Item #	Rationale	
1	Option A is correct	When the salt is mixed with water, it will dissolve.
	Option C is correct	After the salt has dissolved, the water will remain clear.
	Option B is incorrect	When the water is stirred, the salt will not sink; it will dissolve.
	Option D is incorrect	When the water is stirred, the salt will not float; it will dissolve.
	Option E is incorrect	When salt dissolves in water, the water does not turn opaque white. The salt and water mixture remains clear.

Item #	Rationale	
2	Option B is correct	Drawing well is a skill that must be learned.
	Option D is correct	Reading is a skill that must be learned.
	Option A is incorrect	Having brown eyes is not a behavior that can be learned. It is an inherited trait.
	Option C is incorrect	Having freckles is not a behavior that can be learned. It is an inherited trait.
	Option E is incorrect	Having blonde hair is not a behavior that can be learned. It is an inherited trait.

Item #	Rationale	
3	Option C is correct	The penny is the most-dense object because it sank to the bottom of the beaker. The water is less dense than the penny but more dense than the paper clip. The paper clip is less dense than the water but more dense than the oil. The oil is less dense than the paper clip but more dense than the cork.
	Option A is incorrect	This list of options is ordered backward, from least dense to most dense. The least-dense object floats on top of the oil, and the most-dense object sinks through the water, to the bottom of the beaker.
	Option B is incorrect	The penny is more dense than the water, because the penny sank through the water to the bottom of the beaker.
	Option D is incorrect	The oil is less dense than the penny, the cork is less dense than the paper clip, and the paper clip is less dense than the water.

Item #	Rationale	
4	Option B is correct	When the land is overgrazed, there are fewer plants and, therefore, fewer roots. With fewer roots in the soil, it is more likely that soil erosion will occur.
	Option A is incorrect	More axis deer would mean that the populations of native plants would decrease due to being consumed by the deer.
	Option C is incorrect	The predators of native animals will not be affected. The axis deer may become prey for the native predators.
	Option D is incorrect	The axis deer decrease the availability of food because they overgraze the land. Therefore, herbivore populations will not increase.

Item #	Rationale	
5	Option B is correct	With the wire cut at Position 2, electrical energy can flow through the middle and right bulbs and back to the battery's negative terminal. The left bulb will remain unlit.
	Option A is incorrect	With the wire cut at Position 1, electrical energy cannot flow through bulbs or to the battery's negative terminal. All bulbs will remain unlit.
	Option C is incorrect	With the wire cut at Position 3, electrical energy can flow only through the left light bulb. Therefore, only the left bulb will be lit.
	Option D is incorrect	With the wire cut at Position 4, electrical energy flowing through the middle and right bulbs cannot make it back to the battery's negative terminal. Therefore, electrical energy flows only through the left bulb, and only the left bulb will be lit.

Item #	Rationale	
6	Option B is correct	When water is in gas form, it condenses as it cools, changing from a gas to a liquid.
	Option A is incorrect	When water freezes, it changes from a liquid to a solid.
	Option C is incorrect	When water evaporates, it changes from a liquid to a gas.
	Option D is incorrect	When liquid water is heated, it does not melt; it evaporates, changing from a liquid to a gas.

Item #	Rationale	
7	Option A is correct	Light changes direction when it passes into a medium with a different index of refraction.
	Option B is incorrect	The person sees a refracted image, not a reflected image.
	Option C is incorrect	This form of refraction does not occur in this scenario. This also would not explain the distance between the actual fish and the observed fish.
	Option D is incorrect	When light travels from one medium to another, the angle of incidence differs from the angle of refraction. Also, the light that allows the person to see the fish travels from the water to the air, not the other way around.

Item #	Rationale	
8	Bird—Consumer Mushroom—Decomposer Caterpillar—Consumer Parsley—Producer	The bird is a consumer because it feeds on the caterpillar and cannot make its food. The mushroom is a decomposer because it breaks down decaying organic matter in the soil from the parsley plant. The caterpillar is a consumer because it feeds on the plant and cannot make its food. The parsley is a producer because it is a plant and makes its own food.

Item #	Rationale	
9	Option A is correct	When water vapor cools, it condenses and turns into liquid water. The cold glass causes water vapor in the air to cool and turn into liquid water drops on the outside of the glass.
	Option B is incorrect	There is not any ice in the air to melt and stick to the glass. And the water from the melting ice cubes within the glass cannot move to the outside of the glass.
	Option C is incorrect	Liquid water becoming water vapor does not explain why drops of liquid water form on the outside of the glass.
	Option D is incorrect	Water does not convert from a solid to a gas (sublimation) under the circumstances described, and even if it did, sublimation would not explain the water drops on the outside of the glass.

Item #	Rationale	
10	Option D is correct	The grass is a living component of the ecosystem, and the water is a nonliving component.
	Option A is incorrect	The rock and the sun are both nonliving components of the ecosystem.
	Option B is incorrect	The fawn and the predators are both living components of the ecosystem. The deer showing the fawn how to find food is an interaction between the two deer, and both are living.
	Option C is incorrect	While they are still on the deer, antlers are part of a living organism. The tree and leaves are also living.

Item #	Rationale	
11	Option B is correct	Wind and water are renewable, while minerals and oil are not.
	Option A is incorrect	Solar energy is a renewable resource.
	Option C is incorrect	Coal and natural gas are not renewable resources.
	Option D is incorrect	Wind is a renewable resource.

Item #	Rationale	
12	Option B is correct	The bone in the tongue helps break hard surfaces like nuts. The great hornbill's diet does not include hard nuts or fruits, so it does not need a bone in its tongue.
	Option A is incorrect	The macaw does not eat small mammals, as indicated in the table.
	Option C is incorrect	The macaw does not make holes in trees, which is not indicated in the data in the table.
	Option D is incorrect	Macaws do not eat whole prey, as indicated in the table.

Item #	Rationale	
13	Part A	
	Option D is correct	There is a cold front moving toward Denver, which is currently experiencing a low-pressure system.
	Option A is incorrect	Atlanta is far removed from an area of changing pressure and not near a weather front.
	Option B is incorrect	Memphis is in a high-pressure system, and a warm front is moving in. This will not cause any serious changes in weather.
	Option C is incorrect	Dallas is not near a weather front, and there are no upcoming weather changes that will affect the high-pressure system.
	Part B	
	Option A is correct	Cold fronts moving into low-pressure systems cause clouds and storms.
	Option B is incorrect	There is no high-pressure system and no warm front near Denver.
	Option C is incorrect	The cold front is moving toward Denver, not away from it.
	Option D is incorrect	Denver is not near an area of high pressure, and a warm front is not moving away from it.

Item #	Rationale	
14	Option B is correct	We can see that the distance between Position 3 and Position 4 is greater than the distance between Position 2 and Position 3. This indicates that the ball has sped up. The ball can speed up only if a force to the right is applied to the ball at Position 3.
	Option A is incorrect	There is no increase in speed from Position 2 to Position 3. Therefore, a force was not applied to the ball at Position 2.
	Option C is incorrect	The force is applied in the wrong direction. A force to the left would cause the ball to slow down as it rolls to the right.
	Option D is incorrect	The force is applied in the wrong direction. A force to the left would cause the ball to slow down as it rolls to the right. Also, the ball's final position does not indicate a change in speed.

Item #	Rationale	
15	2 pts.	The student needs to identify at least one more piece of equipment, such as a ruler, measuring tape, or meterstick, AND include at least one idea for how the hypothesis can be tested, such as varying the height of the book stack, measuring the distance the toy truck travels, or performing repeated trials.
	1 pt.	The student answers half of the question correctly.
	0 pts.	The response is incorrect or irrelevant.

Item #	Rationale	
16	Option A is correct	The diagram shows that the caterpillar larva is going through a metamorphosis to become an adult.
	Option B is incorrect	Only Animal 2 has immature forms that resemble its adult form.
	Option C is incorrect	The diagram does not indicate the amount of time needed for each animal to reach adulthood.
	Option D is incorrect	The diagram does not indicate the habitats used by the younger forms of each animal.

Item #	Rationale	
17	Option B is correct	Moving water produces V-shaped valleys, and glaciers make U-shaped valleys.
	Option A is incorrect	Fast-moving water produces V-shaped valleys, but wind erosion typically occurs in dry locations.
	Option C is incorrect	The V-shaped valley and U-shaped valley shown are inconsistent with the shape of a river delta or an oxbow lake.
	Option D is incorrect	The diagrams show the results of erosion, not weathering.

Item #	Rationale	
18	Option A is correct	Fossil fuels such as coal form due to pressure and heat.
	Option B is incorrect	Erosion and deposition are involved in forming sedimentary rock, but not all sedimentary rock is associated with fossil fuels.
	Option C is incorrect	Heat is one factor in forming fossil fuels, but cementation binds sediments together to form rock, and not all sedimentary rock is associated with fossil fuels.
	Option D is incorrect	Weathering and compaction are involved in forming sedimentary rock, but not all sedimentary rock is associated with fossil fuels.

Item #	Rationale	
19	Option D is correct	Removing tall trees will result in additional sunlight reaching the forest floor, allowing organisms that use sunlight, such as ferns, to grow.
	Option A is incorrect	Removing tall trees will result in additional sunlight, which is detrimental to spore growth.
	Option B is incorrect	The roots of plants grow underground and are not affected by sunlight above the ground.
	Option C is incorrect	The amount of decaying wood used by fungi will not be affected by the removal of tall trees.

Item #	Rationale	
20	Option B is correct	Pieces of cork will float in a beaker of water, but pebbles will sink in a beaker of water.
	Option A is incorrect	Using tweezers to separate small grains of salt and pepper would be very difficult.
	Option C is incorrect	A magnet would attract both safety pins and iron nails.
	Option D is incorrect	Sand and iron filings would both pass through the holes of a colander.

Item #	Rationale	
21	Option C is correct	As a full moon wanes to a last quarter moon, the illuminated area of the moon's face decreases from 100 percent to 50 percent, with the left side illuminated.
	Option A is incorrect	As a full moon wanes to a last quarter moon, the illuminated area of the moon's face decreases from 100 percent to 50 percent, with the left side, not the right side, illuminated.
	Option B is incorrect	As a full moon wanes to a last quarter moon, the illuminated area of the moon's face decreases from 100 percent to 50 percent, with the left side illuminated. Option B shows a thin crescent of light on the right with between 0 percent and 50 percent illumination, which is a waxing crescent moon.
	Option D is incorrect	As a full moon wanes to a last quarter moon, the illuminated area of the moon's face decreases from 100 percent to 50 percent, with the left side illuminated. Option D shows a thin crescent of light on the left with between 50 percent and 0 percent illumination, which is a waning crescent moon.

Item #	Rationale	
22	Option A is correct	Sedimentary rocks that formed underwater can be uplifted to produce mountains.
	Option B is incorrect	Rivers flow from high elevations to low elevations, not the opposite.
	Option C is incorrect	While a dune can become sandstone, it is unlikely for it to contain the types of fossils described.
	Option D is incorrect	Canyons do not form through the splitting of mountains, and canyon formation does not explain the presence of shelled organisms.

Item #	Rationale	
23	Option D is correct	The sun's relative position in the sky can be determined by examining the shadows made by objects. The sun's position is opposite to the shadow cast by an object.
	Option A is incorrect	The sun's position is opposite, not perpendicular, to the shadow cast by an object.
	Option B is incorrect	The sun's position is opposite to, not in the same direction as, the shadow cast by an object.
	Option C is incorrect	The sun's position is opposite, not perpendicular, to the shadow cast by an object.

Item #	Rationale	
24	Option A is correct	Because an eraser, toothpick, and cotton ball do not allow electricity to flow through the circuit, they are classified as insulators.
	Option B is incorrect	An eraser is an insulator and does not allow electricity to flow through the circuit, but a paper clip and a safety pin will allow electricity to flow and complete the circuit.
	Option C is incorrect	A toothpick is an insulator and does not allow electricity to flow through the circuit, but a paper clip and a safety pin will allow electricity to flow and complete the circuit.
	Option D is incorrect	The paper clip, safety pin, and aluminum foil all allow electricity to flow and complete the circuit and are therefore classified as conductors.

Item #	Rationale	
25	Option C is correct	Plants adapted to the desert are likely to have fleshy leaves that store water, the ability to store large amounts of water over time, and shallow roots that extend over large areas of soil.
	Option A is incorrect	Plants adapted to a swamp are unlikely to have shallow roots or to store water after rain.
	Option B is incorrect	Plants adapted to the Arctic are likely to be small and have shallow roots but are unlikely to have leaves with a thick, waxy coating.
	Option D is incorrect	Plants adapted to a forest are likely to have leaves that fall but are unlikely to have leaves that store water after it rains.

Item #	Rationale	
26	From Most to Least Water Retention: Clay, Loam, Silt, Sand, Gravel	Retention of water by soil depends on several soil features, including particle size and composition. Clay has the smallest particle size and retains the most water; gravel has the largest particle size and retains the least water. Loam is a mixture of sand, silt, clay, and humus (organic matter), and it retains more water than silt or sand alone. Sand has larger particles and retains less water than silt.

Item #	Rationale	
27	Option D is correct	The carnivores in the desert food web are lizards, scorpions, snakes, foxes, and hawks.
	Option A is incorrect	There are two herbivores shown in the food web.
	Option B is incorrect	There are three consumers shown in the food web that eat kangaroo rats.
	Option C is incorrect	There are four consumers shown in the food web that eat only herbivores.

Item #	Rationale	
28	Part A	
	Option A is correct	A lamp will provide heat energy to keep the lizard warm at night.
	Option B is incorrect	A thermometer will measure temperature but not change the amount of heat in the terrarium.
	Option C is incorrect	A radio uses energy but will release little heat.
	Option D is incorrect	A mirror will reflect some types of energy but will not provide heat energy.
	Part B	
	Option B is correct	An object that releases heat will be useful because of the cooler temperatures at night.
	Option A is incorrect	Because the lizard is in a terrarium, its likelihood of survival is more affected by the temperature than by predation by another animal.
	Option C is incorrect	Differences between sounds heard at day and night are unrelated to the amount of heat available to the lizard.
	Option D is incorrect	Moonlight will not affect the temperature of the terrarium.

Item #	Rationale	
29	Option C is correct	Closing Switches 1 and 3 will result in a complete circuit that includes the battery and Bulb 2 but an incomplete circuit for Bulb 1.
	Option A is incorrect	Closing only Switch 1 but not Switch 3 will result in an incomplete circuit that does not allow either Bulb 1 or Bulb 2 to light.
	Option B is incorrect	Closing only Switches 2 and 3 will result in an incomplete circuit because electric current will not be able to flow through the smaller loop.
	Option D is incorrect	Closing Switches 1, 2, and 3 will result in electric current flowing through both loops and lighting both Bulb 1 and Bulb 2.

Item #	Rationale	
30	Option B is correct	Oil is found in areas that were once rich with organic material, such as shallow seas.
	Option A is incorrect	A desert is unlikely to provide the large amount of plant and animal life required to produce fossil fuels.
	Option C is incorrect	A flat grassland is unlikely to allow the gradual decay of organisms required to produce fossil fuels.
	Option D is incorrect	A tropical rain forest is unlikely to allow the gradual decay of organisms required to produce fossil fuels.

Item #	Rationale	
31	Option D is correct	The angle at which the light ray reflects off the tilted mirror is the same as the angle at which the light ray strikes the mirror's surface.
	Option A is incorrect	A light ray does not refract and exit the tilted mirror when it strikes the mirror's surface.
	Option B is incorrect	A light ray reflects when it strikes the surface of a mirror, but the angle of reflection is the same as the angle at which the light ray strikes the tilted mirror.
	Option C is incorrect	A light ray that interacts with a mirror will reflect from the surface of the tilted mirror but will not refract before reflecting.

Item #	Rationale	
32	Option C is correct	Water and rocks are nonliving parts of the frog's habitat.
	Option A is incorrect	Soil is a nonliving part of the frog's habitat, but plant leaves are a living part of the habitat.
	Option B is incorrect	Mealworms and crickets are living parts of the frog's habitat.
	Option D is incorrect	A rock is a nonliving part of the frog's habitat, but plant leaves are a living part of the habitat.