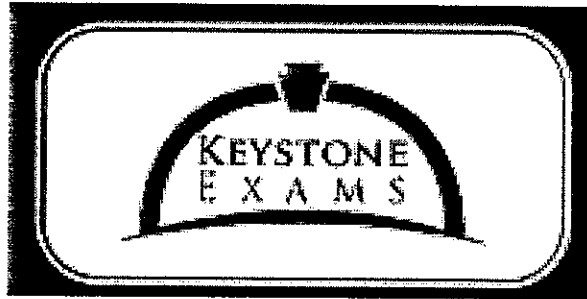


Keystone Exams: Biology

Assessment Anchors and Eligible Content Sample Questions



The Keystone Exams are end-of-course assessments designed to evaluate proficiency in academic content. Beginning in 2012-2013 the Algebra I, Literature, and Biology Keystone Exams will replace the 11th grade Pennsylvania System of School Assessment (PSSA) tests in mathematics, reading, and science for purposes of satisfying No Child Left Behind (NCLB) requirements. Therefore, all students in grade 11 must participate in the Algebra I, Literature, and Biology Keystone Exams. Additionally, students in any grade who are enrolled in a Keystone related course will participate.

Pennsylvania adopted the Common Core Standards, standards aligned with expectations for success in college and the workplace. The keystones are designed to measure these standards. The Biology Keystone Exam will include multiple-choice questions and open-ended questions.

GENERAL KEYSTONE INFORMATION:

Keystone Exam Resources on the PA Department of Education Standards Aligned System portal

- <http://www.pdesas.org/module/assessment/Keystone.aspx>

Information for Parents & Guardians from PA Department of Education

- [http://static.pdesas.org/Content/Documents/Information for Parents or Guardians PA Keystone Exams Aug 2012 final.pdf](http://static.pdesas.org/Content/Documents/Information%20for%20Parents%20or%20Guardians%20PA%20Keystone%20Exams%20Aug%202012%20final.pdf)

Student Name: _____

School Name: _____

BIOLOGY KEYSTONE REVIEW RESOURCES:

Keystone Biology Sample Questions

- <http://tesd.net/cms/lib/PA01001259/Centricity/Domain/98/Keystone%20Bio%20Sample%20Questions.pdf>

Council Rock SD, Megan Lichtenwalner's website (podcasts for each assessment anchor)

- <http://www.crsd.org/Page/31715>

Crash Course – Biology (40 short videos by topic)

- <http://www.youtube.com/course?list=EC3EED4C1D684D3ADF&feature=plcp>

Keystone Biology Flashcards (Conestoga HS – with a printable version available)

- <http://tesd.net/Page/8862>

Keystone Biology Review Guides by topic – (Hempfield HS)

- <http://www.hasdpa.net/21512042794638620/blank/browse.asp?A=383&BMDRN=2000&BCOB=0&C=64856>

Keystone Biology Resources by Module (Resources for each module compiled by Council Rock HS)

- <http://www.crsd.org/Page/31715>

SparkNotes Review of Biology

- <http://www.sparknotes.com/biology/>

Biology Review from Khan Academy (Podcasts for review of Biology topics)

- <http://www.khanacademy.org/science/biology>

Review of a Year of Biology in 12 pages

- This is titled as a review for the New York Regents Exam, but covers all essential terms for Biology in an organized fashion.
- http://newyorkscienceteacher.com/sci/files/user-submitted/LE_Must_Know_Facts.pdf

CK-12 Biology E-book

- Biology Textbook from CK-12 Foundation available free to access or download.
 - <http://www.ck12.org/book/Biology/>
- Biology Textbook from CK-12 Foundation available free to download on Amazon for Kindle.
 - http://www.amazon.com/CK-12-Biology-ebook/dp/B006VYHU84/ref=sr_1_1?s=digital-text&ie=UTF8&qid=1350411041&sr=1-1&keywords=ck-12+biology

For a student to perform at an advanced level they must be able to do the following:

Basic Biological Principles

Anchors: BIO.A.1.1, BIO.A.1.2

- Evaluate the application of scientific reasoning, inventions, tools, and new technologies in the study of biology.
- Apply the scientific concepts of hypothesis, inference, law, theory, principle, fact, and observation.
- Analyze structural and functional similarities and differences between prokaryotes and eukaryotes.
- Evaluate relationships between structures and functions at various levels of biological organization.
- Analyze the unique properties of water and explains how they support life on Earth.

1. Which characteristic is shared by **all** prokaryotes and eukaryotes?
 - a. Ability to store heredity 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?
 - a. Cell wall and nucleus
 - b. Cell wall and chloroplast
 - c. Plasma membrane and nucleus
 - d. Plasma membrane and cytoplasm

3. **Statement:** 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 size.

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

Continued. Please refer to the previous page (Question 3) for task explanation.

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

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?
- They increase the amount of energy transferred from the lungs to the blood.
 - They increase the flexibility of the lungs as they expand during inhalation.
 - They increase the volume of the lungs allowing more oxygen to be inhaled.
 - They increase the surface area of the lungs, allowing efficient gas exchange.

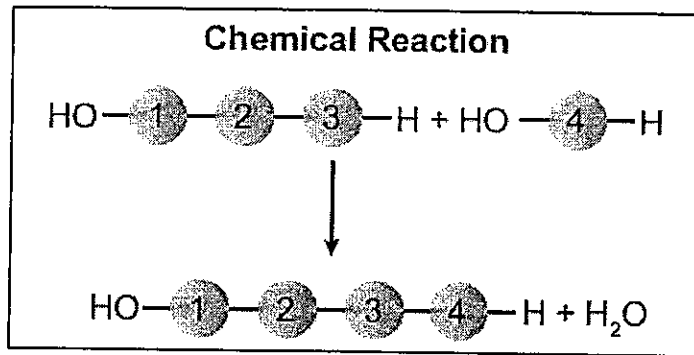
Chemical Basis for Life

Anchors: BIO.A.2.1, BIO.A.2.2, BIO.A.2.3

- Evaluate relationships between structure and function at various levels of biochemical organization.
- Analyze and predict how enzymes can regulate biochemical reactions within a cell.

5. Which statement **best** describes an effect of the low density of frozen water in a lake?
- When water freezes, it contracts, decreasing the water level in a lake.
 - Water in a lake freezes from the bottom up, killing most aquatic organisms.
 - When water in a lake freezes, it floats, providing insulation for organisms below.
 - 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?
- It forms short, simple carbon chains.
 - It forms large, complex, diverse molecules.
 - It forms covalent bonds with other carbon atoms.
 - It forms covalent bonds that can exist in a single plane.

7. Use the diagram below to answer the question.



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?
- 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. **Statement:** 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. Please refer to the previous page (Question 9) 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.

10. Substance A is converted to substance B in a metabolic reaction. Which statement **best** describes the role of an enzyme during this reaction?
- It adjusts the pH of the reaction medium.
 - It provides energy to carry out the reaction.
 - It dissolves substance A in the reaction medium.
 - It speeds up the reaction without being consumed.
11. A scientist observes that, when the pH of the environment surrounding the enzyme is changed, the rate of the enzyme catalyzes a reaction greatly decreases. Which statement **best** describes how a change in pH can affect an enzyme?
- A pH change can cause the enzyme to change its shape.
 - A pH change can remove energy necessary to activate an enzyme.
 - A pH change can add new molecules to the structure of the enzyme.
 - A pH change can cause an enzyme to react with a different substrate.

- Analyze cell structures and processes that transform energy in living systems.

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

- ATP to light
- Light to chemical
- Heat to chemical
- Chemical to chemical

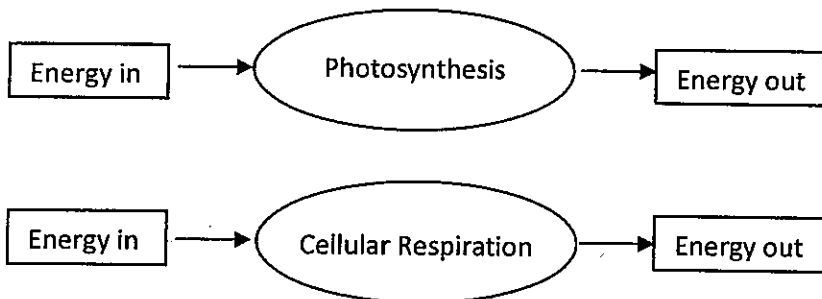
13. Photosynthesis and cellular respiration are two major processes of carbon cycling in living organisms. Which statement correctly describes one similarity between photosynthesis and cellular respiration?

- Both occur in animal and plant cells.
- Both include reactions that transform energy.
- Both convert light energy into chemical energy.
- 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?

- ATP
- ADP
- Catalase
- Amylase

15. 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. Please refer to the previous page (Question 15) for task explanation.

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

Homeostasis and Transport

Anchors: BIO.A.4.1, BIO.A.4.2

- Analyze and predict how cell structures transport material into, out of, and within a cell.
- Analyze how organisms use feedback and response mechanisms to maintain homeostasis.

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?

- Orientation of cholesterol in the plasma membrane
- Concentration gradient across the plasma membrane
- Configuration of phospholipids in the plasma membrane
- 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 membrane?

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

18. **Statement:** Some animals can produce a potassium ion concentration inside their cells that is twenty times greater than that of their environment. This ion concentration 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.

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

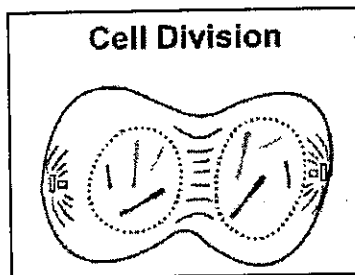
19. The rough endoplasmic reticulum and Golgi apparatus work together in eukaryotic cells. What is the one way that the rough endoplasmic reticulum assists the Golgi apparatus?
- It assembles nucleic acids from monomers.
 - It breaks down old, damaged macromolecules.
 - It packages new protein molecules into vesicles.
 - 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?
- Using camouflage to avoid predators
 - Feeding at night to regulate body temperature
 - Moving into deeper water to regulate metabolic wastes
 - Exchanging gases through its gills to regulate oxygen levels

Cell Growth and Reproduction

Anchors: BIO.B.1.1, BIO.B.1.2

- Compare and analyze the three stages and the outcomes of the cell cycle.

21. Use the illustration below to answer the question.



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

- The cell is in prophase of mitosis because the number of chromosomes has doubled.
 - The cell is in prophase I of meiosis because the number of chromosomes has doubled.
 - The cell is in telophase of mitosis because the cell is separating and contains two copies of each chromosome.
 - 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 animals and plant cells divide. Which statement **best** describes a difference between mitosis and meiosis?
- Meiosis is a multi-step process.
 - Mitosis occurs only in eukaryotic cells.
 - Meiosis is used in repair of an organism.
 - Mitosis produces genetically identical daughter cells.

23. **Statement:** Patau syndrome can be 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 separate.

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

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.

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

- The replacement of nitrogen thymine with uracil
- Enzymes quickly linking nitrogen bases with hydrogen bonds
- The synthesis of unique sugar and phosphate molecules for each nucleotide
- 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?

- Red and white alleles present on one chromosome
- Red and white alleles present on two chromosomes
- A red allele present on both homologous chromosomes
- A red allele present on at least one of two homologous chromosomes

Genetics

Anchors: BIO.B.2.1, BIO.B.2.2, BIO.B.2.3, BIO.B.2.4

- Analyze and predict how genetic information is inherited, altered, and expressed.
- Analyze the processes associated with protein synthesis.
- Predict the impacts of genetic engineering on medicine, forensics, and agriculture.

26. Use the table below to answer the question.

Blood Types

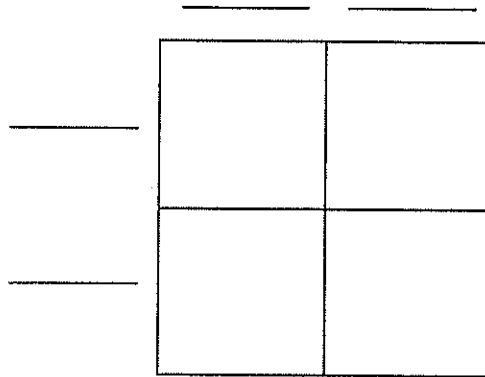
Genotypes(s)	Phenotype
ii	O
$I^A I^A$, $I^A i$	A
$I^B I^B$, $I^B i$	B
$I^A I^B$	AB

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?

- Phenotypes O or A
- Phenotypes A or AB
- Phenotypes A, B, AB
- Phenotypes O, A, B, AB

27. **Statement:** 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 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.

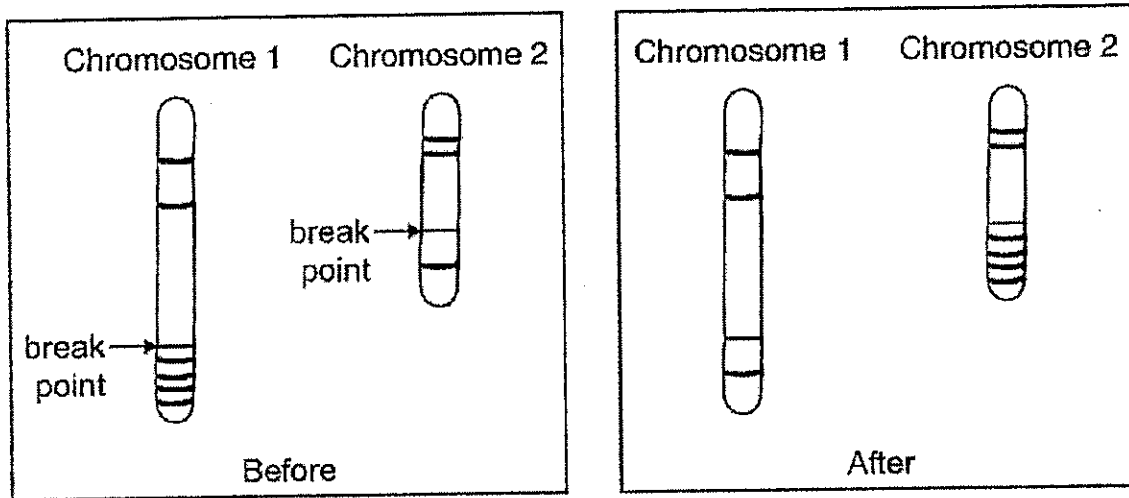


Part B: Explain how a roan calf results from one white- and one red-coated parent. In your explanation, use letters to represent genes. Be sure to indicate what colors the letters represent.

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

28. Use the diagram below to answer the question.

Chromosome Change



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

- Deletion
 - Insertion
 - Inversion
 - Translocation
29. Which statement describes a cell process that is common to both eukaryotic and prokaryotic cells?
- Both cell types carry out transcription in the nucleus.
 - Both cell types use ribosomes to carry out translation.
 - Both cell types assemble amino acids to carry out transcription.
 - Both cell types carry out translation in the endoplasmic reticulum.
30. 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?
- It stores all proteins for later use.
 - It provides an attachment site for larger organelles.
 - It aids in the production membrane and secretory proteins.
 - It stores amino acids required for the production of all proteins.
31. 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?
- It was a silent mutation that caused a change in the DNA of the organism.
 - It was a silent mutation that caused a change in the phenotype of the organism.
 - It was a nonsense mutation that caused a change in the DNA of the organism.
 - It was a nonsense mutation that caused a change in the phenotype of the organism.

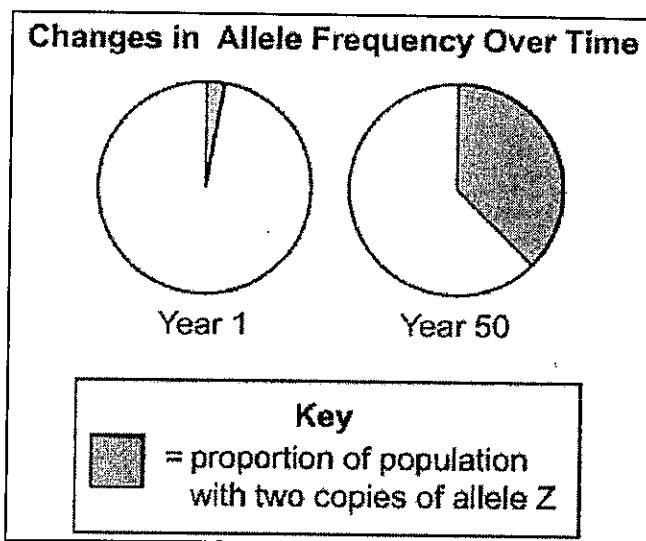
32. Genetic engineering has led to genetically modified plants that resist insect pests and bacterial and fungal infections. Which outcome would **most likely** be a reason why some scientists recommend caution in planting genetically modified plants?
- Unplanned ecosystem interactions
 - Reduced pesticide and herbicide use
 - Improved agricultural yield and profit
 - Increased genetic variation and diversity

Theory of Evolution

Anchors: BIO.B.3.1, BIO.B.3.2, BIO.B.3.3

- Evaluate the mechanisms and sources of evidence related to the theory of evolution.

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



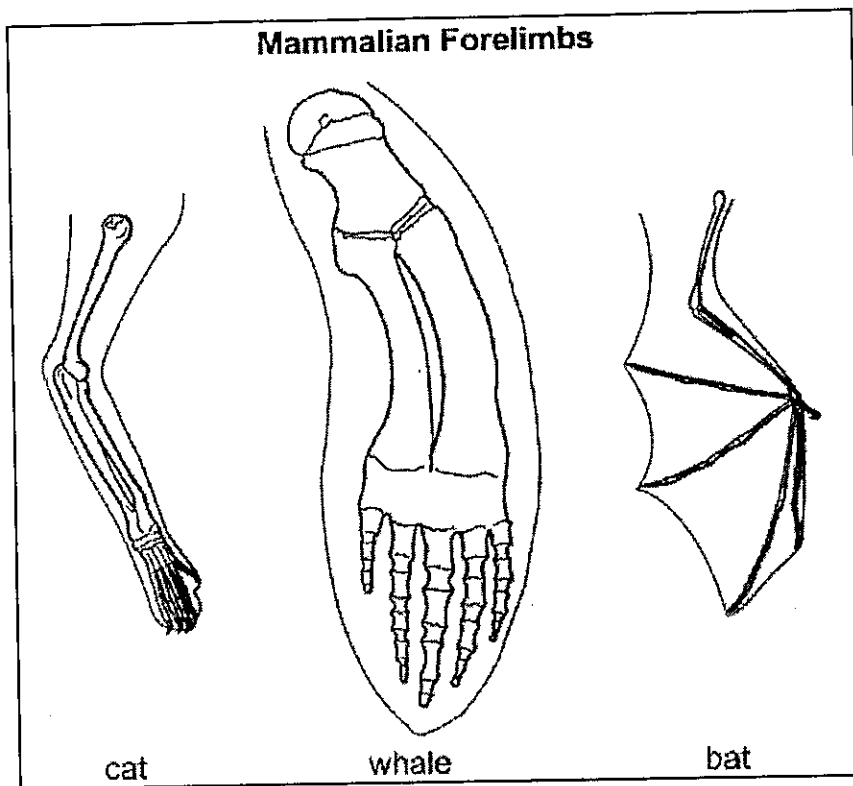
The graphs illustrate change in a lizard population over time. Which process **most likely** led to the change in the lizard population?

- Natural selection acting on a harmful trait
 - Natural selection acting on a beneficial trait
 - Natural selection acting on a dominant trait
 - Natural selection acting on a recessive trait
34. In North America, the eastern spotted skunk mates in late winter, and the western spotted skunk mates in the 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?
- Habitat isolation
 - Gametic isolation
 - Geographic isolation
 - Reproductive isolation

35. 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

36. Use the illustrations below to answer the question.



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 the forelimbs?

- a. Changes in muscle structure
- b. Changes in genetic codes
- c. Trait formation due to behaviors
- d. Development of vestigial structures

37. 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.

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.

38. Use the table below to answer the question.

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?

- The frogs living in the pond represent a population.
- Water is an abiotic component in the pond ecosystem.
- If the fish are given more food, then they will be happier.
- If the frogs are startled, then they will jump into the water.

Ecology

Anchors: BIO.B.4.1, BIO.B.4.2

- Compare ecological levels of organization in the biosphere.
- Analyze interactions and relationships in an ecosystem as they relate to energy flow, biotic components, biogeochemical cycles, and limiting factors.
- Predict changes in an ecosystem in response to natural and human disturbances.

39. Use the list below to answer the question.

Observations
<ul style="list-style-type: none">• two grey wolves• five moose• several species of conifer trees• large granite rock• shallow pond

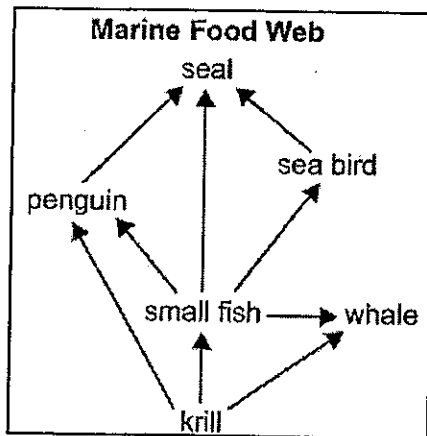
A student wrote several observations in field notebook. Which term **best** classifies all of the student's observations?

- Population
- Food chain
- Ecosystem
- Community

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

- Biotic factors in a forest
- Biotic factors in a tundra
- Abiotic factors in a prairie
- Abiotic factors in an ocean

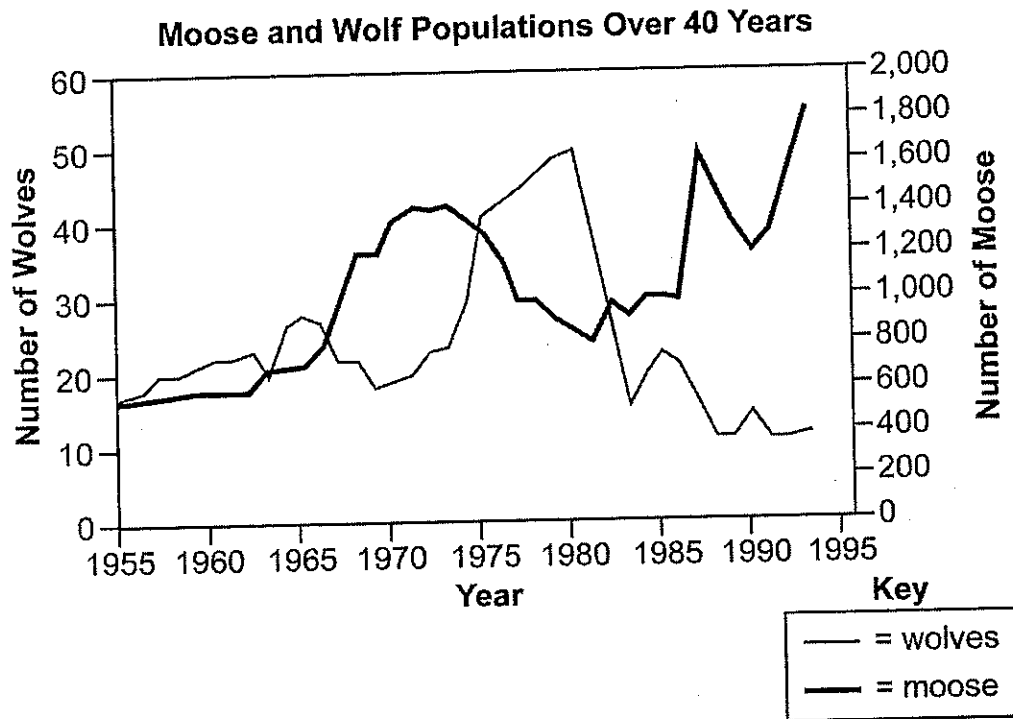
41. Use the diagram below to answer the question.



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
42. 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
43. 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.
44. 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 waters surface
45. 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 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.

46. 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.

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

2012 Biology Keystones Answer Key

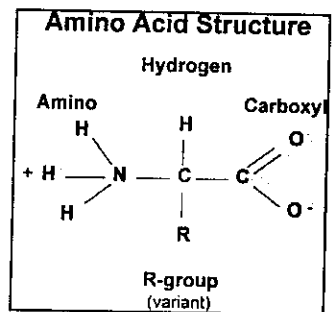
- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| 1. A | 17. B | 33. B |
| 2. D | 18. *See short answer section | 34. D |
| 3. * See short answer section | 19. C | 35. C |
| 4. D | 20. D | 36. C |
| 5. C | 21. C | 37. *See short answer section |
| 6. B | 22. D | 38. D |
| 7. D | 23. *See short answer section | 39. C |
| 8. B | 24. D | 40. C |
| 9. * See short answer section | 25. D | 41. D |
| 10. D | 26. D | 42. A |
| 11. A | 27. *See short answer section | 43. B |
| 12. B | 28. D | 44. C |
| 13. B | 29. B | 45. B |
| 14. A | 30. C | 46. *See short answer section |
| 15. *See short answer section | 31. A | |
| 16. B | 32. A | |

Short Answer Section

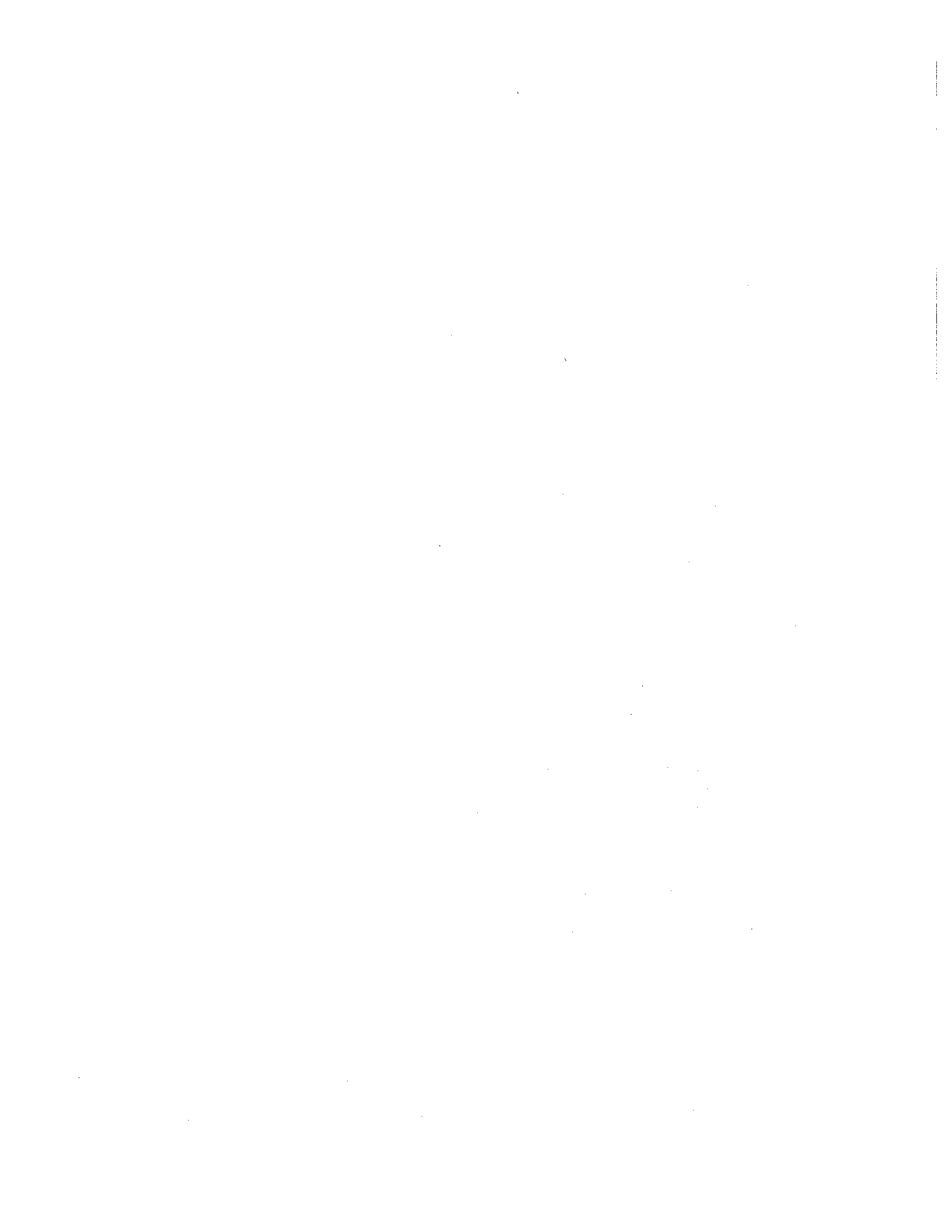
3. A: Eukaryotes – have a nucleus, contain membrane-bound organelles
 Prokaryotes – Lack a nucleus, do not have membrane-bound organelles
 B: They lack more complex structures such as membrane-bound organelles and a nucleus.
 C: Both eukaryotic and prokaryotic cells have cell (plasma) membranes for protection and to regulate what enters and exits.

9. A: The general composition of a protein molecule is a string of amino acids which form a polypeptide. The amino acids will be attracted to each other or repelled depending on their R group interactions. The polypeptide will form a globular shape that is specific to its function.

- B: Proteins are globular and specific to its function. Proteins are made up of Carbon, Hydrogen, Oxygen, and Nitrogen. Carbohydrates are made up of ringed monomers like glucose. Carbohydrates are made up of Carbon, Hydrogen, and Oxygen in a fixed ratio of 1:2:1.



- C: The functions of proteins include enzymes, storage, communication, and defense. The functions of carbohydrates include short and long term energy as well as structure.
15. A: Photosynthesis : $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
 Cellular respiration: $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- B: The products of photosynthesis are the reactants of cellular respiration. Photosynthesis stores energy in the form of glucose, while cellular respiration releases the energy stored in glucose to create ATP (cellular energy).
18. A: Proteins embedded in the plasma membrane act as pumps fueled by cellular energy ATP. These proton pumps use active transport to create a difference in concentration on either side of the plasma membrane
- B: The process of active transport is the movement of an ion or substance across a semi-permeable membrane against the concentration gradient through a membrane protein. The binding of the substance to the membrane protein changes its shape to allow the movement of the Sodium ion out, and the Potassium ion in.



C: Another process by which substances move across the plasma membrane is facilitated diffusion. Facilitated diffusion is the movement of large or charged substances through a membrane protein with the concentration gradient. (You could also compare active transport to any other type of membrane transport you learned about during Biology I).

23. A: Anaphase I or Anaphase II

B: In Meiosis I, homologous chromosomes separate with sister chromatids still in tact. In Meiosis II, sister chromatids are separated. Similarly, sister chromatids are separated during Mitosis.

C: The failure of chromosomes to separate during Meiosis will have much more severe effects on the individual than the failure of chromosomes to separate (nondisjunction) during Mitosis. If nondisjunction occurs during Meiosis, the resulting offspring may have potential serious genetic conditions. Whereas, if nondisjunction occurs during Mitosis, most likely the cell will be marked for apoptosis (cell death) and the individual will not be affected.

27. A: A cross to produce Roan cattle offspring only. Roan is a term that means both red and white (like a black and white dairy cow).

KEY: W = white cattle R= red cattle RW= roan cattle

	W	W
R	RW	RW
R	RW	RW

B: Cross of a White and Red coated cattle.

	W	W
R	RW	RW
R	RW	RW

C: Cross of two Roan cattle.

	R	W
R	RR	RW
W	RW	WW

37. A: Based on the data, mice are more closely related to rats than cows because there are a higher number of base differences in cows than mice.

B: Different organisms sharing a common gene such as COII supports the theory of evolution because the common ancestor of these species must have had this gene.

C: A monkey and a rat have fewer base differences for the COII gene than a monkey and a mouse, therefore the monkey and the rat must be more closely related.

46. A: The limiting factor of the moose is the number of wolves.

B: A likely reason for the rapid increase of the wolf population between 1975 and 1980 is the high population of moose. The higher the population of moose, the more food available and thus higher survival and reproduction of wolves.

C: After 1994, the number of wolves should increase because of the abundance of prey, the moose.

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.



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Assessment Anchor & Eligible Content Glossary

Abiotic	A term that describes a nonliving factor in an ecosystem.
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.
Bioenergetics	The study of energy flow (energy transformations) into and within living systems.

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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.
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.

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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).
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 anaphase 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.
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.
DNA Replication	The process in which DNA makes a duplicate copy of itself.

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Dominant Inheritance	A pattern of inheritance in which the phenotypic effect of one allele is completely expressed within a homozygous and heterozygous genotype.
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.
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.

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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.
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.

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Frame-shift Mutation
The addition (insertion mutation) or removal (deletion mutation) of one or more nucleotides that is not indivisible by three, therefore resulting in a completely different amino acid sequence than would be normal. The earlier in the sequence nucleotides are added or removed, the more altered the 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.

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.

Habitat An area that provides an organism with its basic needs for survival.

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.

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.

Inheritance The process in which genetic material is passed from parents to their offspring.

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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.
Isolating Mechanisms	Features of behaviors, morphology, or genetics which serve to 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; ecological 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 sperm transfer during an attempted mating; and gametic incompatibility, when there is sperm transfer without fertilization occurring).
Law (Scientific)	If mating can take place, there are four factors that prevent hybrid viability: zygotic mortality (fertilization but no zygote), hybrid inviability (embryo is not viable), hybrid sterility (resulting adult is sterile), and hybrid breakdown (first generation is viable but future generations are not). 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 or physical 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.
Macromolecule	A polymer with a high molecular mass. Within organisms there are four main groups: carbohydrates, lipids, proteins, and nucleic acids.
Mechanism (Scientific)	The combination of components and processes that serve a common function.

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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.
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).
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 sister chromatids fail to separate during and after mitosis or meiosis.

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Nonnative Species	A species normally living outside a distribution range that has been introduced through either deliberate or accidental human activity; also can be known as introduced, invasive, alien, nonindigenous, or exotic.
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.
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 and 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.

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.

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.

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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 and 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.

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 on 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 carried by either the male or female parent (e.g., color blindness and sickle-cell anemia).

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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.
Succession	A series of predictable and orderly changes within an ecosystem over time.
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 describes 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.
Tissue	An anatomical unit composed of cells organized to perform a similar function.

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Transcription

The process in which a strand of messenger RNA (mRNA) is synthesized by using the genetic information found on a strand 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.

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.