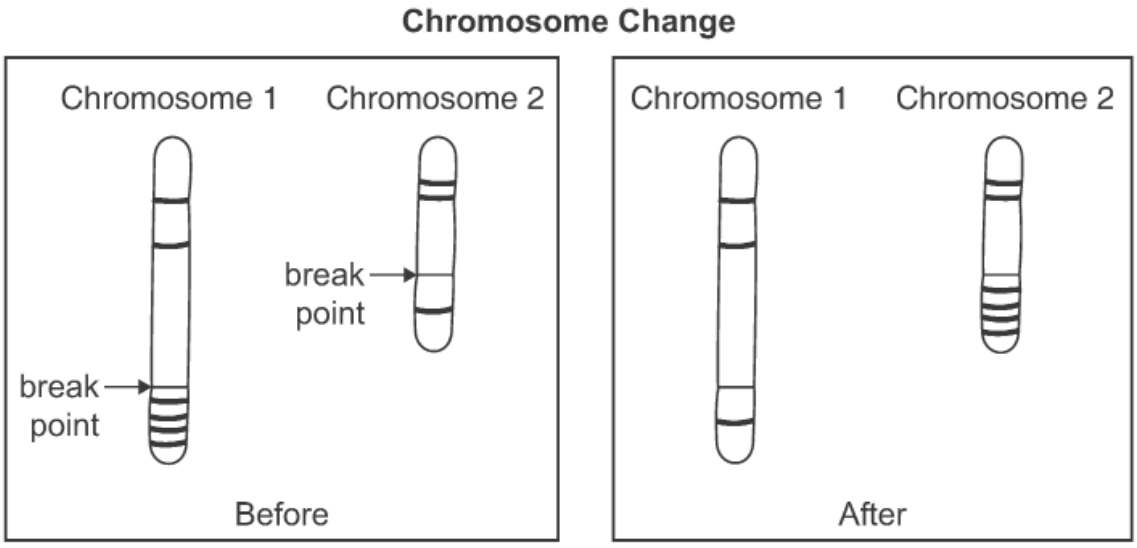


Part B: Explain how a roan calf results from one white- and one red-coated parent. In your explanation, use letters to represent genes. Be sure to indicate what colors the letters represent.

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

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

Use the diagram below to answer the question. **Standard BIO.B.2.1.2**



_____ 27. Which type of change in chromosome composition is illustrated in the diagram?

A. deletion
B. insertion
C. inversion
D. translocation

_____ 28. Which statement describes a cell process that is common to both eukaryotic and prokaryotic cells? **Standard BIO.B.2.2.1**

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.

_____ 29. 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? **Standard BIO.B.2.2.2**

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.

_____ 30. 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? **Standard BIO.B.2.3.1**

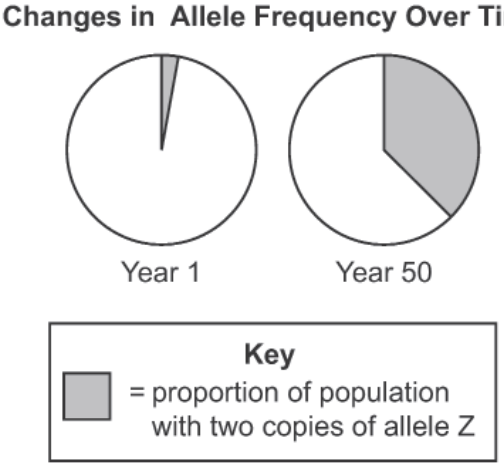
A. It was a silent mutation that caused a change in the DNA of the organism.
B. It was a silent mutation that caused a change in the phenotype of the organism.
C. It was a nonsense mutation that caused a change in the DNA of the organism.
D. It was a nonsense mutation that caused a change in the phenotype of the organism.

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

_____ 31. 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? **Standard BIO.B.2.4.1**

A. unplanned ecosystem interactions
B. reduced pesticide and herbicide use
C. improved agricultural yield and profit
D. increased genetic variation and diversity

Use the circle graphs below to answer the question. **Standard BIO.B.3.1.1**



_____ 32. 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

_____ 33. 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? **Standard BIO.B.3.1.2**

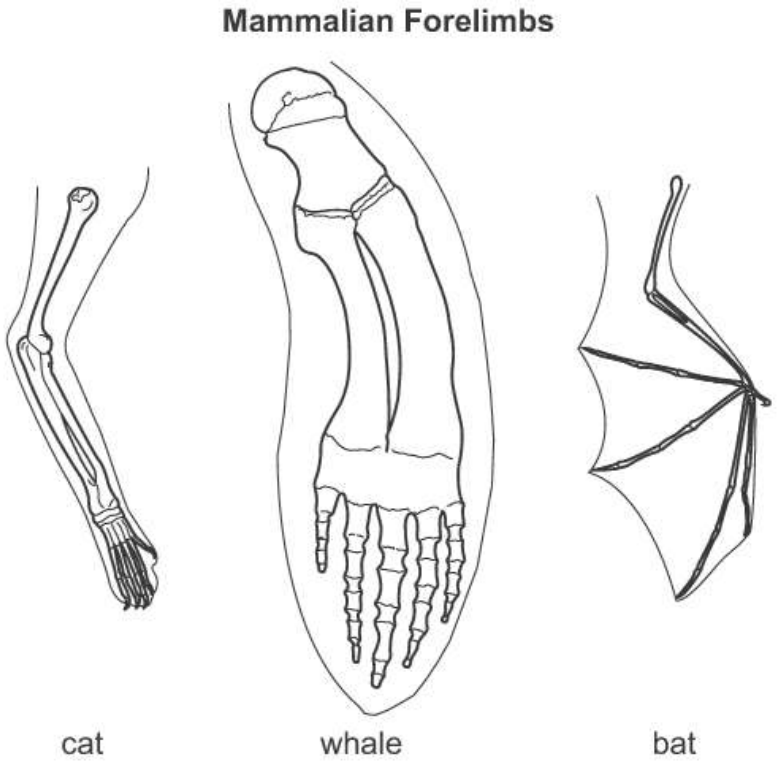
A. habitat isolation
B. gametic isolation
C. geographic isolation
D. reproductive isolation

_____ 34. A mutation occurs in the genes that code for coat color in deer. Which change will **most likely** result from this mutation? **Standard BIO.B.3.1.3**

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

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

Use the illustrations below to answer the question. **Standard BIO.B.3.2.1**



_____ 35. 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

Use the table below to answer the question. **Standard BIO.B.3.2.1**

Sequence Differences between COII Genes in Some Animals

Animal	**Number of Base Differences from a Rat**
Mouse	101
Cow	136

36. 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.

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KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

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

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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.

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Use the table below to answer the question. **Standard BIO.B.3.3.1**

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, sand	All 3 frogs are sitting on a pond bank.

_____ 37. 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.

Use the list below to answer the question. **Standard BIO.B.4.1.1**

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

_____ 38. A student wrote several observations in a field notebook. Which term **best** classifies all of the student's observations?

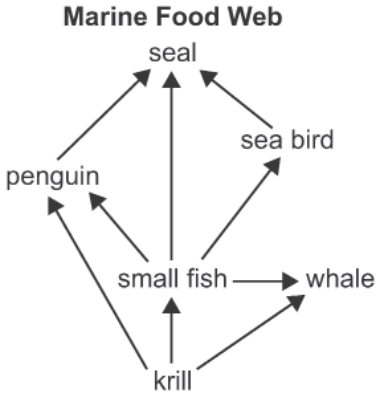
A. population
B. food chain
C. ecosystem
D. community

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

_____ 39. A researcher observing an ecosystem describes the amount of sunlight, precipitation, and type of soil present. Which factors is the researcher **most likely** describing? **Standard BIO.B.4.1.2**

A. biotic factors in a forest
B. biotic factors in a tundra
C. abiotic factors in a prairie
D. abiotic factors in an ocean

Use the diagram below to answer the question. **Standard BIO.B.4.2.1**



_____ 40. 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

_____ 41. 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? **Standard BIO.B.4.2.2**

A. predation
B. symbiosis
C. parasitism
D. competition

Standard BIO.B.4.2.3

_____ 42. 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.

_____ 43. 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? **Standard BIO.B.4.2.4**

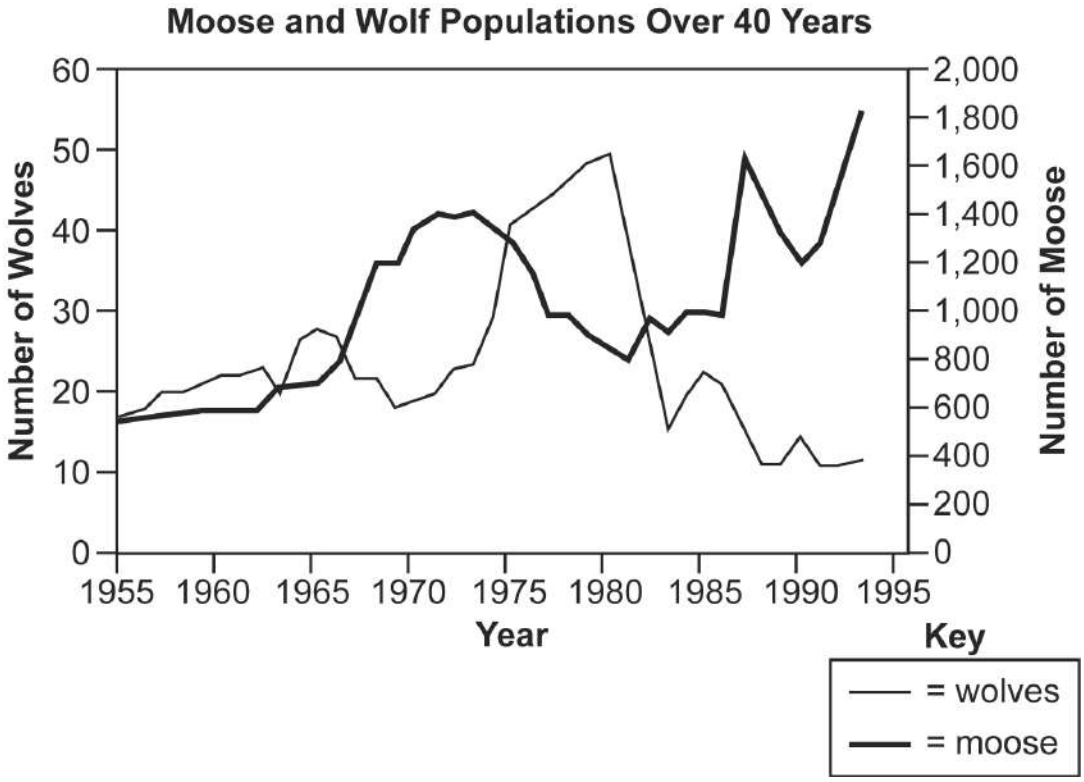
A. an increase in water level
B. an increase in water clarity
C. a reduction in dissolved oxygen needed by fish and shellfish
D. a reduction in temperature variations near the water's surface

KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

_____ 44. 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? **Standard BIO.B.4.2.5**

A. Nitrogen was a biotic factor.
B. Nitrogen was a limiting factor.
C. Nitrogen became a surplus resource.
D. Nitrogen became a selection pressure.

Use the graph below to answer the question. **Standard BIO.B.4.2.5**



45. 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.

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

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KEYSTONE MODULE B—CONTINUITY AND UNITY OF LIFE

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

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.