

STAAR Spring 2024 Biology Rationales

Item Position	Rationale	
1	Option C is correct	Genes are located primarily in DNA nucleotides. A nucleotide contains phosphate, a deoxyribose sugar, and a nitrogenous base. The sequence of nucleotides determines the gene.
	Option A is incorrect	Genes are not located primarily in RNA ribose sugars. Transfer RNA is used to bring amino acids to ribosomes for protein synthesis.
	Option B is incorrect	Genes are not located primarily in DNA phosphate groups. Phosphates are part of the backbone of a DNA molecule.
	Option D is incorrect	Genes are not located primarily in RNA exons. Exons in RNA code for proteins.

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Item Position	Rationale	
2	Option B is correct	The food chain that depicts the correct flow of energy in the Texas Hill Country habitat is Grasshopper --> Frog --> Snake --> Hawk.
	Option A is incorrect	Frogs do not transfer energy to grasshoppers in the Texas Hill Country habitat, and hawks do not transfer energy to snakes.
	Option C is incorrect	Hawks do not transfer energy to frogs in the Texas Hill Country habitat, and frogs do not transfer energy to grasshoppers.
	Option D is incorrect	This food chain has the flow of energy in the reverse order.

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Item Position	Rationale	
3	Option B is correct	The different, interacting populations of organisms in an area form a community.
	Option A is incorrect	A group of individuals of the same species that interact with one another form a population.
	Option C is incorrect	An individual plant is an example of an organism.
	Option D is incorrect	An ecosystem consists of the organisms within a geographic area and the nonliving features of the environment of the area, such as air, water, and sunlight.

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Item Position	Rationale	
4	Option A is correct	Based on the graph, the new population of cacti contains more cacti with more spines. This indicates that a greater number of spines on cacti is an adaptation that promotes the reproduction of these cacti.
	Option B is incorrect	If having more spines decreased reproductive fitness, then the new population would contain fewer cacti with a greater number of spines.
	Option C is incorrect	If having more spines were not an adaptation, then the number of spines in the new population would be similar to the number found in the original population.
	Option D is incorrect	Having more spines is an adaptation that increases reproductive fitness in cacti.

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Item Position	Rationale	
5	Option B is correct	Since the offspring has straight hair and is a PTC taster, the offspring would have two recessive alleles (<i>hh</i>) for hair type and be heterozygous (<i>Pp</i>) for PTC tasting.
	Option A is incorrect	An offspring with the <i>Hh</i> genotype would have curly hair.
	Option C is incorrect	An offspring with the <i>Hh</i> genotype would have curly hair, and the <i>pp</i> genotype indicates that the offspring would be a non-taster for PTC.
	Option D is incorrect	An offspring with the <i>pp</i> genotype would be a non-taster for PTC.

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Item Position	Rationale	
6	Option D is correct	Low rainfall and fire can reduce the plant growth rate that drives ecological succession.
	Option A is incorrect	Stimulating plant growth in this ecosystem would speed up the progression of succession.
	Option B is incorrect	Water alone does not dissolve limestone rocks. Carbon dioxide from the air or soil sometimes combines with water during the process of carbonation. This produces a weak acid (carbonic acid) that can dissolve rock surfaces. The breakdown of rock would increase the rate of soil formation and therefore promote ecological succession.
	Option C is incorrect	Shrubby plants are characteristic of a stage of ecological succession, not a determining factor in the rate of ecological succession.

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Item Position	Rationale	
7	Option 4 is correct	This is the nucleus, where chromosomes are replicated during the cell cycle.
	Option 1 is incorrect	This is the cell membrane.
	Option 2 is incorrect	This is the cytoplasm.
	Option 3 is incorrect	This is the rough endoplasmic reticulum.
	Option 5 is incorrect	These are ribosomes.
	Option 6 is incorrect	This is a mitochondrion.
	Option 7 is incorrect	This is the Golgi apparatus.
	Option 8 is incorrect	This is a vesicle.

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Item Position	Rationale	
8	Option C is correct	The experiment shows that the shoot tip detects light. When the grass shoot tip was cut, the plant did not respond (bend) toward the light; however, when the shoot tip was present and able to detect light, the plant grew toward the light.
	Option A is incorrect	The light is detected by cells on the shoot tips, but the bending is caused by a growth hormone, not the pigment involved in photosynthesis (chlorophyll).
	Option B is incorrect	The root system's response to light results in the roots moving away from the light, not in the stem bending toward the light.
	Option D is incorrect	The experiment shows that the shoot tip detects light. However, the roots move away from light. The plant is also growing against gravity (upward as opposed to downward).

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Item Position	Rationale	
9	Option A is correct	The S phase (synthesis) is the phase in which DNA is replicated during the cell cycle. This is when DNA-copying errors are most likely to occur.
	Option B is incorrect	The G ₁ phase (first growth phase) is a period of cell growth, not a period when DNA is copied.
	Option C is incorrect	The G ₂ phase (second growth phase) is a period of cell growth, not a period when DNA is copied.
	Option D is incorrect	The M phase (mitosis) is a period during which a series of phases occur and cause a cell to split into two cells; it is not a period when DNA is copied.

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Item Position	Rationale	
10	Option D is correct	Blood pressure is controlled by a negative feedback mechanism, as shown by the cyclic trend for blood pressure in the graph.
	Option A is incorrect	Although blood flows through veins and arteries, this is not responsible for vasodilation and vasoconstriction.
	Option B is incorrect	Although blood is necessary for human life, this fact is not what is responsible for vasodilation and vasoconstriction.
	Option C is incorrect	Although blood flows through the heart at various rates, it is the negative feedback mechanism that is responsible for vasodilation and vasoconstriction.

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Item Position	Rationale	
11	Option B is correct	If a bactericide were added to soil, microorganisms that break down nitrogen would be destroyed. This would significantly reduce the amount of usable nitrogen available to plants.
	Option A is incorrect	If a bactericide were added to soil, microorganisms that break down nitrogen would be destroyed, so the rate at which nitrogen is broken down would decrease. This would result in plants absorbing nitrogen at a slower rate.
	Option C is incorrect	If a bactericide were added to soil, microorganisms that break down nitrogen would be destroyed. This would decrease the amount of nitrogen available to plants.
	Option D is incorrect	If a bactericide were added to soil, the bactericide would destroy the bacteria that convert nitrogen into forms that are usable by plants. However, nitrogen from the air would still be converted by lightning to a form usable by plants, and this nitrogen would be able to enter the soil.

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Item Position	Rationale	
12	Option C is correct	The claim is false because host cells would not be present in the air. To replicate itself, the virus needs to infect a host.
	Option A is incorrect	The claim is false because viruses must directly contact a cell to infect it.
	Option B is incorrect	The claim is false because viruses need a host cell, not particles in air, to replicate.
	Option D is incorrect	The claim is false because, although viruses can be present in the air, they need a host cell to replicate.

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Item Position	Rationale	
13	Option B is correct	There can be more than one codon for the same amino acid. There are 64 different codons, but only 21 amino acids are coded for by these codons. So, an amino acid can be encoded by as many as six different codons.
	Option A is incorrect	One amino acid substitution can significantly change a protein structure. For example, a hydrophobic amino acid may be substituted for a hydrophilic amino acid or a stop codon may be substituted for an amino acid and prematurely terminate a protein chain.
	Option C is incorrect	Mutations at the nucleotide level do affect protein structure. Chromosomal mutations occur on a larger scale.
	Option D is incorrect	Amino acids are categorized into different groups, and each group has different properties.

Item Position	Rationale	
14	Part A	
	Option D is correct	Giant salvinia inhibits the growth of native plants by preventing sunlight from reaching the plants.
	Option A is incorrect	Giant salvinia hinders the growth of new types of plants by preventing sunlight from reaching plants.
	Option B is incorrect	Giant salvinia inhibits the growth of native plant species, which could result in fewer plant species and therefore decrease the stability of the ecosystem.
	Option C is incorrect	While giant salvinia does provide energy for some of the organisms in the ecosystem, the fact that it prevents the growth of native plant species by blocking light is more significant.
	Part B	
	Option D is correct	Giant salvinia inhibits the growth of native plant species by preventing sunlight from reaching plants that grow underwater.
	Option A is incorrect	There is not sufficient information to determine whether giant salvinia is poisonous to other plants that grow on the water's surface. The inhibition of growth of native plant species is due to the fact that giant salvinia prevents sunlight from penetrating the water's surface.
	Option B is incorrect	Giant salvinia might produce waste that can be used by other plants. However, giant salvinia covers large areas of the water's surface, which prevents sunlight from penetrating the water's surface and therefore inhibits the growth of native plant species.
	Option C is incorrect	If giant salvinia released carbon dioxide into the water, then other plants could use that carbon dioxide to grow. However, carbon dioxide is more likely absorbed by giant salvinia for photosynthesis.

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Item Position	Rationale	
15	Option C is correct	Pasteurization involves heating liquids to a high temperature for a short time. This process kills harmful microbes in milk without affecting its taste or nutritional value.
	Option A is incorrect	Pasteurization kills bacteria in milk that can cause illness. The process of homogenization helps mix the milk more uniformly. This process disperses milkfat using a high-pressure procedure that breaks it down into smaller particles.
	Option B is incorrect	Pasteurization kills bacteria in milk that can cause illness, but it does not increase the level of nutrients in the milk.
	Option D is incorrect	Pasteurization kills bacteria in milk that can cause illness, but it does not affect the caloric value of the milk.

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Item Position	Rationale	
16	Option D is correct	Organisms V, W, X, and Y all share common ancestors that are more recent than the most-recent common ancestor shared with Organism Z.
	Option A is incorrect	Organism W shares the same most-recent common ancestor with Organisms X and Y, and Organism W is more closely related to Organism V than to either Organism X or Organism Y.
	Option B is incorrect	Organism Y is more closely related to Organism X than to Organism V.
	Option C is incorrect	None of the organisms is the common ancestor of the other organisms in the tree.

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Item Position	Rationale	
17	2 pts	Active transport is used in the process. The movement of sodium and potassium ions requires energy (ATP) because the ions need to be pumped against their concentration gradient from an area of low concentration to an area of high concentration.
	1 pt	The student answers half of the questions correctly.
	0 pt	The response is incorrect or irrelevant.

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Item Position	Rationale	
18	Option B is correct	Actin is a structural protein. Actin plays a major role in muscle contraction, allowing the body to move.
	Option A is incorrect	Actin is not an enzyme; it does not increase the rate of chemical reactions.
	Option C is incorrect	Actin is not a messenger protein; it does not transmit signals between cells, tissues, and organs.
	Option D is incorrect	Actin is not a transport protein; it does not carry atoms and molecules within cells and throughout the body.

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Item Position	Rationale	
19	Option D is correct	Based on the table, the donkey is most closely related to the mouse, sharing 95.2% of the cytochrome c amino-acid sequence, followed by the horse (94.2%), the chimpanzee (91.3%), and the lamprey (84.6%).
	Option A is incorrect	This answer is not listed in order from the species most closely related to the mouse. The donkey should be listed first.
	Option B is incorrect	This answer is not listed in order from the species most closely related to the mouse. The lamprey should be last, and the horse should be before the chimpanzee.
	Option C is incorrect	This answer is not listed in order from the species most closely related to the mouse. The donkey should be listed first. The horse should be before the chimpanzee, and the lamprey should be last.

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Item Position	Rationale	
20	2 pts	The abrupt appearance of new organisms is evidence of <u>an increase in biodiversity</u> and <u>an unstable environment</u> . OR The abrupt appearance of new organisms is evidence of <u>an unstable environment</u> and <u>an increase in biodiversity</u> .
	1 pt	The student answers half of the questions correctly.
	0 pt	The response is incorrect.

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Item Position	Rationale	
21	Option A is correct	Based on the correlation between temperature and color frequencies in the grasshopper population, it can be inferred that temperature affects gene expression in the grasshoppers.
	Option B is incorrect	Temperature may affect cell division, but differences in cell division would not cause differences in coloration.
	Option C is incorrect	Temperature may affect ATP production, but differences in ATP production rates would not cause differences in coloration.
	Option D is incorrect	Temperature may affect metabolism, but differences in metabolism would not cause differences in coloration.

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Item Position	Rationale	
22	2 pts	The answers, from top to bottom, are Cellular respiration, Photosynthesis, Photosynthesis, Cellular respiration.
	1 pt	The student provides half or more than half of the correct answers.
	0 pt	Less than half of the answers are correct.

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Item Position	Rationale	
23	Option A is correct	Eukaryotic cells (cells with a nucleus) are more complex than prokaryotic cells (cells that lack a nucleus).
	Option B is incorrect	Eukaryotic cells generally take longer to replicate than prokaryotic cells do.
	Option C is incorrect	Prokaryotic cells do not have membrane-bound organelles.
	Option D is incorrect	All cells have an outer (cell) membrane.

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Item Position	Rationale	
24	Option B is correct	UGC codes for cysteine, UAC codes for tyrosine, AGA codes for arginine, and ACC codes for threonine.
	Option A is incorrect	Threonine is not coded for by UGC. The rest of the amino acid sequence is also incorrectly translated.
	Option C is incorrect	Serine is not coded for by UGC. The rest of the amino acid sequence is also incorrectly translated.
	Option D is incorrect	Proline is not coded for by UGC. The rest of the amino acid sequence is also incorrectly translated.

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Item Position	Rationale	
25	Option D is correct	Primary succession can occur in areas around a volcanic eruption in which new soil is created. Secondary succession can happen in places where some disturbance, such as farming, has cleared an existing community.
	Option A is incorrect	Primary succession does not occur in areas with abundant trees.
	Option B is incorrect	An ecosystem that begins on bare rock is an example of primary succession.
	Option C is incorrect	A new ecosystem formed following a hurricane would be an example of secondary succession. The formation of a new sand dune would be an example of primary succession.

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Item Position	Rationale	
26	2 pts	<p>The student should identify Example 1 as mutualism. The bees are benefiting by getting food (energy and nutrients) from the flowers. The flowering plants are benefiting by being pollinated (or cross-pollinated), resulting in fertilization or seed production (or increased biodiversity). AND</p> <p>The student should identify Example 2 as commensalism. Orchids benefit from getting improved access to essential resources such as sunlight, water, and nutrients. The host plant (the tree) neither benefits from nor is harmed by the presence of the orchids.</p>
	1 pt	The student answers half of the questions correctly.
	0 pt	The response is incorrect or irrelevant.

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Item Position	Rationale	
27	Option A is correct	Prophase is characterized by the condensing of chromosomes and the dissolving of the nuclear membrane.
	Option B is incorrect	Metaphase is characterized by chromosomes aligning perpendicular to the spindle fiber apparatus along the metaphase plate.
	Option C is incorrect	Telophase is characterized by the newly made chromosomes being tightly grouped and the formation of a cleavage furrow in animal cells, or a cell plate in plant cells. Telophase indicates that cell division is nearly complete.
	Option D is incorrect	Interphase occurs prior to mitosis and contains the G ₁ (primary growth) phase, the S (synthesis) phase, and the G ₂ (secondary growth) phase. The observations describe prophase, which takes place during mitosis, after the G ₂ phase.

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Item Position	Rationale	
28	Option A is correct	Both parents are carriers for cystic fibrosis, so they are both heterozygous for the trait. Since cystic fibrosis is a recessive trait, the offspring must inherit a recessive allele from each parent. Therefore, there is a 25% probability that the offspring of two carrier parents will inherit the disorder.
	Option B is incorrect	There is a 50% probability that the offspring will be heterozygous like the parents.
	Option C is incorrect	There is a 75% probability that the offspring will not inherit the disorder.
	Option D is incorrect	The probability would be 100% only if both parents had the disorder.

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Item Position	Rationale	
29	Option B is correct	Substance 3 needs energy from ATP in order to move across the cell membrane because it is moving from an area of low concentration to an area of high concentration.
	Option A is incorrect	Substance 2 is in equilibrium, moving in and out across the cell membrane equally without requiring ATP.
	Option C is incorrect	Substance 1 is moving across the cell membrane from an area of high concentration to an area of low concentration, which occurs by passive transport and does not require ATP. Substance 2 is in equilibrium, moving in and out across the cell membrane equally without requiring ATP.
	Option D is incorrect	Substance 1 is moving across the cell membrane from an area of high concentration to an area of low concentration, which occurs by passive transport and does not require ATP.

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Item Position	Rationale	
30	Option D is correct	During the lytic cycle, a virus reproduces within a host cell that eventually bursts, releasing viral particles. During the lysogenic cycle, a virus injects its genome into a host cell genome.
	Option A is incorrect	The lytic cycle results in a host cell bursting, and the lysogenic cycle involves a virus inserting its genome into a host cell genome.
	Option B is incorrect	A virus inserts its genome into a host cell genome during the lysogenic cycle, and the host cell (not the virus) bursts during the lytic cycle.
	Option C is incorrect	The lytic cycle results in a host cell bursting, and the lysogenic cycle involves a virus inserting its genome into a host cell genome.

Item Position	Rationale	
31	Part A	
	Option A is correct	The release of hormones involves the endocrine system, and the brain is part of the nervous system. Through their interaction, these systems regulate the digestive system.
	Option B is incorrect	The respiratory system exchanges gases in the lungs. This system is not described as regulating the digestive system.
	Option C is incorrect	The muscular system supports the body for movement, and the excretory system removes waste from the body. These systems are not described as regulating the digestive system.
	Option D is incorrect	The integumentary system serves as a barrier for the body in addition to other internal functions, and the excretory system removes waste from the body. These systems are not described as regulating the digestive system.
	Part B	
	Option A is correct	Neurons send signals received by glands that allow hormones to travel long distances, signaling hunger.
	Option B is incorrect	Signals are not sent to reduce oxygen intake levels. This would lead to decreased rates of nutrient absorption.
	Option C is incorrect	Water is necessary for digestion, and the removal of water would not increase the rate of nutrient absorption.
	Option D is incorrect	Water is not released through pores in the skin to make room for the absorption of nutrients. Water helps break down food, which allows the body to absorb nutrients.

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Item Position	Rationale	
32	2 pts	From top to bottom: T<A is a base pair, the circle-pentagon-G is a nucleotide, and the lone circle represents phosphate.
	1 pt	The student provides more than half of the correct answers.
	0 pt	Less than half of the answers are correct.

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Item Position	Rationale	
33	Option B is correct	The founder effect occurs when a geographically isolated population with limited genetic diversity causes subsequent populations to have a genetic makeup that varies little from that of the original population.
	Option A is incorrect	Gene flow is the movement of genes into or out of a population, not the movement of a population.
	Option C is incorrect	Mutations are changes in the genetic code of an organism through which genetic variants are created.
	Option D is incorrect	Recombination leads to genetic variability through crossing over or rearranging of genes, which results in high, not low, levels of genetic variation.

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Item Position	Rationale	
34	Option D is correct	The phenotypic distribution shows a greater beak depth in the finches, which allows for better survival due to natural selection. During the drought, finches with larger beaks were able to better obtain resources to survive and reproduce.
	Option A is incorrect	Environmental factors may increase survival rates, but not all finches had the same ability to obtain food.
	Option B is incorrect	Individuals do not evolve; only populations evolve.
	Option C is incorrect	A decrease in fitness reduces survival rates. During the drought, finches with larger beaks had greater fitness.

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Item Position	Rationale	
35	Option A is correct	Plant cells and animal cells contain a nucleus, mitochondria, and ribosomes. Plant cells, but not animal cells, can contain chloroplasts and a cell wall.
	Option B is incorrect	Plant cells also contain mitochondria and ribosomes.
	Option C is incorrect	Animal cells do not contain a cell wall; plant cells also contain ribosomes.
	Option D is incorrect	Plant cells, not animal cells, contain a cell wall.

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Item Position	Rationale	
36	1 pt	15; Meiosis results in haploid daughter cells that have half the number of chromosomes found in diploid cells, and 30 divided by 2 = 15.
	0 pt	The response is incorrect or irrelevant.

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Item Position	Rationale	
37	Option C is correct	Rennin was denatured in Test Tube 3, as evidenced by the fact that it did not cause the milk to solidify.
	Option A is incorrect	There is no evidence that the enzyme in Test Tube 3 caused product to form.
	Option B is incorrect	The substrate (milk) is still present in Test Tube 3 after the experiment.
	Option D is incorrect	There is no evidence that the substrate (milk) reacted with the enzyme (rennin), as the milk did not solidify.

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Item Position	Rationale	
38	Option D is correct	The mistletoe is a parasite on the tree, because it grows into the tree to obtain water and nutrients, which harms the tree but benefits the mistletoe.
	Option A is incorrect	The relationship between the tree and the mistletoe is not commensalism, because the tree is harmed while the mistletoe benefits.
	Option B is incorrect	The relationship between the birds and the trees is not a predator-prey relationship, because neither organism is consuming the other organism.
	Option C is incorrect	The relationship between the birds and the trees is not mutualism, because the trees do not benefit from the birds eating the mistletoe seeds and spreading them.

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Item Position	Rationale	
39	Option A is correct	Plethodontid salamanders need a moist environment in order to breathe; thus, tropical environments are where they are better adapted to live.
	Option B is incorrect	Tundra environments are too dry for plethodontid salamanders.
	Option C is incorrect	Desert environments are too dry for plethodontid salamanders.
	Option D is incorrect	Grassland environments are too dry for plethodontid salamanders.

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Item Position	Rationale	
40	Option C is correct	Releasing new beetles into the environment will cause an increase in competition for food resources among all the beetle species in the habitat.
	Option A is incorrect	Releasing new beetles into the environment will not cause an increase in the available habitat for non-native plant species.
	Option B is incorrect	Releasing new beetles into the environment will not cause an increase in the population numbers of native beetle species, because there will be increased competition for food resources among all the beetle species in the habitat.
	Option D is incorrect	Releasing new beetles into the environment will not cause an increase in pollination of native flowering plant species.

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Item Position	Rationale	
41	1 pt	The student selects "Total Carb" (carbohydrates). Carbohydrates provide the body with a source of quick energy.
	0 pt	The response is incorrect.

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Item Position	Rationale	
42	Option B is correct	Gene expression controls the development of specialized cell types.
	Option A is incorrect	The rate at which cells grow does not determine what type of cell an unspecialized cell will become.
	Option C is incorrect	The nutrients available to cells do not determine what type of cell an unspecialized cell will become.
	Option D is incorrect	The age of neighboring cells does not determine what type of cell an unspecialized cell will become.

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Item Position	Rationale	
43	2 pts	Almost every organism begins the process of protein synthesis with a <u>triplet</u> nucleotide sequence. This start codon is translated to a common <u>amino acid</u> in all organisms.
	1 pt	The student provides half of the correct answers.
	0 pt	The answers are incorrect.

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Item Position	Rationale	
44	Option B is correct	Organism 2 and Organism 4 belong to the same class, which is the lowest level of classification with a match between organisms in the table.
	Option A is incorrect	Organism 1 and Organism 2 share the same kingdom and phylum but not the same class. Therefore, these organisms are less closely related than Organism 2 and Organism 4.
	Option C is incorrect	Organism 3 and Organism 4 share the same kingdom and phylum but not the same class. Therefore, these organisms are less closely related than Organism 2 and Organism 4.
	Option D is incorrect	Organism 1 and Organism 3 share the same kingdom and phylum but not the same class. Therefore, these organisms are less closely related than Organism 2 and Organism 4.

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Item Position	Rationale	
45	Option D is correct	The dark-colored moths increased in population size because the gene coding for dark pigment provided a greater survival advantage than the gene for light pigment did. Dark moths were camouflaged on the soot-covered trees. The light-colored moths were easily seen by predators, and their population declined.
	Option A is incorrect	Dark-colored moths were better adapted than light-colored moths.
	Option B is incorrect	Light-colored moths did not relocate. They were seen more easily, so they were more likely to be eaten by predators. So, the size of the light-colored moth population decreased.
	Option C is incorrect	Diet was not a factor in the development of dark-colored moths. Random genetic variation led to a dark-colored variant