2022 STAAR Biology Rationales

Item #	Rationale	
1	Option A is correct	According to the dichotomous key, squids move by jet propulsion and do not have an external shell.
	Option B is incorrect	According to the dichotomous key, slugs move by crawling with a singular muscular foot.
	Option C is incorrect	According to the dichotomous key, nautilus move by jet propulsion, but they do have an external shell.
	Option D is incorrect	According to the dichotomous key, snails move by crawling with a singular muscular foot and have an external shell.

2022 STAAR Biology Rationales

Item #	Rationale	
2	Option G is correct	Viruses cannot replicate on their own. They enter host cells. Once inside, they use the materials and metabolic pathways from the host cells and incorporate the viral RNA or DNA into the host cells to replicate new virus particles.
	Option F is incorrect	Viruses are not able to divide as a cell would in mitosis. Viruses can only replicate after entering a host cell.
	Option H is incorrect	Viruses do not fuse, and they are not able to replicate without entering the cell of a host organism.
	Option J is incorrect	Once virus particles break down, they are not able to reassemble and make new copies.

2022 STAAR Biology Rationales

Item #	Rationale	
3	Option A is correct	The nervous and muscular systems in horses help the animal repel biting flies by ear twitching, head tossing, leg stomping, and tail swishing. This response is a result of the nervous system sensing the biting flies and sending a signal to the muscular system of the animal.
	Option B is incorrect	The circulatory system does not sense the biting flies to send signals to the nervous system. The nervous system senses the biting flies. The circulatory system delivers nutrients and oxygen to cells and removes waste from animals.
	Option C is incorrect	The muscular system does not sense the biting flies to send signals to the integumentary system, which comprises the outermost layer of animals.
	Option D is incorrect	The integumentary system does not sense the biting flies to send signals to the circulatory system. The circulatory system delivers nutrients and oxygen to cells and removes waste from animals.

2022 STAAR Biology Rationales

Item #	Rationale	
4	Option F is correct	A decrease in the sea otter population would likely result in an increase in the sea urchin population, which in turn would lead to a decrease in the kelp population. Sea otters prey on sea urchins, and sea urchins prey on kelp. Fewer sea otters in the ecosystem preying on sea urchins would allow more sea urchins to survive over time. This would lead to a larger number of sea urchins to prey on kelp, resulting in a decrease in the size of the kelp population.
	Option G is incorrect	The fish population in the food web is not directly impacted by changes in the mussel population.
	Option H is incorrect	The algae population would decrease due to the increase in predation by the sea urchins. Less algae in the ecosystem would reduce the food source for mussels, leading to a decrease in the mussel population.
	Option J is incorrect	The killer whale population would decrease due to the decrease in sea otters as an available food source.

Item #	Rationale	
5	Option D is correct	An insertion mutation is a result of inserting new nitrogenous bases into DNA. In this model, new "K" and "L" genes have been inserted into the chromosome.
	Option A is incorrect	This is an example of a deletion mutation. In this model, "R" and "Z" genes have been deleted from the chromosome.
	Option B is incorrect	This is an example of a deletion mutation. In this model, the "U" gene has been deleted from the chromosome.
	Option C is incorrect	This is an example of a translocation mutation. In this model, the "S" and "U" genes have swapped positions in the chromosome.

Item #	Rationale	
6	Option G is correct	Twelve thousand kilojoules (kJ) of energy from the sun is incorporated into the tissues of the producers. Only 10 percent, or 1,200 kJ, of energy is incorporated into the tissues of herbivores when they consume producers.
	Option F is incorrect	Twelve thousand kilojoules of energy is the same amount of energy present in the producers. This answer is incorrect because it does not account for the approximately 90% loss of energy that occurs when herbivores consume plants.
	Option H is incorrect	Ten-thousand-eight-hundred kilojoules is not approximately 10 percent of the initial kilojoules of energy incorporated into the tissues of the producers.
	Option J is incorrect	One-thousand-eighty kilojoules is not approximately 10 percent of the initial kilojoules of energy incorporated into the tissues of the producers.

2022 STAAR Biology Rationales

Item #	Rationale	
7	Option D is correct	This response of the shoot system benefits the plant by providing added support for the plant to grow and allowing the plant to put more energy into growing toward sunlight to perform photosynthesis.
	Option A is incorrect	Growing upward will not cause the plant to produce more pollen for pollinators.
	Option B is incorrect	Plants can absorb carbon dioxide at any height.
	Option C is incorrect	Plants absorb water through the roots, not the shoot system.

Item #	Rationale	
8	Option H is correct	The chemicals produced by both the white clovers and skunk cabbages are adaptations that deter animals from eating them, and thus increase their chances of survival.
	Option F is incorrect	These adaptations do not allow the plants to attract more pollinators; however, they do allow the plants to attract specific pollinators.
	Option G is incorrect	These adaptations do not allow the plants to survive a long-term drought because they are not related to the plants' ability to retain water.
	Option J is incorrect	These adaptations do not allow the plants to grow better in colder habitats because they are not related to the plants' ability to grow in colder temperatures.

Item #	Rationale	
9	Option A is correct	The albino allele (c) is recessive to all other alleles, so expression of the albino phenotype requires two copies of the allele. This option is the only option where two albino alleles would result.
	Option B is incorrect	The chinchilla parent ($c^{ch}c^{h}$) is not carrying the recessive albino allele. Their offspring would be chinchilla and Himalayan.
	Option C is incorrect	Neither parent is carrying the recessive albino allele. Their offspring would be black and chinchilla.
	Option D is incorrect	Neither parent is carrying the recessive albino allele. Their offspring would be chinchilla and Himalayan.

2022 STAAR Biology Rationales

Item #	Rationale	
10	Option J is correct	The genes that are expressed are directly responsible for the function of a cell.
	Option F is incorrect	The size of a cell can change depending on the environment, but it does not determine the type of cell that the daughter cell becomes.
	Option G is incorrect	The length of the cell cycle depends on the type of cell that the daughter cell becomes, which is determined by the genes that are expressed.
	Option H is incorrect	All chromosomes within a cell are replicated.

2022 STAAR Biology Rationales

Item #	Rationale	
11	Option C is correct	Natural selection led to enlarged pectoral fins in blue flying fish, allowing the fish to escape predators to survive and reproduce.
	Option A is incorrect	Blue flying fish do not glide from different bodies of water to mate with other species.
	Option B is incorrect	The fish do not live on land and water.
	Option D is incorrect	Organisms cannot self-mutate.

Item #	Rationale	
12	Option F is correct	During Stage II, the cells have replicated their DNA, but have not completed mitosis and cytokinesis. Therefore, the mass of DNA is double the mass of the DNA in stages I and III.
	Option G is incorrect	These cells have half the mass of DNA as in stages I and III because DNA did not replicate.
	Option H is incorrect	These cells have the same mass of DNA as seen in stages I and III.
	Option J is incorrect	These cells are in the G_0 phase and have the same mass of DNA as in stages I and III.

2022 STAAR Biology Rationales

Item #	Rationale	
13	Option B is correct	Adaptations (like the ability to change skin color to hide from predators) are beneficial traits that are passed down from parent to offspring that help organisms survive and reproduce.
	Option A is incorrect	Adaptations are beneficial traits acquired through natural selection that occur as a result of random mutation. Artificial selection is the intentional breeding of organisms with established adaptations.
	Option C is incorrect	Geographic isolation would not prevent genetic mutation. Mutations occur randomly and are not related to geographic isolation of an organism.
	Option D is incorrect	The adaptation is a result of a genetic trait that the green anole lizard possesses; however, environmental pressures may lead to a mutation in the genotype.

2022 STAAR Biology Rationales

Item #	Rationale	
14	Option H is correct	Active transport requires cellular energy, which is supplied by ATP.
	Option F is incorrect	Passive transport does not require energy from ATP.
	Option G is incorrect	Simple diffusion is a type of passive transport and does not require energy from ATP.
	Option J is incorrect	Osmosis is a type of passive transport and does not require energy from ATP.

2022 STAAR Biology Rationales

Item #	Rationale	
15	Option B is correct	The relationship between the leaf-cutter ants and the fungi is mutualism. Both the ants and fungi benefit from each other.
	Option A is incorrect	Predation is a relationship where the predator benefits and the prey are eaten.
	Option C is incorrect	The leaf-cutter ants and the fungi are not competing for a resource.
	Option D is incorrect	Commensalism is a symbiotic relationship where one organism benefits and the other organism is unaffected.

2022 STAAR Biology Rationales

Item #	Rationale	
16	Option J is correct	The first mRNA codon is AUG. AUG on the codon chart codes for the amino acid Met.
	Option F is incorrect	A mRNA codon of UGU or UGC would code for the amino acid Cys.
	Option G is incorrect	An mRNA codon of UUU or UUC would code for the amino acid Phe.
	Option H is incorrect	An mRNA codon of AUU, AUC, or AUA would code for the amino acid Ile.

Item #	Rationale	
17	Option A is correct	Each scientific name applies to one species, making it universally identifiable to scientists across languages and regions. Additionally, scientific names help scientists avoid confusion when multiple common names may be used to describe a single species.
	Option B is incorrect	The name of an organism does not have any influence on scientists' understanding of the organism's behavior.
	Option C is incorrect	Scientists do not name organisms by a binomial name for the purpose of creating a common name.
	Option D is incorrect	The name of an organism does not indicate the appearance of an organism relative to others of the same genus.

Item #	Rationale	
18	Option H is correct	In meiosis, during the cellular process of crossing over, homologous chromosome pairs exchange parts with each other creating new allele combinations on each chromosome.
	Option F is incorrect	Chromosomes will continue to replicate after the process of crossover (as seen in the diagram) has been completed.
	Option G is incorrect	Offspring will continue to express traits from previous generations. The crossover process results in genetic recombination.
	Option J is incorrect	Chromatids will have increased genetic diversity as a result of the process seen in the diagram (crossover).

2022 STAAR Biology Rationales

Item #	Rationale	
19	Option D is correct	Petals attract pollinators, pollinators deposit pollen on the stigma, and the pollen grain must grow and fuse with an ovule to complete fertilization.
	Option A is incorrect	Filaments do not attract pollinators.
	Option B is incorrect	Pollinators do not deposit pollen onto the ovule.
	Option C is incorrect	Filaments do not attract pollinators.

2022 STAAR Biology Rationales

Item #	Rationale	
20	Option H is correct	The backbone of a DNA molecule is made up of alternating deoxyribose sugars and phosphates.
	Option F is incorrect	Purines are nitrogenous bases that connect the two backbones of a DNA molecule together.
	Option G is incorrect	Pyrimidines and purines are nitrogenous bases that connect the two backbones of a DNA molecule together.
	Option J is incorrect	Pyrimidines are nitrogenous bases that connect the two backbones of a DNA molecule together.

2022 STAAR Biology Rationales

Item #	Rationale	
21	Option A is correct	The organization of the genetic material is the best characteristic to distinguish these cells as either prokaryotic or eukaryotic.
	Option B is incorrect	The location of the cytoplasm is the same in prokaryotic and eukaryotic cells. The cytoplasm is a gel-like fluid found in all cells.
	Option C is incorrect	The role of the cell membrane is the same in prokaryotic and eukaryotic cells. The cell membrane allows molecules to enter and leave cells.
	Option D is incorrect	The function of the flagella is the same in prokaryotic and eukaryotic cells. The flagella are structures that enable motility for cells.

2022 STAAR Biology Rationales

Item #	Rationale	
22	Option J is correct	Sweat glands are part of the excretory system that is located within the integumentary system. When body temperature increases, the glands release sweat, and body temperature decreases.
	Option F is incorrect	The heart and blood vessels are part of the circulatory system.
	Option G is incorrect	Blood vessels and platelets are part of the circulatory system.
	Option H is incorrect	The pancreas and blood sugar levels are controlled by the digestive and endocrine systems.

2022 STAAR Biology Rationales

Item #	Rationale	
23	Option D is correct	All organisms are composed of the same nucleotide bases.
	Option A is incorrect	Trees, cats, and amoebas are all eukaryotic organisms.
	Option B is incorrect	Trees, cats, and amoebas are each classified in a different kingdom.
	Option C is incorrect	The number of genes varies among organisms and species.

2022 STAAR Biology Rationales

Item #	Rationale	
24	Option G is correct	Plants absorb carbon in the process of photosynthesis.
	Option F is incorrect	Bacteria use nitrogen, not carbon, during nitrification.
	Option H is incorrect	Snails use oxygen for cellular respiration.
	Option J is incorrect	Mushrooms are fungi that release enzymes to absorb nutrients during decomposition.

2022 STAAR Biology Rationales

Item #	Rationale	
25	Option A is correct	Organisms in the Animalia, Protista, and Fungi kingdoms are all part of the domain Eukarya because their cells' DNA is located inside of a nucleus.
	Option B is incorrect	All organisms in the Animalia, Protista, and Fungi kingdoms are eukaryotic.
	Option C is incorrect	Some organisms in the Protista and Fungi kingdoms are multicellular, and all animals are multicellular.
	Option D is incorrect	Some organisms in the Protista and Fungi kingdoms are unicellular.

2022 STAAR Biology Rationales

Item #	Rationale	
26	Option J is correct	Mitochondria produce energy for cells. The increase in the consumption of oxygen between 5 and 10 minutes is due to mitochondria using oxygen to produce ATP.
	Option F is incorrect	Nuclei are organelles that store genetic material, and amino acids are made in the cytoplasm of the cell. Amino acids are monomers of proteins, which are not molecules that store energy.
	Option G is incorrect	Ribosomes do not build carbohydrates to increase energy output. They provide the location for translation of messenger RNA to amino acids to make proteins.
	Option H is incorrect	Chloroplasts are found in the cells of producers, where they use the sun’s energy to make glucose and oxygen. This graph represents an athlete's oxygen consumption.

2022 STAAR Biology Rationales

Item #	Rationale	
27	Option A is correct	Under the Linnaean classification system, the lower the level of classification shared by organisms, the more closely related the organisms are. Family is the classification level directly above genus. The elk and the fallow deer are both members of the family Cervidae. The peccary and the pronghorn are members of different families (Tayassuidae and Antilocapridae, respectively).
	Option B is incorrect	Elk and fallow deer are different species, so they are not able to mate and produce fertile offspring. The definition of a species is having the ability to mate and produce fertile offspring.
	Option C is incorrect	Living in similar habitats would not lead to classifying these organisms in the same genus. Distantly related organisms can share similar habitats.
	Option D is incorrect	All the organisms in the table are in the kingdom Animalia, not just the elk and the fallow deer. Also, distantly related animals living in similar environments can share similar diets.

Item #	Rationale	
28	Option J is correct	The variability in nitrogenous bases carries the genetic information that encodes for traits.
	Option F is incorrect	Phosphate groups do not carry genetic information. Phosphate is a molecule that is part of the backbone of a DNA molecule.
	Option G is incorrect	The sugar phosphate backbone of a DNA molecule does not carry genetic information.
	Option H is incorrect	Deoxyribose does not carry genetic information. It is the sugar in the backbone of DNA.

Item #	Rationale	
29	Option B is correct	At the end of this chemical reaction, the enzyme remains unchanged, and the substrate has been broken down.
	Option A is incorrect	Enzymes are not altered during a chemical reaction.
	Option C is incorrect	A chemical reaction has not occurred in this model since the substrate has not changed.
	Option D is incorrect	The enzyme has been altered, and enzymes are not altered during chemical reactions. Also, the substrate has not undergone a chemical reaction.

Item #	Rationale	
30	Option G is correct	When two heterozygous dogs are crossed, the percentage of the offspring that are expected to be homozygous for smooth hair will be 25%. In a Punnett square, Hh × Hh will result in 25% HH (homozygous wirehair), 50% Hh (heterozygous wirehair), and 25% hh (smooth hair).
	Option F is incorrect	In a Punnett square, Hh × Hh will result in 25% HH (homozygous wirehair), 50% Hh (heterozygous wirehair), and 25% hh (smooth hair). Zero percent is not an option.
	Option H is incorrect	In a Punnett square, Hh × Hh will result in 25% HH (homozygous wirehair), 50% Hh (heterozygous wirehair), and 25% hh (smooth hair). Therefore, 50 percent of the population will have a heterozygous genotype for wirehair.
	Option J is incorrect	In a Punnett square, Hh × Hh will result in 25% HH (homozygous wirehair), 50% Hh (heterozygous wirehair), and 25% hh (smooth hair). Therefore, 75 percent of the population will have wirehair.

2022 STAAR Biology Rationales

Item #	Rationale	
31	Option B is correct	Proteins in the form of enzymes catalyze chemical reactions inside the cell. Lipids make up the cell membrane, which allows certain molecules to be transported into and out of the cell.
	Option A is incorrect	Proteins in the form of enzymes, not lipids, catalyze chemical reactions in the cell.
	Option C is incorrect	Lipids store energy, not genetic information, for the cell.
	Option D is incorrect	Nucleic acids, not proteins, store genetic information.

2022 STAAR Biology Rationales

Item #	Rationale	
32	Option H is correct	Sample 3 is a virus due to the absence of organelles and the presence of a small genome.
	Option F is incorrect	Sample 1 is a plant due to the presence of a chloroplast.
	Option G is incorrect	Sample 2 is bacteria due to the absence of both a nucleus and a chloroplast.
	Option J is incorrect	Sample 4 is an animal due to the presence of a nucleus and ribosome and the absence of a chloroplast.

Item #	Rationale	
33	Option B is correct	The microorganisms found in the body are important in promoting a healthy immune system because they keep the immune system strong, aid in digestion, and neutralize toxins.
	Option A is incorrect	Microorganisms are not harmful to the body; they are important for keeping the immune system strong, aiding in digestion, and neutralizing toxins.
	Option C is incorrect	Not all bacteria increase the effectiveness of the immune system. Some bacteria aid in digestion and neutralize toxins, while some bacteria can be harmful to the body.
	Option D is incorrect	Bacteria that cause infections often lead to an increase in the number of immune cells in the body that fight disease.

Item #	Rationale	
34	Option H is correct	Somatic cell mutations occur in body cells affecting a single cell or tissue. They are not inherited/passed on to offspring. Gamete mutations occur in sperm or egg cells. Gamete mutations can be inherited/passed on to offspring.
	Option F is incorrect	Germ cells, not somatic cells, give rise to gametes. Apoptosis is programmed cell death and occurs in both somatic and gametic cells.
	Option G is incorrect	Cell mutations are found in an individual's genome, not a gene pool.
	Option J is incorrect	A mutation in any cell can be expressed by an individual.

2022 STAAR Biology Rationales

Item #	Rationale	
35	Option B is correct	The stages of mitosis (prophase, metaphase, anaphase, and telophase) are in the correct sequence based on the model shown.
	Option A is incorrect	DNA must line up in the middle of the cell before it can divide evenly.
	Option C is incorrect	During mitosis, one cell becomes two cells.
	Option D is incorrect	DNA must condense into visible chromosomes before it can line up in the middle of the cell.

Item #	Rationale	
36	Option H is correct	Stone crabs consume gulf pipefish, and gulf pipefish consume aquatic plants.
	Option F is incorrect	Canadian geese do not consume silverside fish.
	Option G is incorrect	Aquatic plants are the producers for this energy pyramid, so aquatic plants should be located at the bottom of the energy pyramid.
	Option J is incorrect	Aquatic plants are the producers for this energy pyramid, so aquatic plants should be located at the bottom of the energy pyramid.

Item #	Rationale	
37	Option A is correct	Contact inhibition is a mechanism that stops the cell cycle and prevents cells from performing replication/proliferation and growth. The cells in an organism that lack contact inhibition will continue to replicate/proliferate and grow, and potentially lead to the development of tumors.
	Option B is incorrect	Cells replicate normally, replacing body cells that die, when normal contact inhibition mechanisms are functioning correctly.
	Option C is incorrect	Cell replication is not based on the availability of food.
	Option D is incorrect	Cells do stop replicating when normal contact inhibition mechanisms are functioning correctly.

2022 STAAR Biology Rationales

Item #	Rationale	
38	Option H is correct	Commensalism is the symbiotic relationship that exists. The pygmy seahorse does not harm or benefit the sea fan while it grasps the branches with its tail.
	Option F is incorrect	The seahorse is not eating the sea fan.
	Option G is incorrect	The sea fan does not benefit from the relationship.
	Option J is incorrect	The seahorse is not harming the sea fan.

Item #	Rationale	
39	Option C is correct	The theory of punctuated equilibrium, devised by Niles Eldredge and Stephen Jay Gould, is characterized by periods of slow change interrupted by periods of rapid change with few transitional fossils in the fossil record.
	Option A is incorrect	Charles Darwin's theory of natural selection proposed that evolution was a "steady, slow and continuous" process unlike punctuated equilibrium, which suggests periods of both slow and rapid change.
	Option B is incorrect	Genetic drift explains how gene frequencies change by chance.
	Option D is incorrect	Gene flow is the movement of genetic material from one population to another.

2022 STAAR Biology Rationales

Item #	Rationale	
40	Option F is correct	DNA replication occurs during the S phase. Nuclear division occurs during the M phase.
	Option G is incorrect	Nuclear division occurs during the M phase.
	Option H is incorrect	Cytoplasm division occurs during the M phase. Cell growth occurs during the S phase.
	Option J is incorrect	DNA replication occurs during the S phase.

Item #	Rationale	
41	Option B is correct	Location 2 is the branch point on the phylogenetic tree that identifies characteristics shared by Species B, C, and D.
	Option A is incorrect	Location 1 is the branch point that led to all lineages on this phylogenetic tree.
	Option C is incorrect	Location 3 is the branch point that led to all species on the phylogenetic tree except for Species A.
	Option D is incorrect	Location 4 is the branch point that led to Species E and F on the phylogenetic tree.

2022 STAAR Biology Rationales

Item #	Rationale	
42	Option J is correct	The circulatory system transports blood to and from the heart and the rest of the body. Nutrients and gases, such as oxygen, are dissolved in the blood. The circulatory system must interact with the respiratory and digestive systems to transport the nutrients and gases in the blood throughout the body.
	Option F is incorrect	The endocrine system is comprised of hormones that regulate body processes, such as metabolism and growth.
	Option G is incorrect	The integumentary system is comprised of the outer layer of the body, including skin, nails, hair, and exocrine glands.
	Option H is incorrect	The immune system is comprised of a variety of cells and organs to protect organisms from pathogens.

Item #	Rationale	
43	Option A is correct	Gene flow describes the transfer of genetic material from one population to another population. Cross-pollination of flowering plants from different populations of the same species will most likely result in a greater number of genetic combinations and an overall increase in the genetic diversity/variation within the species.
	Option B is incorrect	Evolution is due to environmental demands and natural selection over time.
	Option C is incorrect	Since the flowers are of the same species, the gametes would be compatible.
	Option D is incorrect	Cross-pollination will increase genetic variation.

2022 STAAR Biology Rationales

Item #	Rationale	
44	Option H is correct	After a wheat field is cleared, wild grasses and weeds begin growing due to secondary succession, since soil is already present. Primary succession can only occur in areas where life was not previously present e.g., newly formed volcanic rock.
	Option F is incorrect	Primary succession occurs when there is a lack of soil. Pioneer species such as lichen must make new soil before secondary succession can begin.
	Option G is incorrect	Primary succession occurs when there is a lack of soil, not a lack of large trees. Pioneer species such as lichen must make new soil before secondary succession can begin.
	Option J is incorrect	Soil is needed for secondary succession to occur; however, inorganic matter such as water is a necessary component for producers (grasses and weeds) to grow.

Item #	Rationale	
45	Option D is correct	Organelle I is mitochondria, where carbon dioxide and water are the products of the process of cellular respiration. Organelle II is a chloroplast, where glucose and oxygen are the products of the process of photosynthesis.
	Option A is incorrect	Glucose and oxygen are the products of photosynthesis, which occur in the chloroplast (organelle II). Oxygen and glucose are the reactants of cellular respiration, which takes place in the mitochondria (organelle I).
	Option B is incorrect	In organelle I, carbon dioxide and oxygen are not the products of cellular respiration. In organelle II, glucose and water are not the products of photosynthesis.
	Option C is incorrect	In organelle I, oxygen and glucose are not the products of cellular respiration. In organelle II, water and carbon dioxide are not the products of photosynthesis.

Item #	Rationale	
46	Option H is correct	The ecosystem would become less stable if most of the ground cover dried up. Less energy would be available to the ecosystem due to a decrease in the number of producers.
	Option F is incorrect	An extended dry season would reduce available resources and likely reduce the numbers and ranges of most organisms.
	Option G is incorrect	Water is the limiting factor affecting all organisms, including plants. Less water would lead to more competition among canopy plants and less stability within the ecosystem.
	Option J is incorrect	The ecosystem would become less stable and there would be fewer prey available.

2022 STAAR Biology Rationales

Item #	Rationale	
47	Option D is correct	The roots take in/absorb water from the ground, and the leaves produce sugar through the process of photosynthesis. Water and sugar are transported throughout the plant via vascular tissues.
	Option A is incorrect	The leaves do not take in water or sugar.
	Option B is incorrect	The roots take in water, but they do not take in sugar.
	Option C is incorrect	The leaves do not take in water, and the roots do not produce sugar.

Item #	Rationale	
48	Option H is correct	The scientists' results indicate that gene expression for the enzymes was controlled by the presence of lactose because enzyme concentration was high when lactose was present and low when lactose was not present.
	Option F is incorrect	The scientists' results do not indicate that gene expression for the enzymes was controlled by the temperature of lactose.
	Option G is incorrect	The scientists' results do not indicate that gene expression for the enzymes was expressed in equal amounts during both experiments.
	Option J is incorrect	The scientists' results do not indicate that the genes for the enzymes were mutated before being expressed by the presence of lactose.

Item #	Rationale	
49	Option B is correct	The viceroy butterfly benefits from mimicking the monarch butterfly by being able to deter predators who avoid eating monarch butterflies due to their bad taste.
	Option A is incorrect	Mimicking the monarch butterfly does not make it possible for viceroy butterflies and monarch butterflies to reproduce.
	Option C is incorrect	Mimicking the monarch butterfly does not mean viceroy butterflies will follow the migratory patterns of monarch butterflies.
	Option D is incorrect	Mimicking the monarch butterfly does not allow viceroy butterflies to find additional sources of food used by monarch butterflies.

Item #	Rationale	
50	Option F is correct	The order of cell, tissue, organ, and organ system represents the smallest to largest levels of cellular organization.
	Option G is incorrect	This order is reversed from largest to smallest levels of organization. Cells form tissues, tissues form organs, and organs form organ systems.
	Option H is incorrect	Cells must form before they can be organized into tissues, organs, and organ systems.
	Option J is incorrect	Cells organize to form tissue before organs and organ systems can form.