



Mississippi Academic Assessment Program (MAAP)

Biology

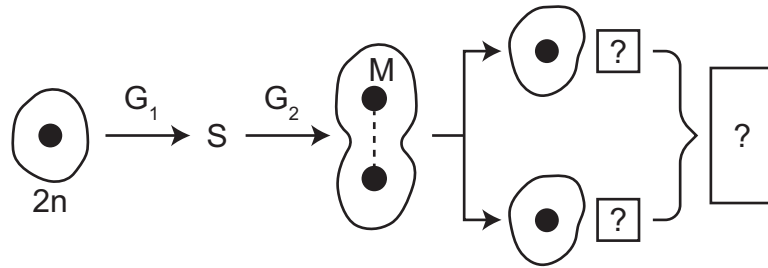
PRACTICE TEST

2021-2022

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.**

- The model shows an incomplete process of cell division.

Incomplete Model of Cell Division

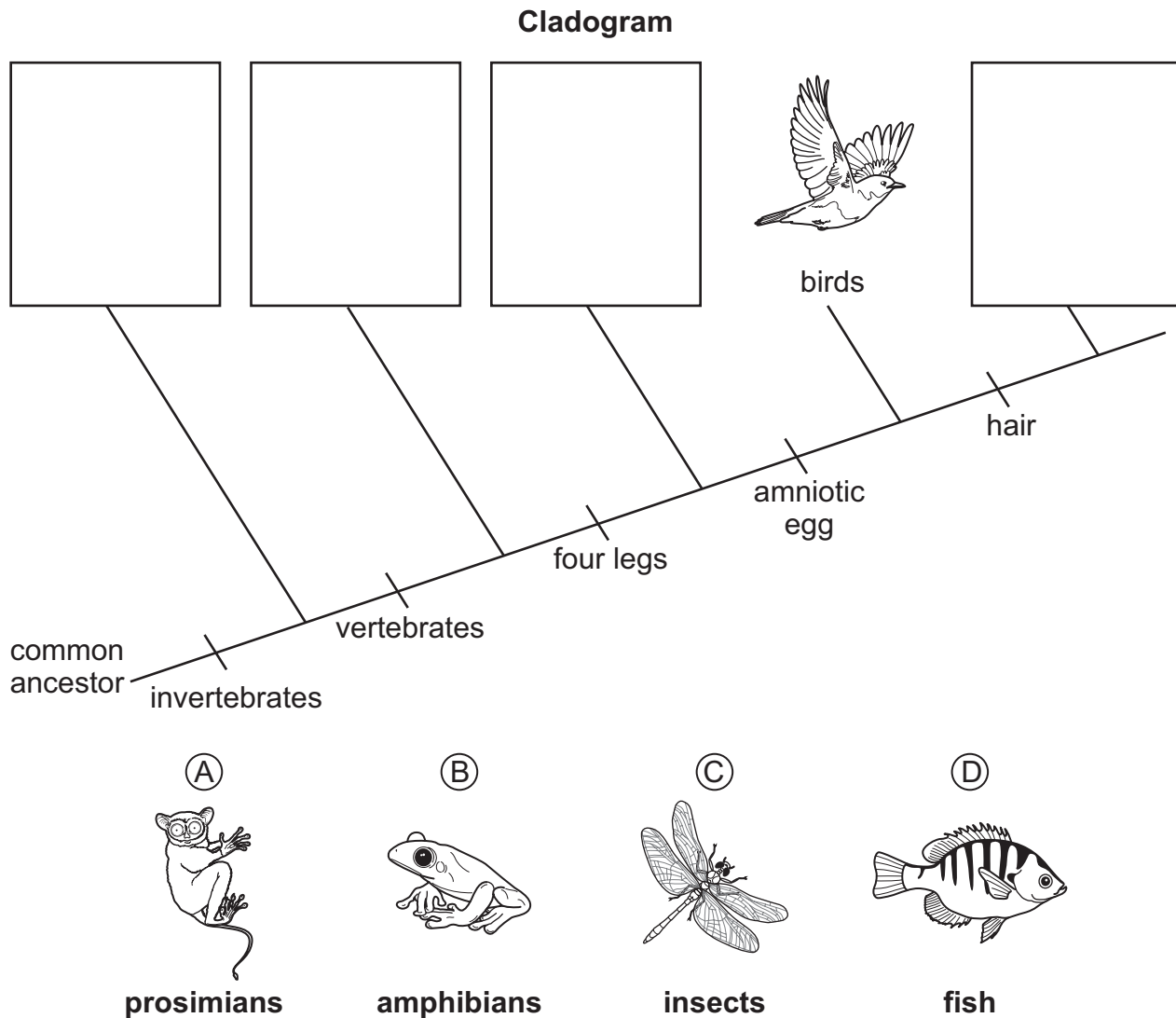


Which labels for the daughter cells **best** complete the model?

- identical haploid daughter cells, which support organism growth
- identical diploid daughter cells, which support organism variation
- identical haploid daughter cells, which support organism variation
- identical diploid daughter cells, which support organism growth

2. A cladogram shows the relationships of organisms without being an evolutionary tree of how a specific group of organisms has changed over time. The diagram below is a cladogram with one organism placed in its proper location.

Record the letter of each remaining organism in its **best** location in the cladogram to demonstrate how the organisms are related.



3. A student is researching the benefits and risks associated with transgenic organisms in agriculture. Record an “X” in each row to identify whether the statement describes a benefit or a risk associated with transgenic organisms.

	Benefit	Risk
cross-pollination with native organic plants		
decrease in the consumer price of meat		
human hormonal effects from consumption		
increase in crop tolerance from pesticides		

4. Students researched different types of chromosomal abnormalities. They recorded information in a table.

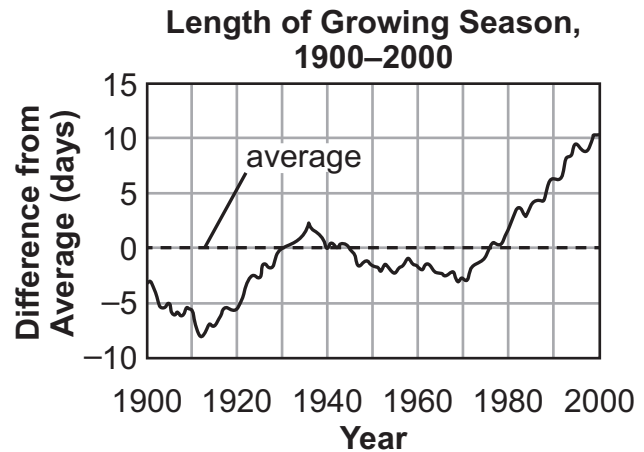
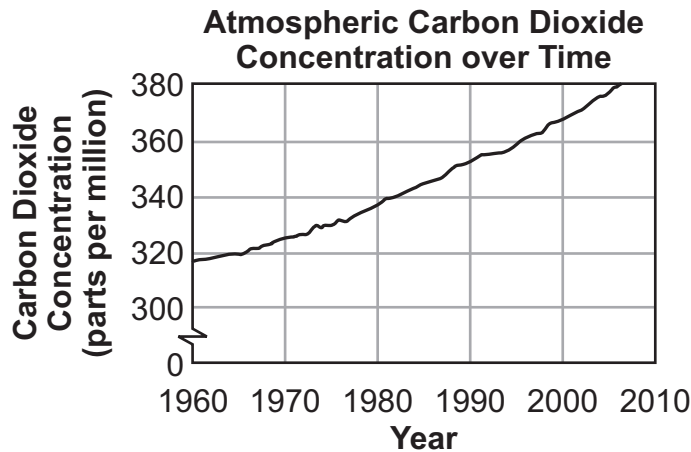
Comparing Chromosomal Abnormalities

Chromosomal Abnormality	Number of Chromosomes	Description
Klinefelter Syndrome	47 or 48	extra sex chromosome (XXY or XXXY)
Turner Syndrome	45	absence of an X chromosome
Triple X Syndrome	47	three X chromosomes instead of two

Which statement **best** describes these chromosomal abnormalities?

- A. These abnormalities are caused by translocation in meiosis and result in more than the characteristic 44 chromosomes.
- B. These abnormalities are caused by nondisjunction in meiosis and result in more or fewer than the characteristic 46 chromosomes.
- C. These abnormalities are caused by chromosomal deletion during mitosis and result in fewer than the characteristic 50 chromosomes.
- D. These abnormalities are caused by chromosomal insertion during mitosis and result in more or fewer than the characteristic 46 chromosomes.

5. Study the two graphs.



Part A: Circle a word in each set of options to explain a possible relationship between the data in the two graphs.

The relationship between atmospheric carbon dioxide concentration and the length of the growing season is most likely (direct / indirect) because as atmospheric carbon dioxide concentration increases, the length of the growing season (increases / decreases).

Part B: Further research indicates that the change in atmospheric carbon dioxide concentration correlates with observed changes in pollen concentration and the length of the pollen season. Circle a word in each set of options to **best** explain these observations.

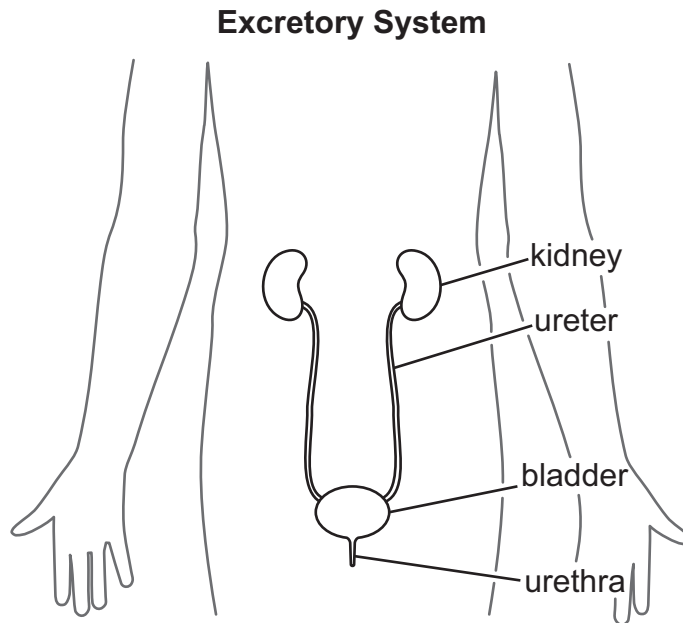
Increases in atmospheric carbon dioxide concentration have likely caused global annual average temperatures to (rise / lower) and plant photosynthesis rates to (increase / decrease). These changes result in (greater / reduced) plant growth and (more / less) pollen production.

6. A group of biology students conducted a lab investigation in which they sealed a flask with a balloon. The flask contained a teaspoon of yeast, a teaspoon of sugar, and 200 mL of warm water. The objective was to determine how much carbon dioxide gas was produced.

Which statement **best** explains why the students used yeast?

- A. Yeast is a fungus that undergoes anaerobic respiration in the presence of oxygen.
- B. In the absence of oxygen, yeast breaks down sugar into carbon dioxide and ethanol.
- C. Yeast is a heterotroph that undergoes aerobic respiration in an oxygen-rich environment.
- D. In the presence of oxygen, yeast breaks down sugar into carbon dioxide and ethanol.

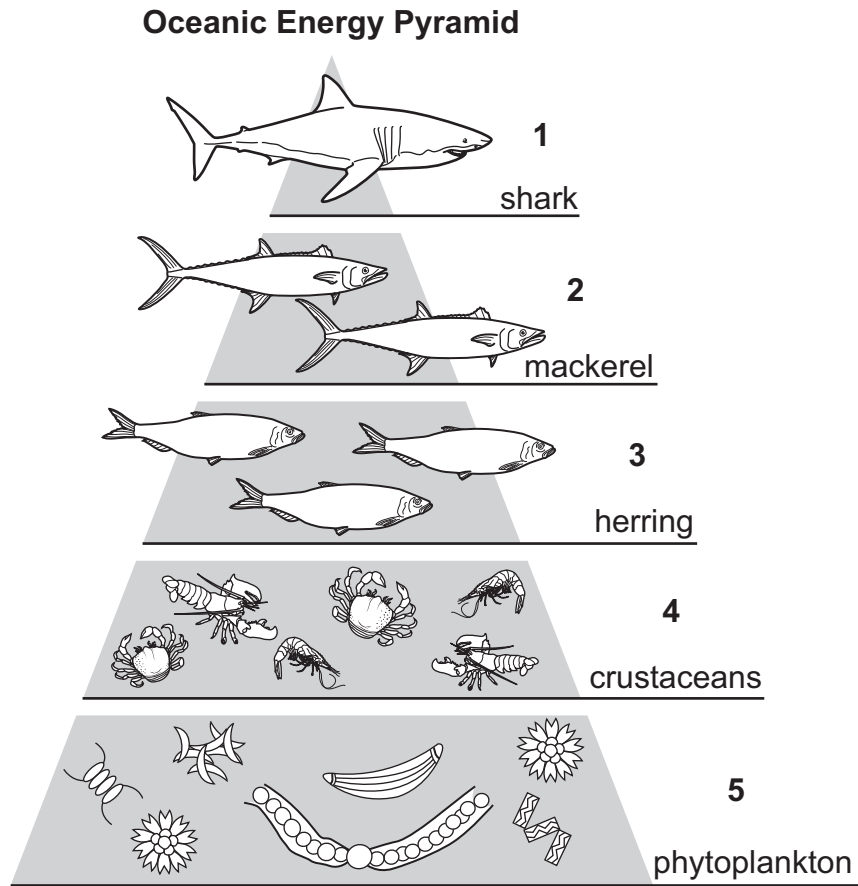
7. The diagram shows components of the human excretory system.



Which statement **best** describes an example of organization within this system?

- A. Organs in the kidney work with organs in the ureter to filter and move materials.
- B. The kidney, ureter, bladder, and urethra are cells with specific roles in the system.
- C. The bladder is an organ composed of muscle tissues that helps eliminate fluid waste.
- D. Specialized cells in the urethra are composed of tissues that work independently of one another.

8. An energy pyramid can be used to model the biomass at each trophic level in an ecosystem.



Part A: Which trophic level has the **least** biomass?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

Part B: Circle a number in each set of options to describe the energy available to organisms in the energy pyramid if the phytoplankton contain 10,000 kcal.

Organisms in level (1 / 2 / 3 / 4) contain (10 / 100 / 1,000 / 10,000) kcal.

9. A student is studying living things. The student made the following list of characteristics to describe only living things.

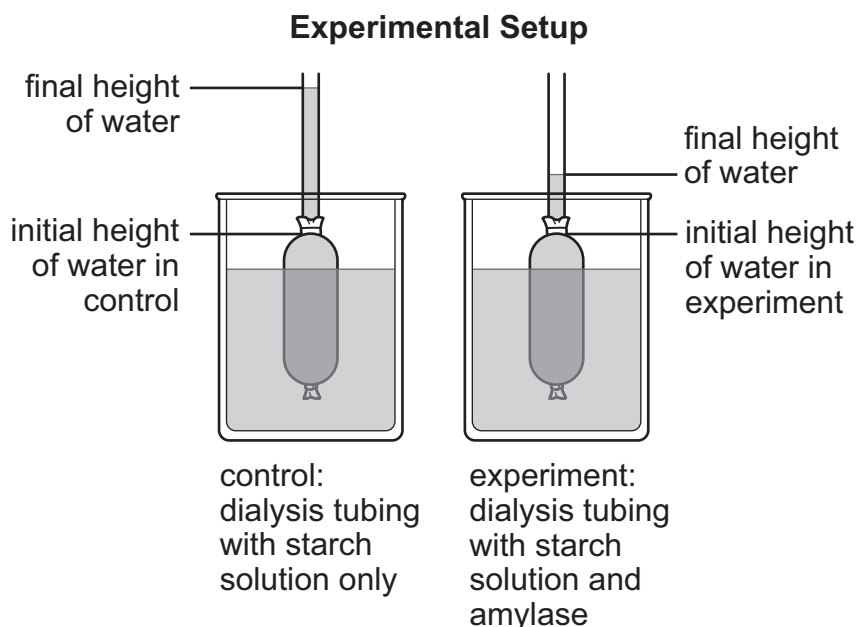
Living Things

1. are made of atoms
2. convert food to energy
3. are capable of movement
4. grow by metabolic reactions
5. are made of one or more cells
6. sense and respond to environmental changes

Another student claims that some characteristics on the list also describe nonliving things. Which characteristics from the list should be removed so the list describes only living things?

- A. 1 and 3
- B. 2 and 5
- C. 3 and 4
- D. 5 and 6

10. The diagram describes an experimental setup to study cell membrane permeability.



Two beakers are filled with equal amounts of water. Each beaker contains dialysis tubing. One is filled with a starch solution, and the other is filled with the same starch solution and the enzyme amylase. Amylase breaks down starch into maltose.

Dialysis tubing is permeable to particles smaller than 5,000 daltons (Da). Daltons are a unit of mass. The table shows sizes of some of the particles in the solution.

Sizes of Particles

Name	Size (Da)
starch	1,000,000
maltose	342
salt ion	23

Part A: Predict whether each substance will move or will not move through the dialysis tubing. Record an "X" in each row.

	Will Move through Tubing	Will Not Move through Tubing
starch		
maltose		
salt ion		

Part B: Circle a word or phrase in each set of options to describe the movement of water during this investigation.

In the control, water moves (into / out of) the dialysis tube because (more / less) solvent is inside the tube than in the beaker. In the experiment, amylase breaks down starch into maltose. Maltose (stays in / moves out of) the dialysis tube, and (more / less) water movement is observed than in the control.

11. Which table **best** compares the parent cell to the daughter cells in the process of meiosis?

A.

Parent Cell	Daughter Cells
one haploid cell	two identical diploid cells

B.

Parent Cell	Daughter Cells
one diploid cell	two identical haploid cells

C.

Parent Cell	Daughter Cells
one haploid cell	four different diploid cells

D.

Parent Cell	Daughter Cells
one diploid cell	four different haploid cells

Use the scenario to answer the next two questions.

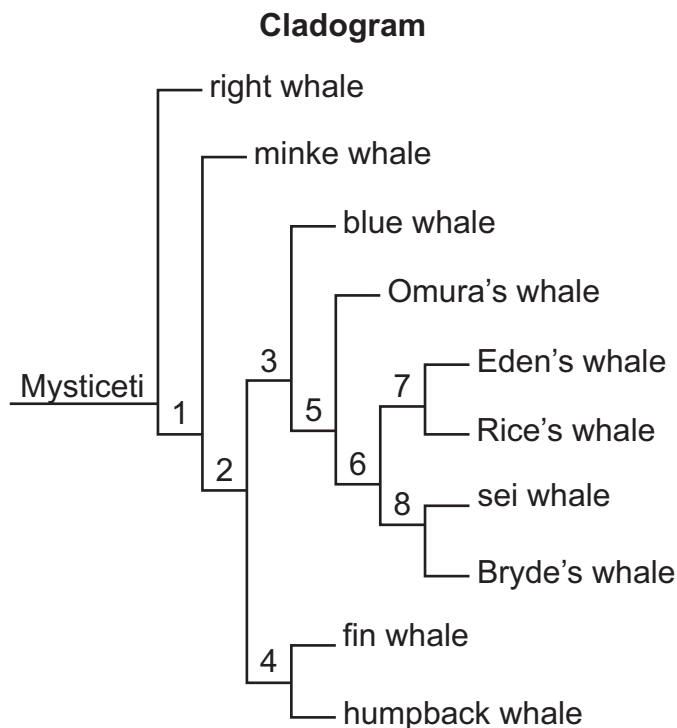
Rice's Whales

For years, scientists have studied a relatively small group of baleen whales in the Gulf of Mexico. Thought to be a subspecies of Bryde's whale, the whales in the Gulf of Mexico showed several differences, as listed below.

Differences between Gulf of Mexico Whales and Bryde's Whales

1. Gulf of Mexico whales do not migrate, and Bryde's whales range throughout the Atlantic, Pacific, and Indian Oceans.
2. Mitochondrial DNA differs between the whale groups.
3. Gulf of Mexico whales dive deep to feed along the seabed, and Bryde's whales feed at the surface.
4. Skeletal measurements differ between the whale groups.
5. Skull bone shapes around the blowholes differ between the two whale groups.

These differences helped confirm the Gulf of Mexico whales as a new species, which was named Rice's whale. The cladogram shows the relationships between the Rice's whale and other baleen whales (Mysticeti).

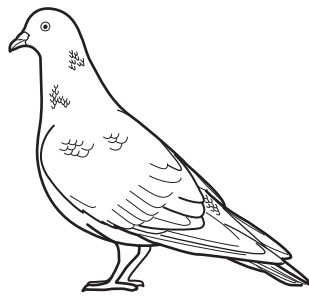


12. Which **three** types of data described in the scenario provide the **best** evidence to support the conclusion that Rice's whales represent a unique species?
- A. genetic code
 - B. embryonic development
 - C. anatomy and morphology
 - D. biogeographic distribution
 - E. radiocarbon dating of fossils

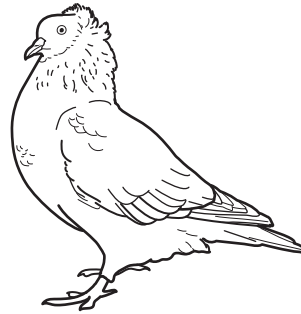
13. Which statement explains the conditions that **most likely** led to the development of the Rice's whale species?
- A. A group of whales experienced lower rates of mutation and reproduction, and these changes resulted in a reproductively isolated whale population.
 - B. A group of whales experienced higher rates of mutation and reproduction, and these changes resulted in a geographically isolated whale population.
 - C. A group of whales became geographically isolated, and over time and through reduced gene flow, they developed genetic differences and established distinct food preferences.
 - D. A group of whales stopped migrating because of a sufficient food supply, and through increased gene flow, they developed genetic differences and established distinct food preferences.

14. The drawing shows two different pigeon head phenotypes, which are controlled by a single gene. The allele for no crest (N) is dominant to the allele for having a crest (n).

Pigeon Head Phenotypes



no crest



crest

Part A: Record the alleles in the Punnett square to show the predicted offspring between a heterozygous dominant male and a homozygous recessive female.

Parent Allele
Options

N

n

N

Offspring Allele
Options

Nn

NN

nn

Part B: Record the predicted percentages of each phenotype.

No Crest _____ %

Crest _____ %

15. The table compares some features of a virus with an animal cell.

Comparing a Virus with an Animal Cell

Feature	Virus	Animal Cell
has nucleic acids	X	X
has a nucleus		X
has ribosomes		X

Which statement **best** explains why viruses must use a host cell to reproduce?

- A. Viruses need to use the nucleic acid material from the host cell.
- B. Ribosomes in the viruses lack the ability to translate genetic information.
- C. Genetic information in viruses gets damaged without protection from a host cell nucleus.
- D. Animal cells have the organelle structures that viruses lack to replicate genetic material.

16. Which **two** examples **best** illustrate the driving force of natural selection for increased survival supporting Darwin's theory of evolution?
- A. Wolves hunt in packs to have a higher success rate of capturing prey so the pack has food to survive.
 - B. Harp seals abandon their young as early as twelve days after birth, leaving the young to survive independently.
 - C. Sea turtles lay an average of a hundred eggs in a nest approximately three to seven times per nesting season.
 - D. Fox squirrel coat colors range from a red-orange color variation to a silver-gray color variation based on geography.
 - E. Sharks and porpoises have similar characteristics, but sharks are classified as fish, while porpoises are classified as mammals.

17. A teacher listed different natural events that at some time have occurred in certain locations across the United States. These events led to primary succession or secondary succession.

Events That Led to Succession

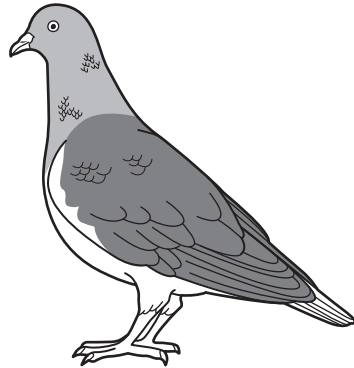
1. Landslide along a coast in California
2. Barrier island formation in New Jersey
3. Advancing of glaciers across Minnesota
4. Fire that released lodgepole pine seed in Colorado
5. Volcanic eruption and extensive lava flow in Hawaii
6. Straight-line wind damage uprooting hardwood trees in Mississippi

Record an “X” in each row to match the **three** events that led to primary succession and the **three** events that led to secondary succession.

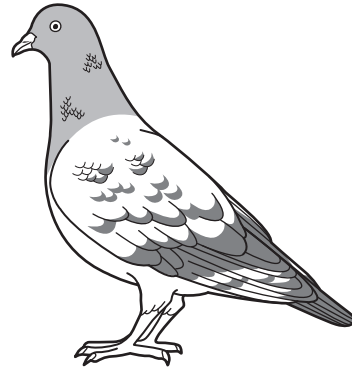
Event	Primary Succession	Secondary Succession
1		
2		
3		
4		
5		
6		

18. In pigeons, the allele for the T-check feather pattern (C^T) is dominant to the allele for the check feather pattern.

Two Pigeon Feather Patterns



T-check (C^T)



Check (C)

What is the probability that offspring from a cross between two heterozygous pigeons will display the dominant phenotype?

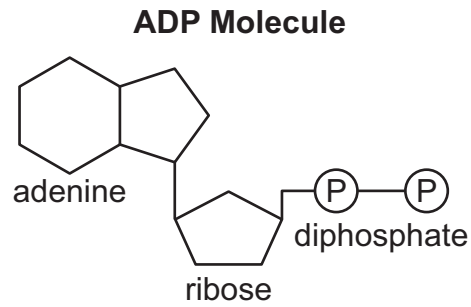
- A. 25%
- B. 50%
- C. 75%
- D. 100%

19. A student is studying a continued argument within the scientific community: Are viruses living or nonliving?

Record an "X" in each row to identify whether each evidence statement supports the claim that viruses are living or the claim that viruses are nonliving.

	Living	Nonliving
Viruses can replicate.		
Viruses change over time.		
Viruses do not grow or develop.		
Viruses contain genetic information.		
Viruses do not contain one or more cells.		
Viruses do not obtain or use their own energy.		

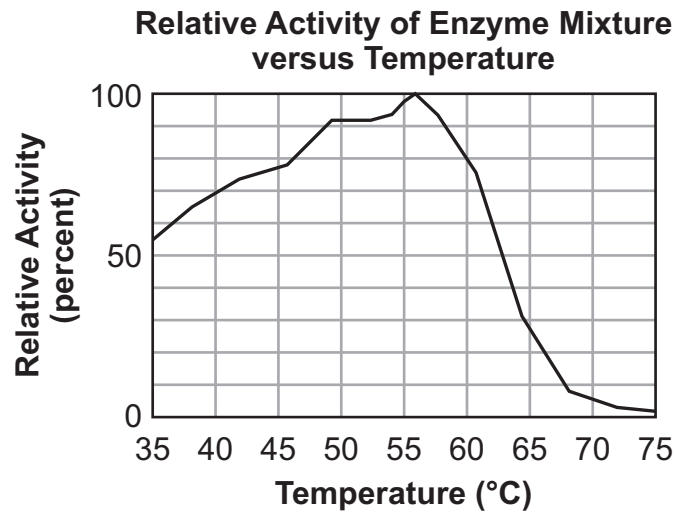
20. The model shows an ADP molecule involved in the body's energy cycle.



Which statement **best** describes the relationship between ADP and ATP?

- A. The addition of thymine to adenine will decrease the energy to form ATP from ADP.
- B. The substitution of deoxyribose for ribose will provide energy to form ATP from ADP.
- C. The addition of a phosphate group to ADP forms ATP and results in a net gain of energy.
- D. The subtraction of a phosphate group from ADP forms ATP and results in a net loss of energy.

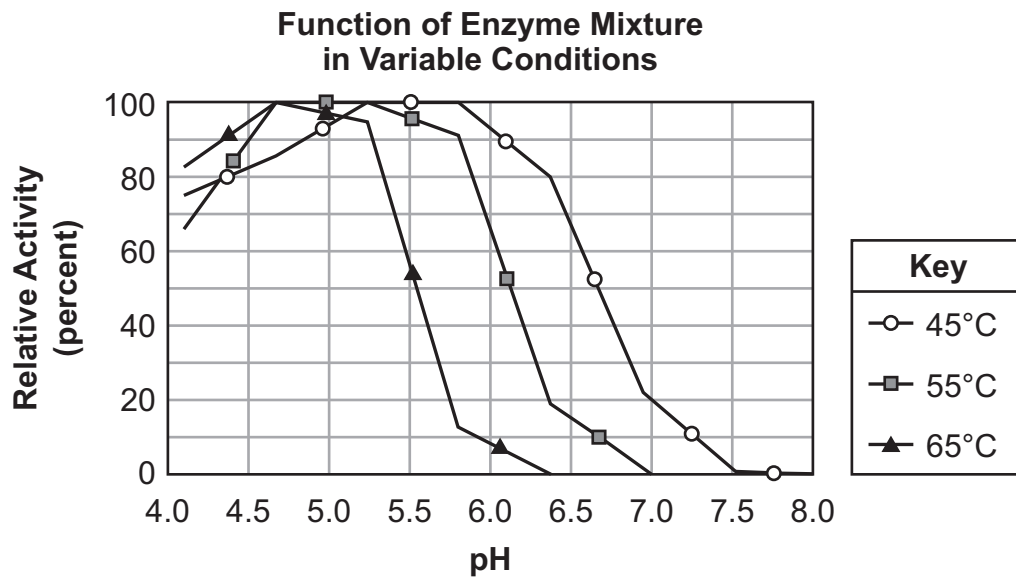
21. Researchers in a lab performed an experiment to evaluate the function of an enzyme mixture. The graph shows the results.



Part A: Circle a word or phrase in each set of options to correctly describe the variables in this experiment.

The independent variable is the (type of enzyme / relative activity / temperature), and the dependent variable is the (type of enzyme / relative activity / temperature).

Part B: In additional experimental trials, the researchers gathered more data about the function of the enzyme mixture. The graph below summarizes their results.



Circle a word or phrase in each set of options to **best** explain these data.

At higher temperatures, the enzyme functions most efficiently when pH is (higher / lower), and at lower temperatures, the enzyme can tolerate (higher / lower) pH values.

- 22.** Students are comparing the processes of transcription and translation in a cell. Record the letter of each process feature in its associated column in the chart.

Transcription	Translation

- Ⓐ occurs at a ribosome
- Ⓑ occurs in the nucleus
- Ⓒ reads RNA to make a protein
- Ⓓ uses DNA to make RNA
- Ⓔ links amino acids together

23. A student filled six test tubes with saltwater solutions of differing concentrations. The student recorded the starting masses of six potato slices before placing each of them in a different test tube. The student recorded the final masses of the potato slices after 30 minutes. The results are shown in the data table.

Potato Slices in Test Tubes with Different Solution Concentrations

Test Tube	Concentration of Solution (mol/L)	Starting Mass (g)	Final Mass (g)	Change in Mass (g)	Percentage of Mass (%)
1	5	1.50	0.93	-0.57	-38.0
2	4	1.37	0.92	-0.45	-32.8
3	3	1.54	1.20	-0.34	-22.1
4	2	1.56	1.39	-0.17	-10.9
5	1	1.51	1.51	0.00	0.0
6	0	1.54	1.74	0.20	13.0

Part A: Circle a word or phrase in each set of options to compare the solutions in the test tubes.

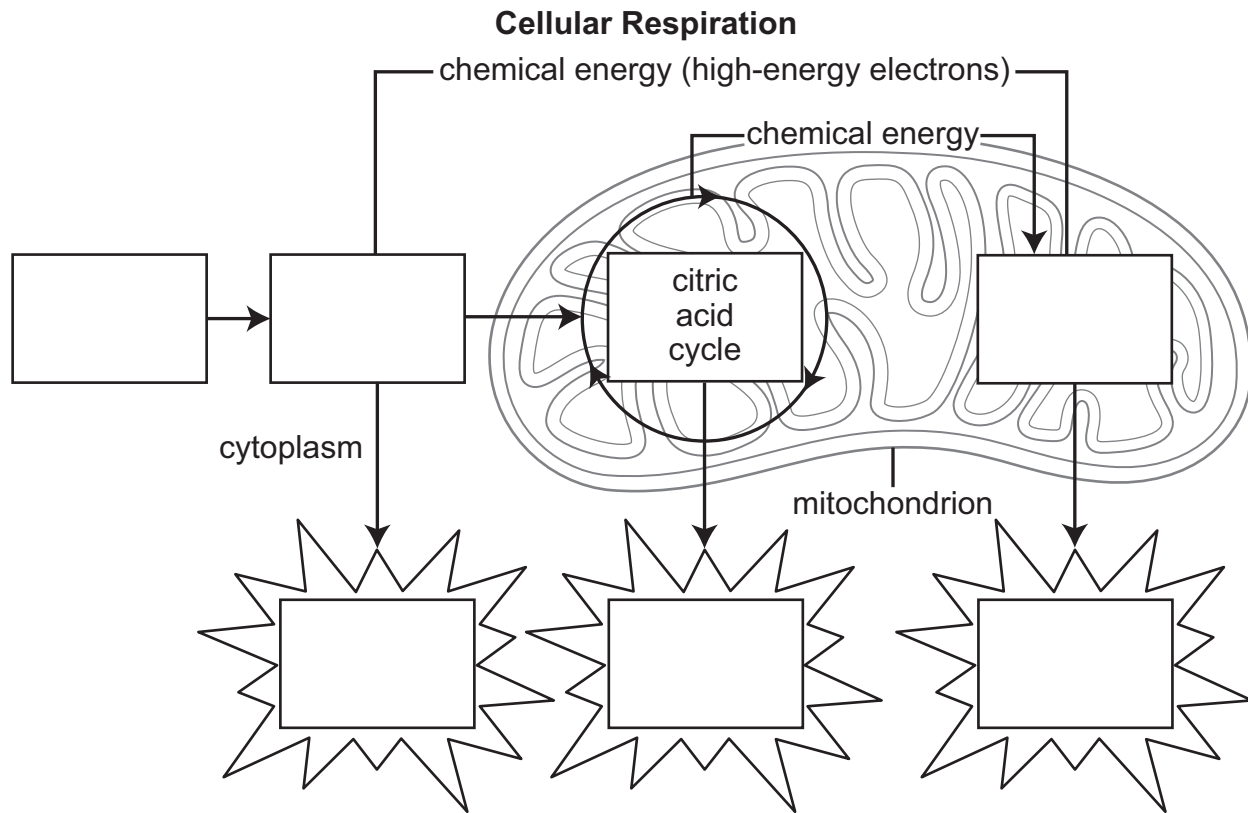
The potato slice in test tube 4 was in a (hypertonic / hypotonic / isotonic) solution, so water (moved out of / moved into / remained unchanged in) the potato cells, as evidenced by (an increase / a decrease / no change) in mass.

Part B: Circle a word in each set of options to explain how the cells in the potato slices responded to the different experimental conditions.

The solution in test tube 5 is (hypertonic / hypotonic / isotonic), and the solution in test tube 6 is (hypertonic / hypotonic / isotonic). The potato slices in these test tubes would have felt (more / less) firm to the student than the potato slice in test tube 1.

24. Cellular respiration is a series of chemical reactions that occur in cells.

Record the letters of each of the **six** missing labels in the boxes to **best** complete the model of cellular respiration. Some labels may be used more than once.



Labels

- Ⓜ ATP
- ⓧ electron transport chain
- Ⓨ glucose
- Ⓩ glycolysis

25. Examples of ecological hierarchy are shown in the table.

Ecological Hierarchy

Example	Description
W	A pride of lions in Kenya.
X	The eagles, snakes, mice, grass, and bushes plus the rocks and the river in a canyon.
Y	An alligator in the Florida Everglades.
Z	The coyotes, black bears, trees, and porcupines that live in a forest.

Which table correctly identifies each example of ecological hierarchy?

A.

W	population
X	ecosystem
Y	organism
Z	community

B.

W	organism
X	ecosystem
Y	population
Z	community

C.

W	population
X	community
Y	organism
Z	ecosystem

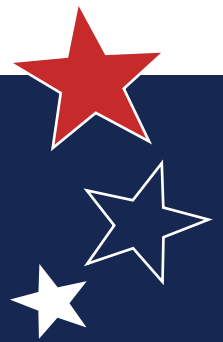
D.

W	organism
X	ecosystem
Y	community
Z	population

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Biology Practice Test

END OF
COURSE



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Biology Practice Test

Fall 2021

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.

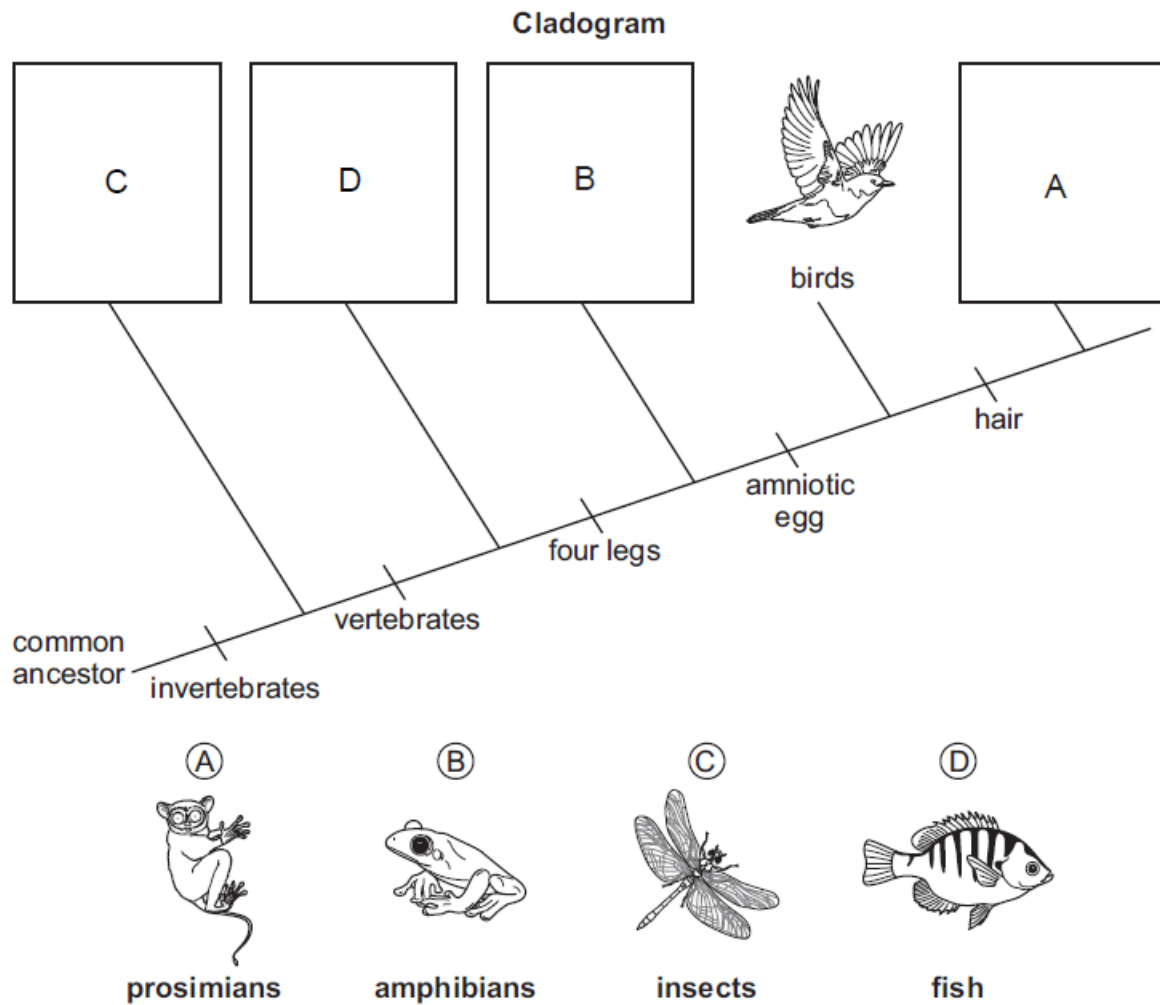
Item Number	Objective	DOK Level	Item Type	Correct Answer
1	(BIO.1E.1) Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.	2	Multiple Choice	D
2	(BIO.4.3) Construct cladograms/phylogenetic trees to illustrate relatedness between species.	2	Technology Enhanced	See Answer Key
3	(BIO.3C.4) Research and identify how DNA technology benefits society. Engage in scientific argument from evidence over the ethical issues surrounding the use of DNA technology (e.g., cloning, transgenic organisms, stem cell research, and the Human Genome Project, gel electrophoresis).	2	Technology Enhanced	See Answer Key
4	(BIO.3A.3) Investigate chromosomal abnormalities (e.g., Down syndrome, Turner's syndrome, and Klinefelter syndrome) that might arise from errors in meiosis (nondisjunction) and how these abnormalities are identified (karyotypes).	3	Multiple Choice	B
5	(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	Technology Enhanced	See Answer Key
6	(BIO.2.4) Conduct scientific investigations or computer simulations to compare aerobic and anaerobic cellular respiration in plants and animals, using real world examples.	2	Multiple Choice	B
7	(BIO.1A.3) Using specific examples, explain how cells can be organized into complex tissues, organs, and organ systems in multicellular organisms.	2	Multiple Choice	C
8	(BIO.5.4) Develop and use models to describe the flow of energy and amount of biomass through food chains, food webs, and food pyramids.	2	Technology Enhanced	See Answer Key
9	(BIO.1A.1) Develop criteria to differentiate between living and non-living things.	2	Multiple Choice	A
10	(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.	3	Technology Enhanced	See Answer Key
11	(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.	1	Multiple Choice	D
12	(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	Multi-Select	See Answer Key

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Item Number	Objective	DOK Level	Item Type	Correct Answer
13	(BIO.4.6) Construct explanations for the mechanisms of speciation (e.g., geographic and reproductive isolation).	2	Multiple Choice	C
14	(BIO.3B.1) Demonstrate Mendel's law of dominance and segregation using mathematics to predict phenotypic and genotypic ratios by constructing Punnett squares with both homozygous and heterozygous allele pairs.	2	Technology Enhanced	See Answer Key
15	(BIO.1C.3) Contrast the structure of viruses with that of cells, and explain why viruses must use living cells to reproduce.	2	Multiple Choice	D
16	(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	Multi-Select	See Answer Key
17	(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
18	(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	Multiple Choice	C
19	(BIO.1A.4) Use evidence from current scientific literature to support whether a virus is living or non-living.	2	Technology Enhanced	See Answer Key
20	(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	C
21	(BIO.1B.2) Design and conduct an experiment to determine how enzymes react given various environmental conditions (i.e., pH, temperature, and concentration). Analyze, interpret, graph, and present data to explain how those changing conditions affect the enzyme activity and the rate of the reactions that take place in biological organisms.	3	Technology Enhanced	See Answer Key
22	(BIO.3C.2) Evaluate the mechanisms of transcription and translation in protein synthesis.	2	Technology Enhanced	See Answer Key
23	(BIO.1D.2) Develop and use models to explain how the cell deals with imbalances of solute concentration across the cell membrane (i.e., hypertonic, hypotonic, and isotonic conditions, sodium/potassium pump).	3	Technology Enhanced	See Answer Key
24	(BIO.2.3) Develop models of the major reactants and products of cellular respiration (aerobic and anaerobic) to demonstrate the transformation of the chemical energy stored in food to the available energy of ATP. 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
25	(BIO.5.1) Illustrate levels of ecological hierarchy, including organism, population, community, ecosystem, biome, and biosphere.	1	Multiple Choice	A

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Technology Enhanced Items
Answer Key

Item #2



Item #3

	Benefit	Risk
cross-pollination with native organic plants		X
decrease in the consumer price of meat	X	
human hormonal effects from consumption		X
increase in crop tolerance from pesticides	X	

Biology Practice Test
Fall 2021
Technology Enhanced Items
Answer Key

Item #10

Part A: Predict whether each substance will move or will not move through the dialysis tubing. Record an "X" in each row.

	Will Move through Tubing	Will Not Move through Tubing
starch		X
maltose	X	
salt ion	X	

Part B: Circle a word or phrase in each set of options to describe the movement of water during this investigation.

In the control, water moves (into / out of) the dialysis tube because (more / less) solvent is inside the tube than in the beaker. In the experiment, amylase breaks down starch into maltose. Maltose (stays in / moves out of) the dialysis tube, and (more / less) water movement is observed than in the control.

Item #12

- ☒ A. genetic code
- ☐ B. embryonic development
- ☐ C. anatomy and morphology
- ☐ D. biogeographic distribution
- ☐ E. radiocarbon dating of fossils

Biology Practice Test
Fall 2021
Technology Enhanced Items
Answer Key

Item #14

Part A: Record the alleles in the Punnett square to show the predicted offspring between a heterozygous dominant male and a homozygous recessive female.

<u>Parent Allele</u>		<u>N</u>	<u>n</u>	<u>Offspring Allele</u>
<u>Options</u>				<u>Options</u>
N	<u>n</u>	<u>Nn</u>	<u>nn</u>	Nn
n	<u>n</u>	<u>Nn</u>	<u>nn</u>	NN
				nn

Part B: Record the predicted percentages of each phenotype.

No Crest 50 %

Crest 50 %

Item #16

- ☒ C. Sea turtles lay an average of a hundred eggs in a nest approximately three to seven times per nesting season.
- ☐ D. Fox squirrel coat colors range from a red-orange color variation to a silver-gray color variation based on geography.

Item #17

Event	Primary Succession	Secondary Succession
1		X
2	X	
3	X	
4		X
5	X	
6		X

Biology Practice Test
Fall 2021
Technology Enhanced Items
Answer Key

Item #19

	Living	Nonliving
Viruses can replicate.	X	
Viruses change over time.	X	
Viruses do not grow or develop.		X
Viruses contain genetic information.	X	
Viruses do not contain one or more cells.		X
Viruses do not obtain or use their own energy.		X

Item #21

Part A: Circle a word or phrase in each set of options to correctly describe the variables in this experiment.

The independent variable is the (type of enzyme / relative activity / temperature), and the dependent variable is the (type of enzyme / relative activity / temperature).

Part B:

At higher temperatures, the enzyme functions most efficiently when pH is (higher / lower), and at lower temperatures, the enzyme can tolerate (higher / lower) pH values.

Biology Practice Test
Fall 2021
Technology Enhanced Items
Answer Key

Item #22

Transcription	Translation
B and D	A, C, E

Item #23

Part A: Circle a word or phrase in each set of options to compare the solutions in the test tubes.

The potato slice in test tube 4 was in a (hypertonic / hypotonic / isotonic) solution, so water (moved out of / moved into / remained unchanged in) the potato cells, as evidenced by (an increase / a decrease / no change) in mass.

Part B: Circle a word in each set of options to explain how the cells in the potato slices responded to the different experimental conditions.

The solution in test tube 5 is (hypertonic / hypotonic / isotonic), and the solution in test tube 6 is (hypertonic / hypotonic / isotonic). The potato slices in these test tubes would have felt (more / less) firm to the student than the potato slice in test tube 1.

Biology Practice Test
Fall 2021
Technology Enhanced Items
Answer Key

Item #24

