



Mississippi Academic Assessment Program (MAAP)

Biology

PRACTICE TEST

Version 3: Updated art in Question 2 and Query in Question 25

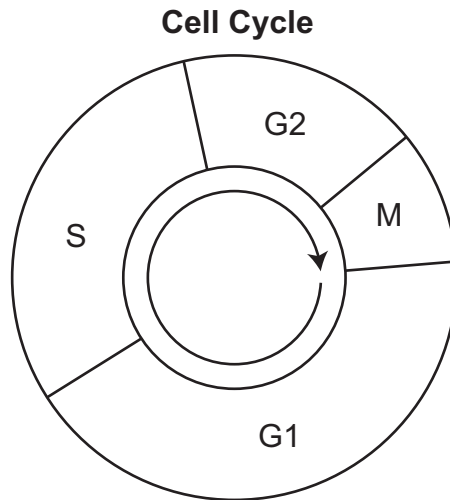
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The Biology Practice Test is a useful tool for Mississippi educators to use in preparing students for the format of the Mississippi Academic Assessment Program for Science. The items were written and aligned to the 2018 Mississippi College- and Career-Readiness Standards for the Science. **This document contains 25 Biology items.**

Use the scenario to answer the next two questions.

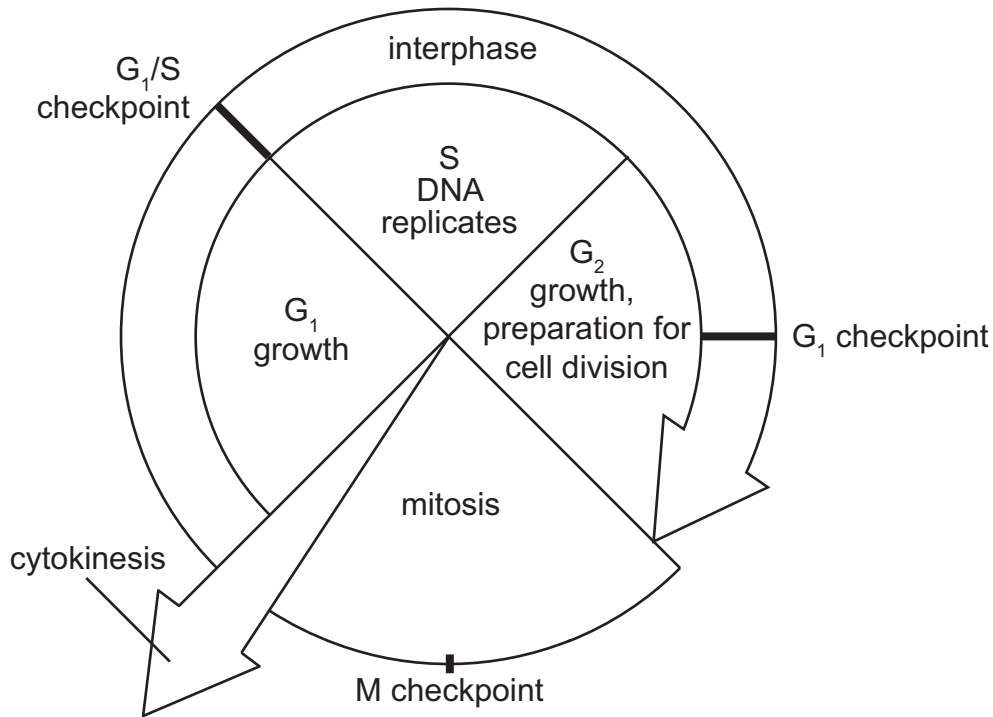
The Cell Cycle

Cells use a regulated cell cycle to grow and reproduce. Cellular replication, or cellular division, is one part of that cell cycle.



The cell cycle is highly regulated, with numerous checkpoints throughout the process. When mistakes are detected, they are usually corrected immediately. Understanding the cell cycle has helped doctors treat many human disorders. Scientists are investigating how to control this cycle in an attempt to prevent diseases and repair damaged tissues and organs. The diagram above shows that the cell cycle is divided into different phases.

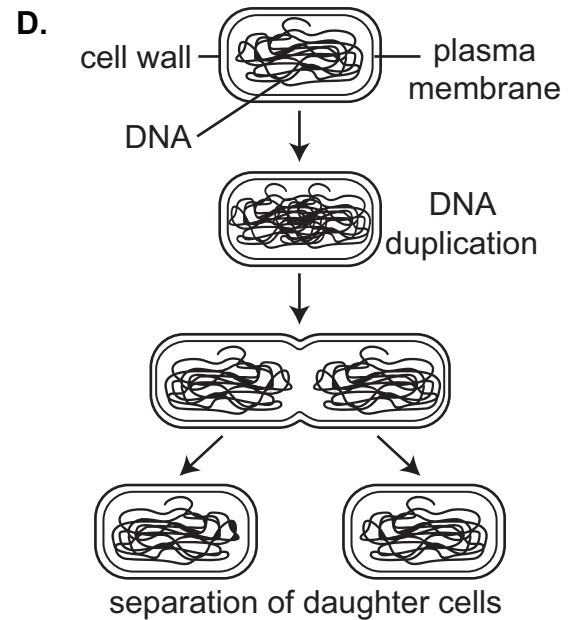
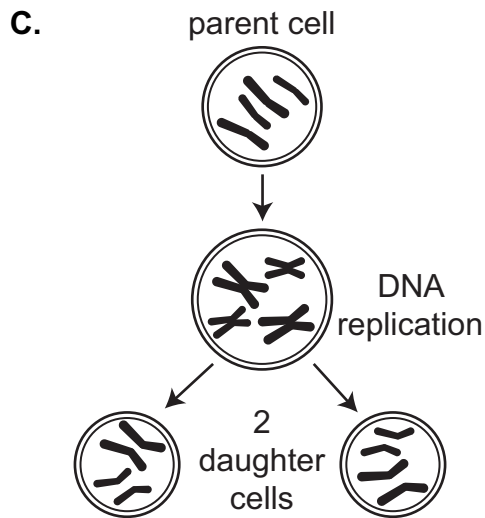
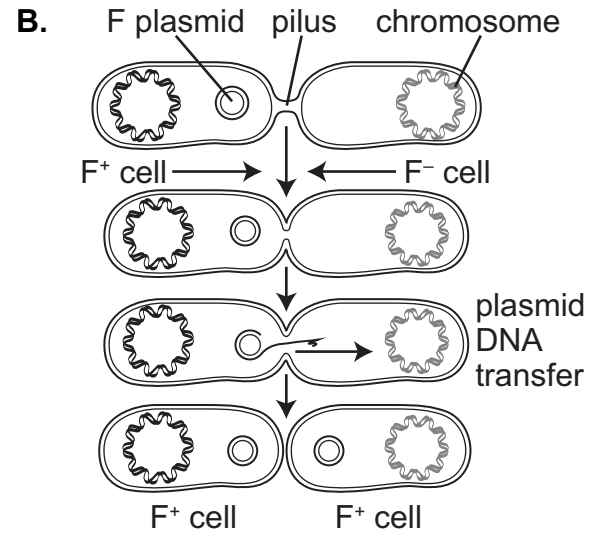
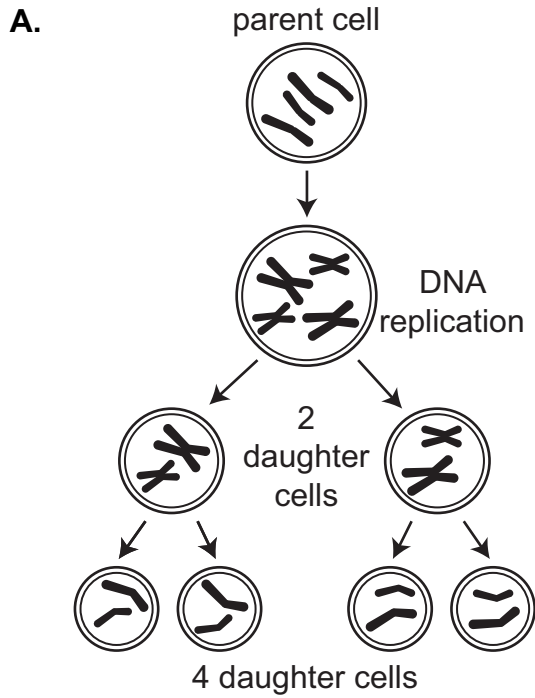
1. The diagram below shows the occurrence of three checkpoints in the cell cycle. At each checkpoint, the cell determines whether conditions are favorable for cell division to continue. If the conditions are not favorable, a protein called p53 stops the cell cycle and causes the cell to die.



Which statement describes what would **most likely** happen if p53 mutated and could not perform its task?

- A. The cell would divide without control and lead to the formation of cancer.
- B. The cell would regain control of the cell cycle by using a type of lipid instead of p53.
- C. The cell would divide without control and produce new cells that make p53 without the mutation.
- D. The cell would regain control of the cell cycle by adding an additional checkpoint at cytokinesis.

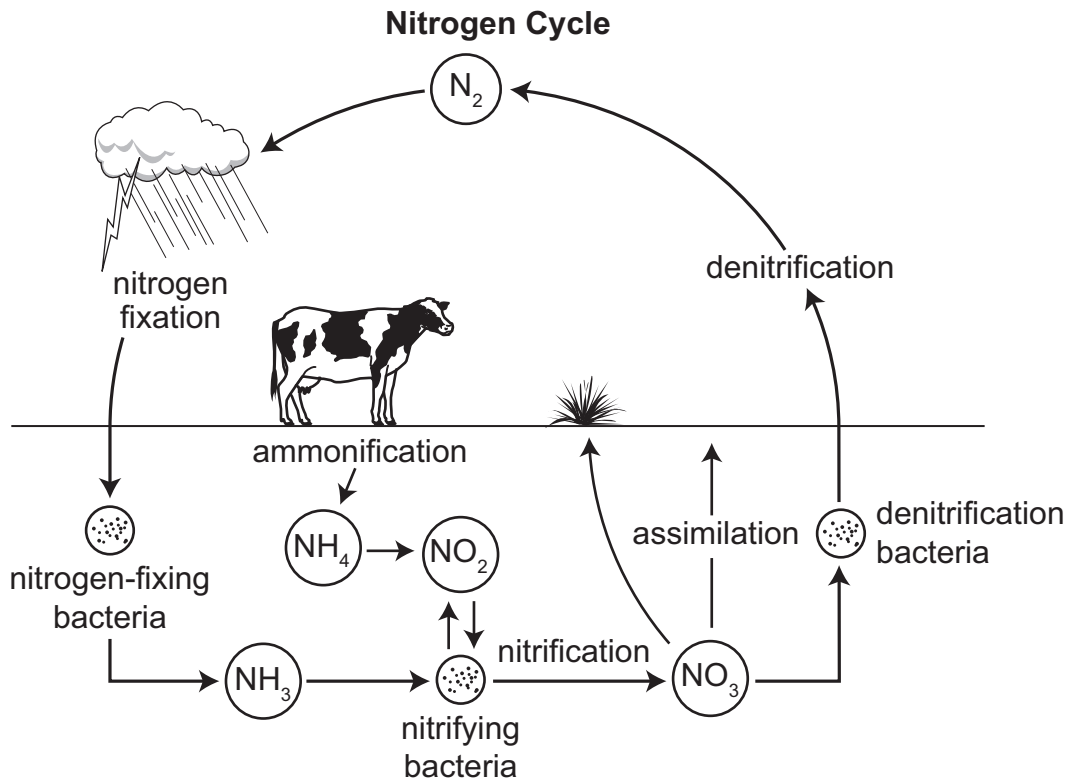
2. After an injury, the human body begins a process of cell division to repair damaged tissues. Which model **best** represents the cellular process for tissue repair?



3. In dogs, merle coloring occurs when a dog has solid-colored patches of different colors in its coat. The gene for merle-colored coats (M) is dominant over the gene for solid-colored coats (m). Two heterozygous merle-colored dogs mate and produce offspring. Record the percentage of the offspring expected to have solid-colored coats.

_____ %

4. Nitrogen is a nutrient that is critical for the survival of living organisms. The diagram represents the nitrogen cycle.



In recent years, soil tests have shown the presence of increasing amounts of various antibiotics. Antibiotics kill organisms such as bacteria. How would increasing concentrations of antibiotics in soil **most likely** affect the nitrogen cycle?

- A. by causing a reduction in nitrogen-fixation reactions
- B. by increasing the rate of return of nitrogen to the atmosphere
- C. by providing nitrogen compounds and eliminating the need for nitrogen-fixing bacteria in the soil
- D. by increasing the rate of nitrogen fixation so that excess nitrates and ammonia are released into the atmosphere

5. An mRNA codon chart is shown below.

Codon Chart					
Second Position					
	U	C	A	G	
First Position	U UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA stop UAG stop	UGU } Cys UGC } UGA stop UGG Trp	U C A G
	C CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G
Third Position					

An original DNA strand had the following sequence.

Sequence: TAC TTT GGC ATG CCT CGC AAA

Based on the codon chart, which DNA sequence is an example of a silent mutation to this DNA strand?

- A. TAC TTT GGG ATG CCT CGC AAA
- B. TAC TTT GGC ATC CCT CGC AAA
- C. TAG TTT GGC ATG CCT CGC AAA
- D. TAC TTT GGC ATG CCT CGC AAA

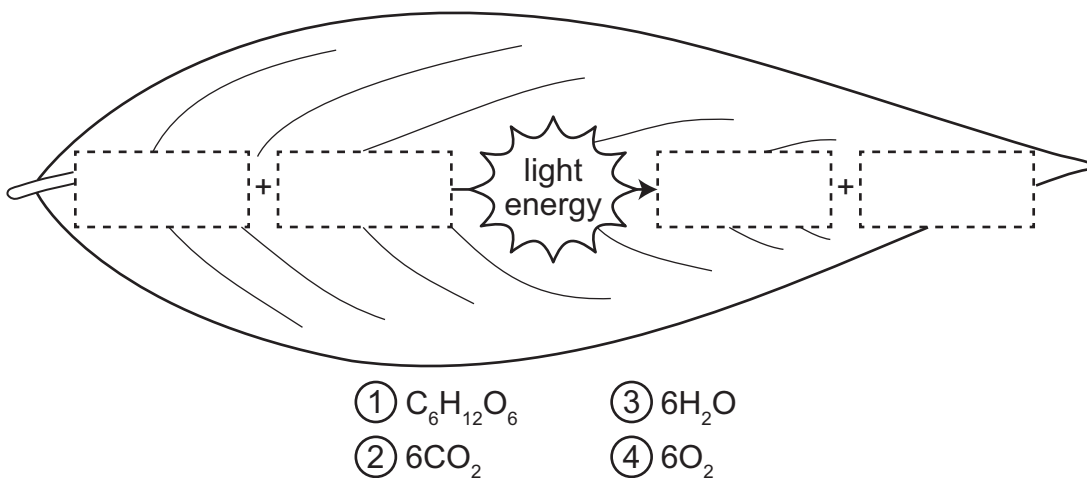
6. The table includes descriptions of four different types of relationships between organisms. Record the number of each relationship in the table to correctly identify which type of relationship each description represents.

Description	Type of Relationship
A king snake stalks a small mouse before constricting it and eating it whole.	
A tapeworm enters a host's digestive system and feeds on digested food.	
An oxpecker bird lands on the back of a rhinoceros and feeds on parasites while being protected from predators.	
Barnacles grow on the skin of a whale, leaving it unharmed, while filtering food as the whale swims.	

① commensalism ② predation ③ mutualism ④ parasitism

7. The model represents photosynthesis. Write the number of each product and reactant in a correct position in the model to **best** represent the process of photosynthesis.

Photosynthesis Model



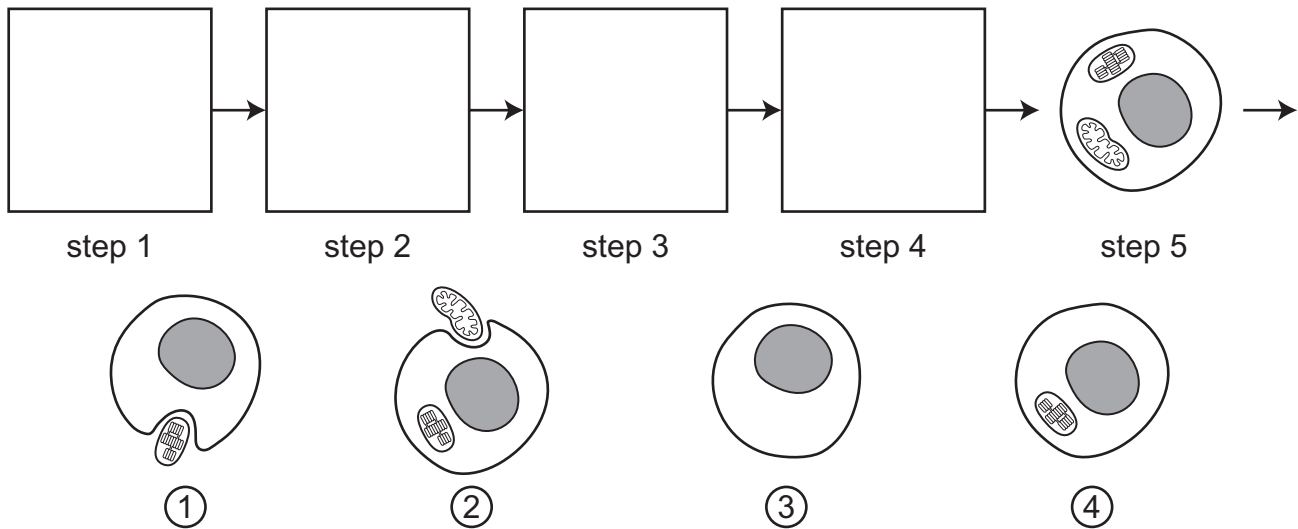
8. A group of researchers performed an investigation in which they grew two species of microscopic aquatic organisms called paramecia in test tubes. The researchers found that both species grew better alone. When grown together, the growth of one species (A) declined and the growth of the other species (B) increased until it reached capacity.

Which statement **best** describes what would likely happen to these species if they were grown in a lake instead of a test tube?

- A. Over time, species A would outcompete species B for food.
- B. Over time, species A would evolve so that it could compete with species B.
- C. Over time, species B would survive and pass on its traits to future offspring.
- D. Over time, species B would exhaust its food source and begin to rapidly decline.

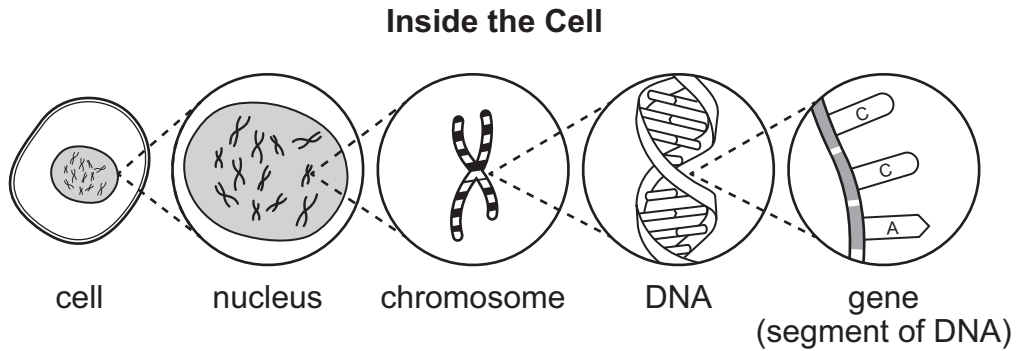
9. The evolution of eukaryotic cells is explained by the endosymbiotic theory. Write the number of each image to the correct box to show the sequence of evolution of eukaryotic cells.

Evolution of Eukaryotic Cells



10. A student investigates patterns of flower color in a certain species of plant. When a plant with red flowers is crossed with a plant with white flowers, all the offspring show pink flowers. Which pattern of inheritance describes the pink flower color?
- A. codominance
 - B. X-linked dominance
 - C. autosomal dominance
 - D. incomplete dominance

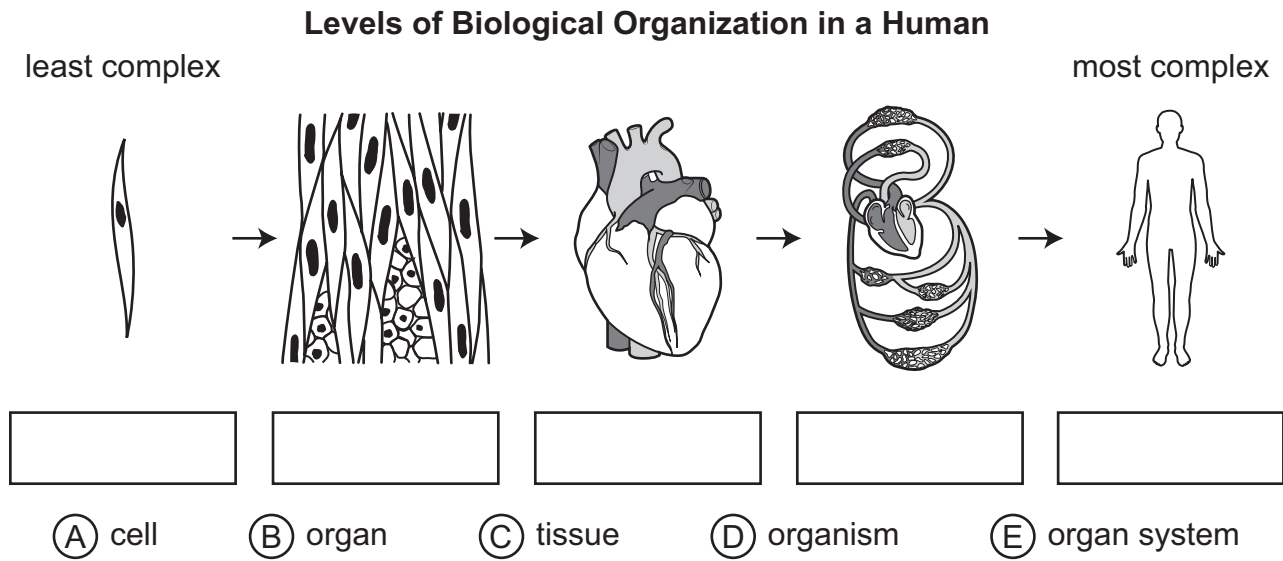
11. The model shows structures within the nucleus of a cell.



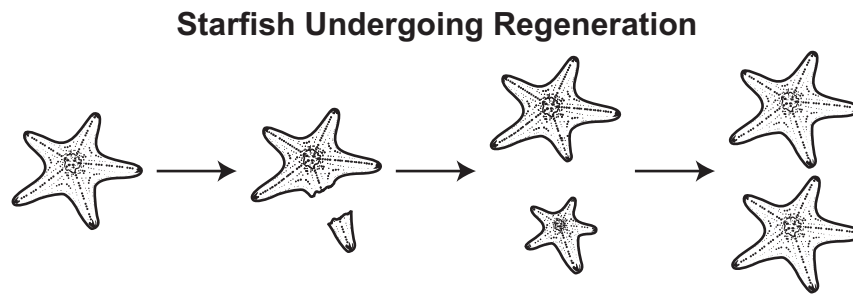
Which **two** statements **best** explain a relationship between these structures?

- A. The chromosome is made up of several DNA strands that have embedded proteins.
- B. The chromosome is made up of tightly wound genes that are made up of DNA molecules.
- C. The gene has nucleotides that code for several proteins that make up the DNA molecule.
- D. The genetic code specific for a protein is carried in the genes that make up the DNA molecule.
- E. The nucleus contains the chromosomes, which have the genetic code and are sent to the DNA molecule.
- F. The DNA molecule is made up of nucleotides, and the gene is a section of DNA that contains nucleotides that code for a specific protein.

12. The model shows the levels of biological organization from least complex to most complex in a human. Write each label in the correct box.



13. The model shows a starfish undergoing the process of regeneration.



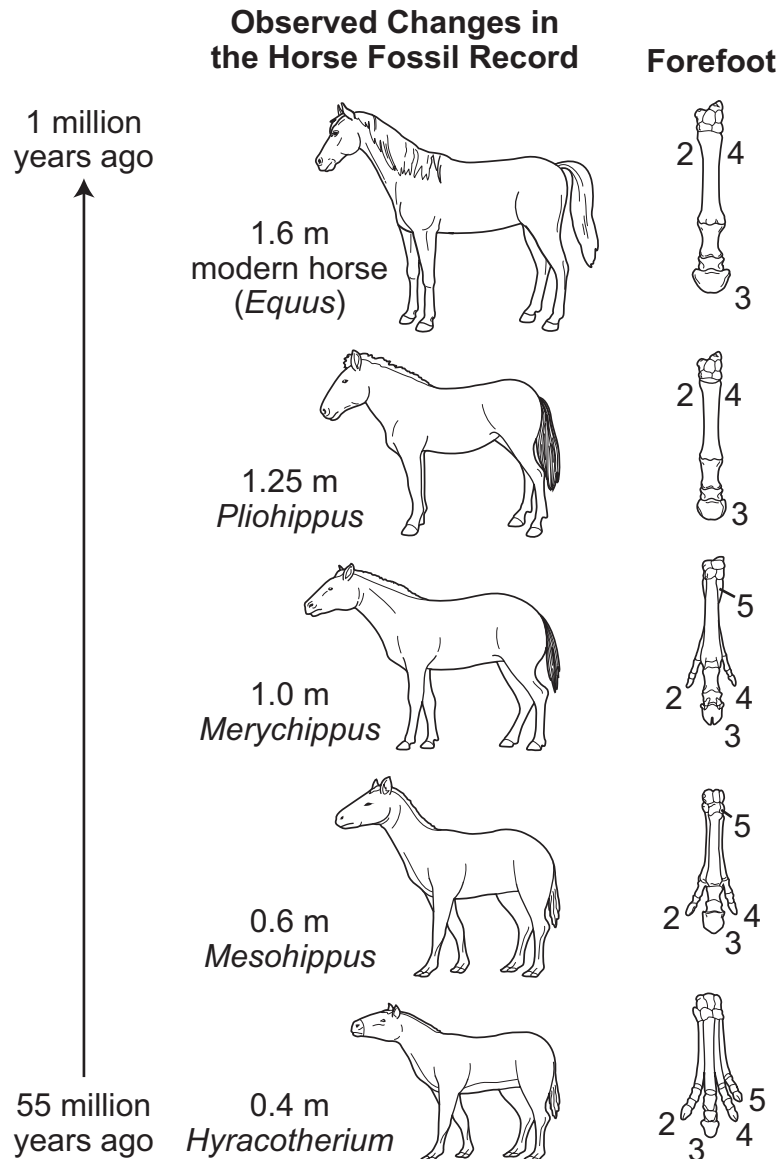
Part A: Circle one word or phrase in each set of parentheses to **best** describe the process of regeneration.

Regeneration is a form of (sexual / asexual) reproduction. Following regeneration, the DNA of the offspring is (identical to / different from) the DNA of the parent.

Part B: Which statement **best** describes a **negative** effect of regeneration on a starfish population?

- A. The genetic variation within the starfish population decreases.
- B. The number of genetic mutations in the starfish population increases.
- C. Regenerated starfish reproduce less often than starfish that have not regenerated.
- D. Regenerated starfish are eaten by predators more often than starfish that have not regenerated.

14. The fossil record contains evidence of physical changes in horses over time. The diagram shows some of the changes in horse height and number of toes per forefoot as observed in the fossil record.

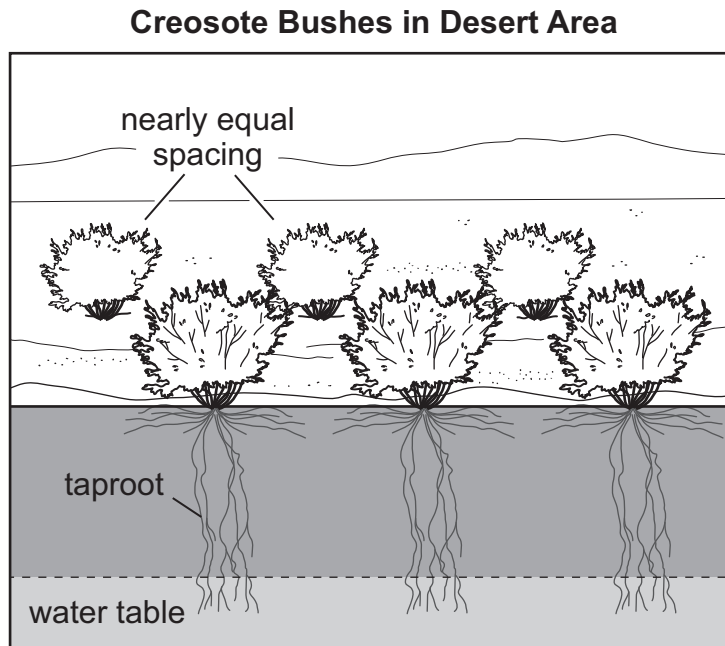


Part A: Circle a word or phrase in each set of parentheses to **best** describe the changes observed in horse height and number of toes per forefoot over time.

Compared to *Hyracotherium*, the height of modern horses has (decreased / increased / stayed the same) and the number of toes has (decreased / increased / stayed the same).

Part B: Using the evidence shown, record the number to identify the toe that likely had the **most** impact on the evolution of the forefoot of horses.

15. Creosote bushes are drought-tolerant plants that commonly grow in desert regions of North America.



While many desert plants have fibrous roots near the surface, creosote bushes have deep taproots to collect water far below the surface. Creosote bushes also grow in a grid-like pattern, with nearly equal spacing between each plant. Older creosote bushes release toxins from their roots that kill any young and establishing plants—even creosote seedlings.

Which statement describes the **most likely** reason that creosote bushes release toxins that harm other plants?

- A. Toxins increase the need for pollinators and decrease the bushes' ability to reproduce.
- B. Toxins increase the bushes' ability to grow taller and increase their ability to reproduce.
- C. Toxins decrease competition from neighboring plants and increase the bushes' ability to reproduce.
- D. Toxins decrease the bushes' ability to photosynthesize and decrease their ability to reproduce.

16. A student is setting up an investigation of cellular respiration in plant cells. The materials for the investigation are listed.

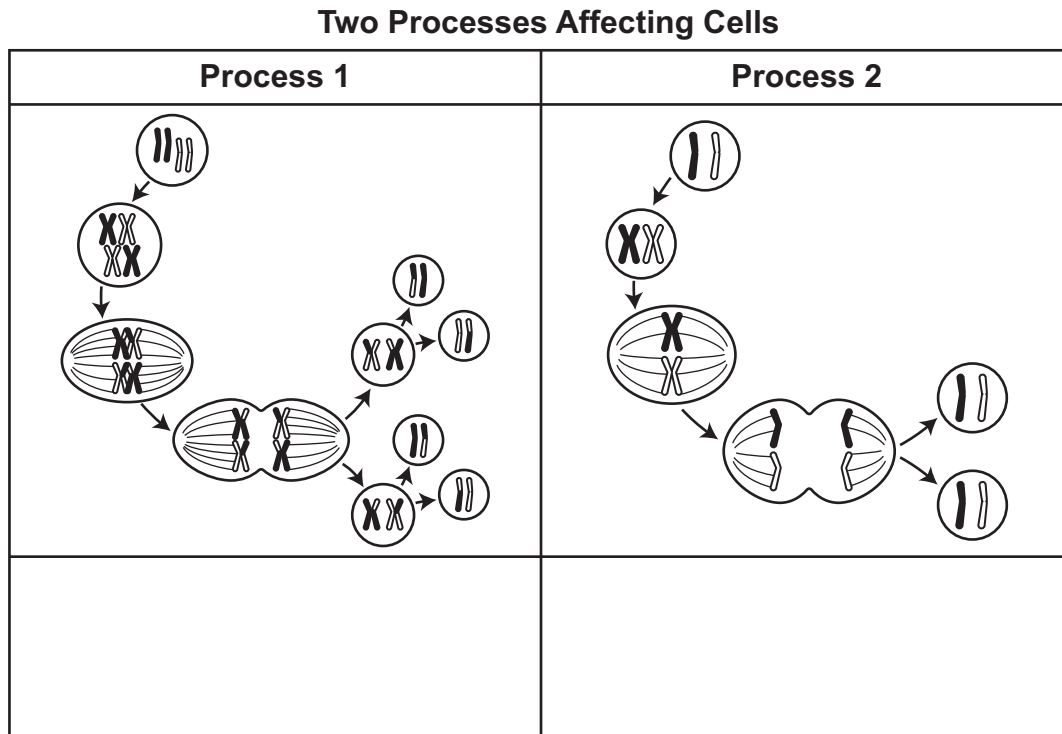
Cellular Respiration Investigation Materials

- potted plant enclosed in a bell jar
- lamp with plant-growing light bulb
- timer for lamp
- small electric humidifier
- electric heating pad
- automatic plant-watering machine
- high-powered microscope

Which set of conditions would **most likely** result in the plant performing anaerobic cellular respiration?

- A. exposing the plant to bright light
increasing the amount of water given to the plant and increasing the humidity around the plant
- B. exposing the plant to total darkness
decreasing the amount of water given to the plant and decreasing the humidity around the plant
- C. exposing the plant to more light than darkness
decreasing the amount of water given to the plant and increasing the humidity around the plant
- D. exposing the plant to half darkness and half light
maintaining a constant amount of water given to the plant and maintaining a constant humidity around the plant

17. The diagram shows two different processes that can affect cells. Write the numbers of the two correct descriptions in the box below each diagram to **best** describe the chromosomes at the end of each process.



- ① The chromosomes in the daughter cells are exactly the same as in the parent cells.
- ② The chromosomes in the daughter cells have alleles that were not found in the parent cells.
- ③ The chromosomes in the daughter cells have new combinations of alleles from the parent cells.
- ④ The chromosomes in the daughter cells are completely different from those found in the parent cells.

18. A student is studying the process of protein synthesis.

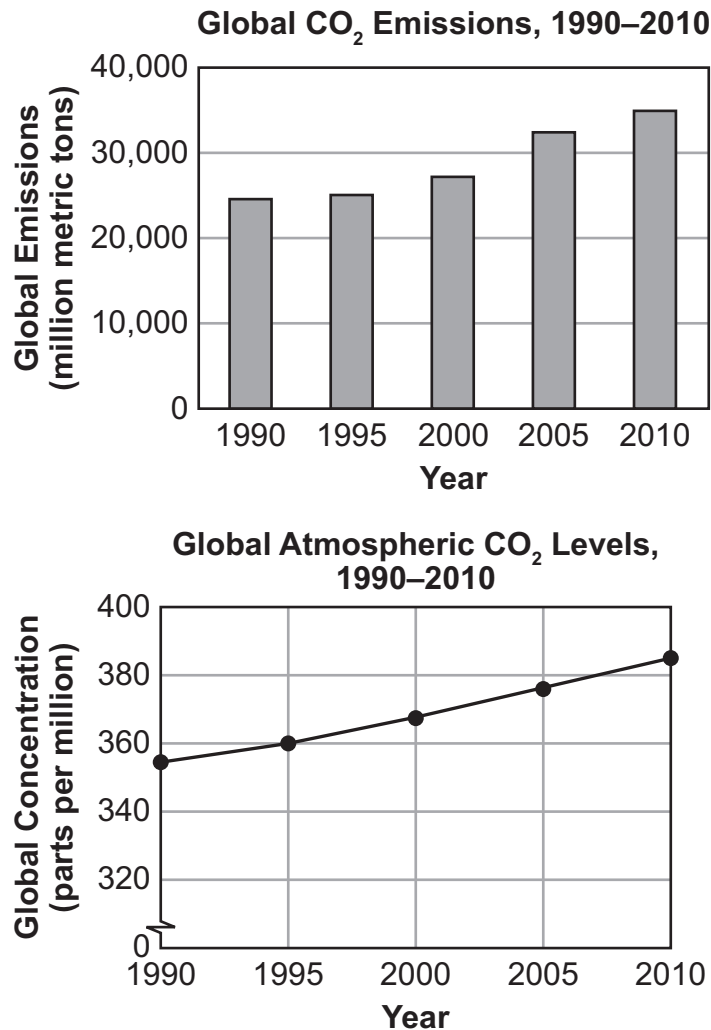
Part A: Circle a word or phrase in each set of parentheses to **best** complete the statement describing protein synthesis.

During protein synthesis, the (nucleus / lysosome / ribosome / mitochondrion / Golgi apparatus) stores the information for the protein, while the (nucleus / lysosome / ribosome / mitochondrion / Golgi apparatus) uses the information to build the protein.

Part B: Which statement **best** describes what happens to many cellular proteins after protein synthesis?

- A. Lysosomes attach to proteins and expel them from the cell.
- B. The Golgi apparatus processes and packages proteins for transport.
- C. Mitochondria store proteins for use during cellular respiration processes.
- D. The nucleus breaks down proteins into smaller units and stores them as gene copies.

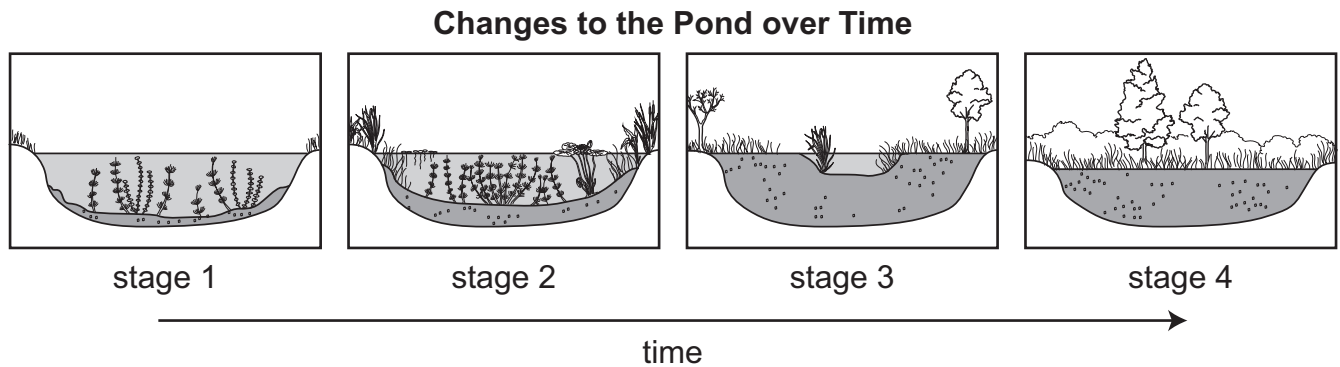
19. The graphs show global carbon dioxide (CO₂) emissions and global atmospheric CO₂ levels between 1990 and 2010.



Which statement **best** explains the effect of global CO₂ emissions on the cycling of CO₂ in the atmosphere?

- A. Atmospheric CO₂ levels are increasing because CO₂ is being removed from the atmosphere slower than it is being released into the atmosphere.
- B. Atmospheric CO₂ levels are increasing because CO₂ is being removed from the atmosphere faster than it is being released into the atmosphere.
- C. Atmospheric CO₂ levels are decreasing because CO₂ is being removed from the atmosphere slower than it is being released into the atmosphere.
- D. Atmospheric CO₂ levels are decreasing because CO₂ is being removed from the atmosphere faster than it is being released into the atmosphere.

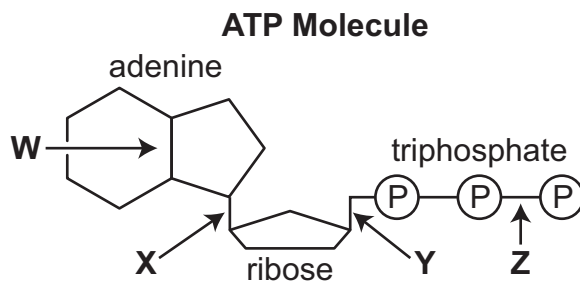
20. A farmer built a dam that prevented water from flowing into a pond. The diagram shows the changes to the pond over time.



Circle a word or phrase in each set of parentheses to describe the **most likely** reason for the changes between stage 1 and stage 4.

As the amount of available water (increased / decreased), the number of woody tree species (decreased / increased / stayed the same) and the number of plants growing in the water (decreased / increased / stayed the same).

21. The diagram shows an ATP molecule with four bonds labeled.



Which statement **best** explains the structure and function of ATP?

- A. When bond Z is formed, energy is released for cellular activities.
- B. When bond Z is broken, energy is released for cellular activities.
- C. When bond Y is formed, energy is stored for cellular activities.
- D. When bond Y is broken, energy is stored for cellular activities.

22. A student compares cells from a leaf, a human cheek, and a cup fungus. The student records information for the three cells in the table.

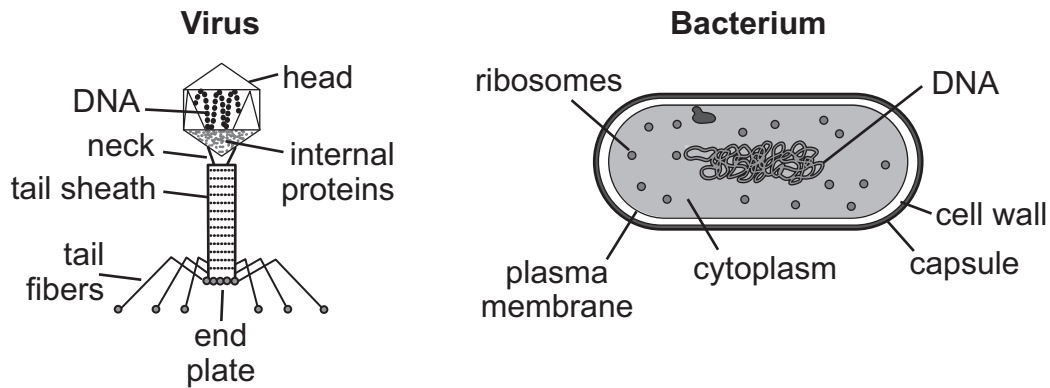
Comparison of Cells

Cell Trait	Leaf Cell	Human Cheek Cell	Cup Fungus Cell
has a cell membrane	yes	yes	yes
has a cell wall	yes	no	yes
has organelles	yes	yes	yes
has chloroplasts	yes	no	no
has a nucleus	yes	yes	yes
ingests an energy source	no	yes	yes
produces an energy source	yes	no	no
reproduces	yes	yes	yes

Based on this information, which statement **best** compares the three cells?

- A. All the cells have a nucleus and organelles, but they differ in their ability to reproduce.
- B. All the cells have a cell wall and a cell membrane, but they differ in the use of chloroplasts.
- C. All the cells have cell membranes and organelles, but they differ in how they obtain energy.
- D. All the cells have a common energy source and a nucleus, but they differ in the use of organelles.

23. Viruses called bacteriophages use bacterial cells to replicate. The diagram shows a virus and a bacterium.

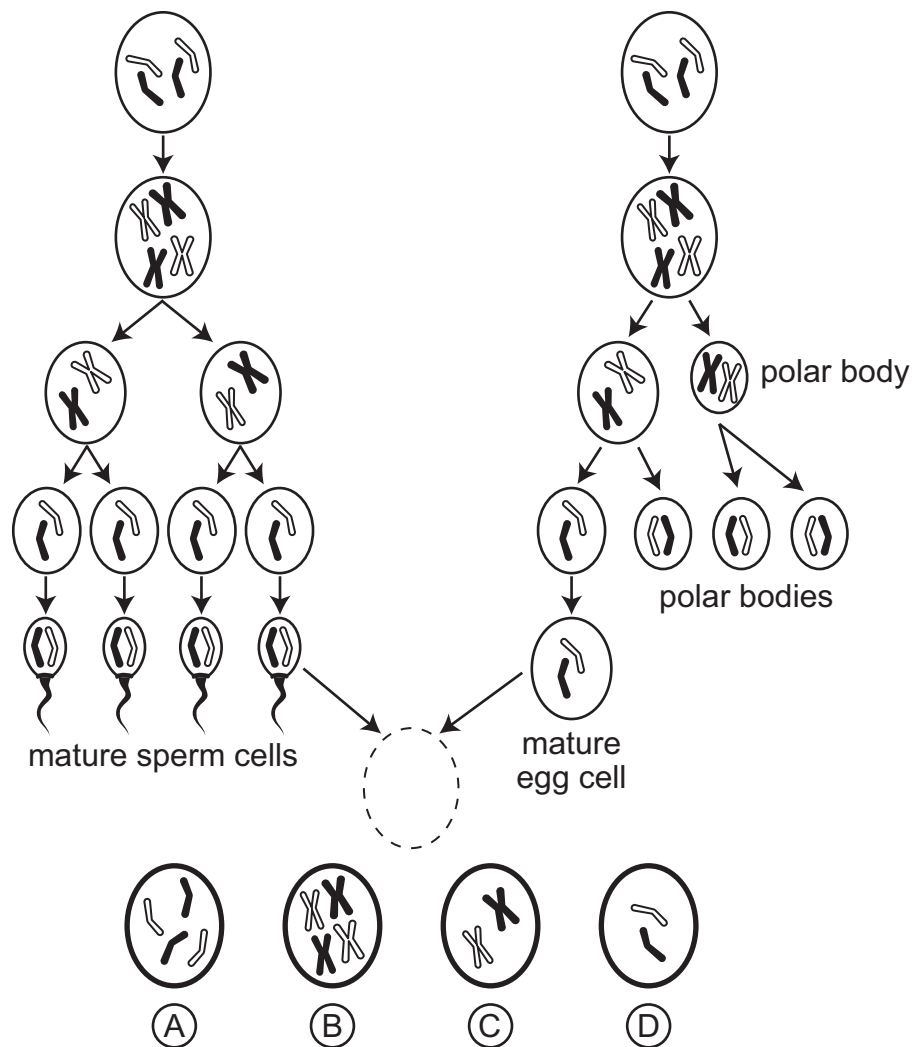


Circle a word or phrase in each set of parentheses to **best** compare the virus and the bacterium.

The virus (is / is not) considered to be alive. Like the virus, the bacterium has (a DNA-containing head / a tough external barrier / a fluid cytoplasm), but the bacterium is different because it has (DNA / tail fibers / ribosomes) that it uses to make proteins.

24. The model shows the development of sex cells before fertilization can occur. Write the letter of the cell that represents the **most likely** genetic outcome of fertilization in the dashed circle.

Fertilization of Sex Cells



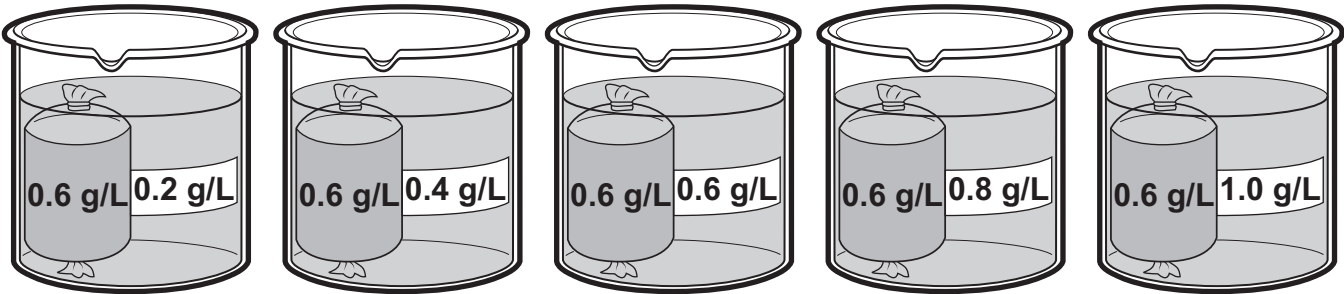
25. A student uses the method shown to study the movement of water molecules across a semipermeable material.

Investigation Method

- 1. Prepare five salt water solutions (0.2 g/L, 0.4 g/L, 0.6 g/L, 0.8 g/L, 1.0 g/L).
- 2. Place 10 mL of the 0.6 g/L solution in five semipermeable material pouches and seal the tops.
- 3. Place 150 mL of each solution in separate beakers. Attach a single pouch with the 0.6 g/L solution to the side of each beaker.
- 4. Wait for 30 minutes.
- 5. Observe and record the changes to each pouch.

For each column in the chart, identify the beaker with the solution combination that best matches the title of the column. Draw one line from a beaker to the **Most Movement into the Pouch** column, and draw one line from a beaker to the **Most Movement out of the Pouch** column.

Most Movement into the Pouch	Most Movement out of the Pouch



Biology Practice Test
Fall 2020

The information for each item, including the objective, DOK level, item type, and correct answer, is located in this document. The items appear in the order as shown in the table.

Item Number	Objective	DOK Level	Item Type	Correct Answer
1	(BIO.1E.2) Identify and describe the changes that occur in a cell during replication. Explore problems that might occur if the cell does not progress through the cycle correctly (cancer).	2	Multiple Choice	A
2	(BIO.1E.1) Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.	2	Multiple Choice	C
3	(BIO.3B.2) Illustrate Mendel's law of independent assortment using Punnett squares and/or the product rule of probability to analyze monohybrid crosses.	2	Technology Enhanced	See Answer Key
4	(BIO.5.2) Analyze models of the cycling of matter (e.g., carbon, nitrogen, phosphorus, and water) between abiotic and biotic factors in an ecosystem and evaluate the ability of these cycles to maintain the health and sustainability of the ecosystem.	3	Multiple Choice	A
5	(BIO.3C.3) Use models to predict how various changes in the nucleotide sequence (e.g., point mutations, deletions, and additions) will affect the resulting protein product and the subsequent inherited trait.	3	Multiple Choice	A
6	(BIO.5.5) Evaluate symbiotic relationships (e.g., mutualism, parasitism, and commensalism) and other co-evolutionary (e.g., predator-prey, cooperation, competition, and mimicry) relationships within specific environments.	2	Technology Enhanced	See Answer Key
7	(BIO.2.2) Develop models of the major reactants and products of photosynthesis to demonstrate the transformation of light energy into stored chemical energy in cells. Emphasize the chemical processes in which bonds are broken and energy is released, and new bonds are formed and energy is stored.	2	Technology Enhanced	See Answer Key
8	(BIO.4.5) Use Darwin's Theory to explain how genetic variation, competition, overproduction, and unequal reproductive success acts as driving forces of natural selection and evolution.	2	Multiple Choice	C
9	(BIO.4.1) Use models to differentiate between organic and chemical evolution, illustrating the steps leading to aerobic heterotrophs and photosynthetic autotrophs.	2	Technology Enhanced	See Answer Key
10	(BIO.3B.3) Investigate traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles in human blood types, and sex-linkage).	2	Multiple Choice	D

**Biology Practice Test
Fall 2020**

Item Number	Objective	DOK Level	Item Type	Correct Answer
11	(BIO.3C.1) Develop and use models to explain the relationship between DNA, genes, and chromosomes in coding the instructions for the traits transferred from parent to offspring.	2	Multi-Select	D, F
12	(BIO.1A.3) Using specific examples, explain how cells can be organized into complex tissues, organs, and organ systems in multicellular organisms.	2	Technology Enhanced	See Answer Key
13	(BIO.1E.3) Relate the processes of cellular reproduction to asexual reproduction in simple organisms (i.e., budding, vegetative propagation, regeneration, binary fission). Explain why the DNA of the daughter cells is the same as the parent cell.	2	Technology Enhanced	See Answer Key
14	(BIO.4.2) Evaluate empirical evidence of common ancestry and biological evolution, including comparative anatomy (e.g., homologous structures and embryological similarities), fossil record, molecular/biochemical similarities (e.g., gene and protein homology), and biogeographic distribution.	2	Technology Enhanced	See Answer Key
15	(BIO.4.4) Design models and use simulations to investigate the interaction between changing environments and genetic variation in natural selection leading to adaptations in populations and differential success of populations.	3	Multiple Choice	C
16	(BIO.2.4) Conduct scientific investigations or computer simulations to compare aerobic and anaerobic cellular respiration in plants and animals, using real world examples.	3	Multiple Choice	B
17	(BIO.3A.2) Compare and contrast mitosis and meiosis in terms of reproduction.	2	Technology Enhanced	See Answer Key
18	(BIO.1C.1) Develop and use models to explore how specialized structures within cells (e.g., nucleus, cytoskeleton, endoplasmic reticulum, ribosomes, Golgi apparatus, lysosomes, mitochondria, chloroplast, centrosomes, and vacuoles) interact to carry out the functions necessary for organism survival.	2	Technology Enhanced	See Answer Key
19	(BIO.5.3) Analyze and interpret quantitative data to construct an explanation for the effects of greenhouse gases on the carbon dioxide cycle and global climate.	3	Multiple Choice	A
20	(BIO.5.7) Investigate and evaluate factors involved in primary and secondary ecological succession using local, real world examples.	2	Technology Enhanced	See Answer Key

**Biology Practice Test
Fall 2020**

Item Number	Objective	DOK Level	Item Type	Correct Answer
21	(BIO.2.1) Use models to demonstrate that ATP and ADP are cycled within a cell as a means to transfer energy.	2	Multiple Choice	B
22	(BIO.1C.2) Investigate to compare and contrast prokaryotic cells and eukaryotic cells, and plant, animal, and fungal cells.	2	Multiple Choice	C
23	(BIO.1C.3) Contrast the structure of viruses with that of cells, and explain why viruses must use living cells to reproduce.	2	Technology Enhanced	See Answer Key
24	(BIO.3A.1) Model sex cell formation (meiosis) and combination (fertilization) to demonstrate the maintenance of chromosome number through each generation in sexually reproducing populations. Explain why the DNA of the daughter cells is different from the DNA of the parent cell.	2	Multiple Choice	A
25	(BIO.1D.1) Plan and conduct investigations to prove that the cell membrane is a semi-permeable, allowing it to maintain homeostasis with its environment through active and passive transport processes.	2	Technology Enhanced	See Answer Key

Biology Practice Test
Fall 2020
Technology Enhanced Items
Answer Key

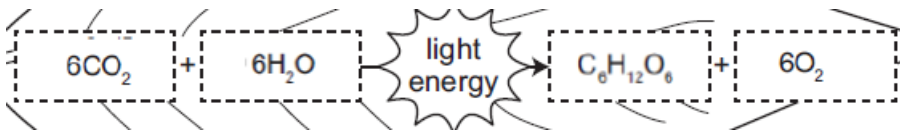
Item #3
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Item #6

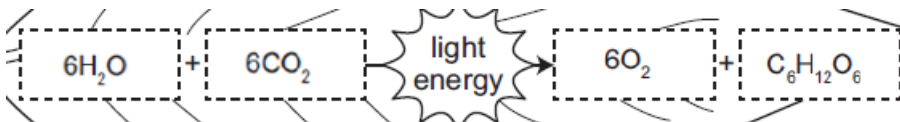
Description	Type of Relationship
A king snake stalks a small mouse before constricting it and eating it whole.	2
A tapeworm enters a host's digestive system and feeds on digested food.	4
An oxpecker bird lands on the back of a rhinoceros and feeds on parasites while being protected from predators.	3
Barnacles grow on the skin of a whale, leaving it unharmed, while filtering food as the whale swims.	1

Item #7

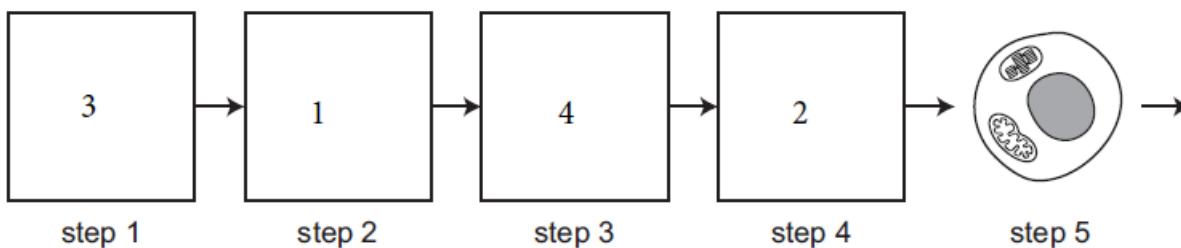
On each side of the arrow, the two *drag* entities can be reversed for full credit. Either response can be correct.



OR



Item #9



Item #12



Biology Practice Test
Fall 2020
Technology Enhanced Items
Answer Key

Item #13

Part A:

Regeneration is a form of (sexual / asexual) reproduction. Following regeneration, the DNA of the offspring is (identical to / different from) the DNA of the parent.

Part B: A

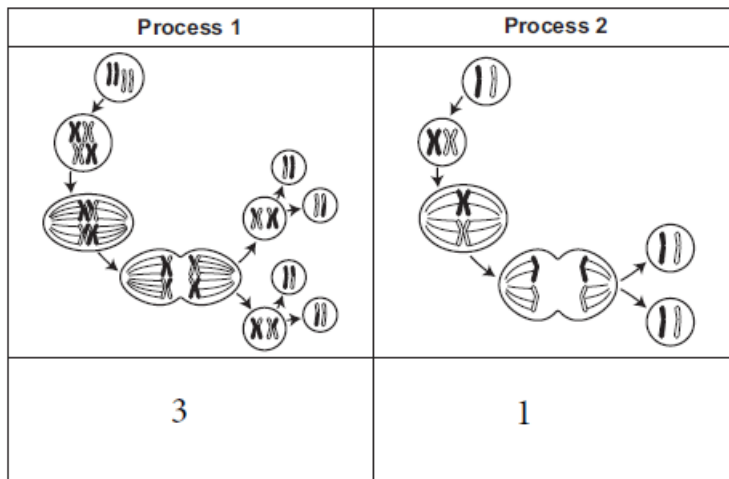
Item #14

Part A:

Compared to Hyracotherium, the height of modern horses has (decreased / increased / stayed the same) and the number of toes has (decreased / increased / stayed the same).

Part B: 3

Item #17



Item #18

Part A:

During protein synthesis, the (nucleus / lysosome / ribosome / mitochondrion / Golgi apparatus) stores the information for the protein, while the (nucleus / lysosome / ribosome / mitochondrion / Golgi apparatus) uses the information to build the protein.

Part B: B

Biology Practice Test
Fall 2020
Technology Enhanced Items
Answer Key

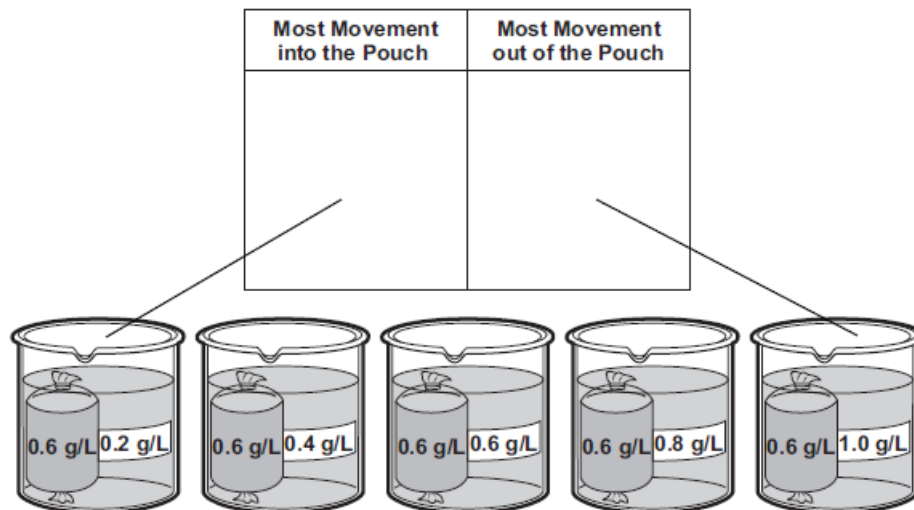
Item #20

As the amount of available water (increased / decreased), the number of woody tree species (decreased / increased / stayed the same) and the number of plants growing in the water (decreased / increased / stayed the same).

Item #23

The virus (is / is not) considered to be alive. Like the virus, the bacterium has (a DNA-containing head / a tough external barrier / a fluid cytoplasm), but the bacterium is different because it has (DNA / tail fibers / ribosomes) that it uses to make proteins.

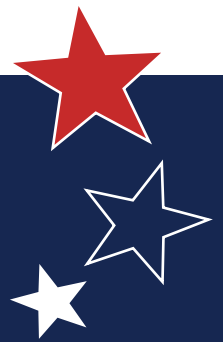
Item #25



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Biology Practice Test

END OF
COURSE



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