Texas STAAR 2021 Grade 8 Science

STAAR GRADE 8 SCIENCE REFERENCE MATERIALS

FORMULAS

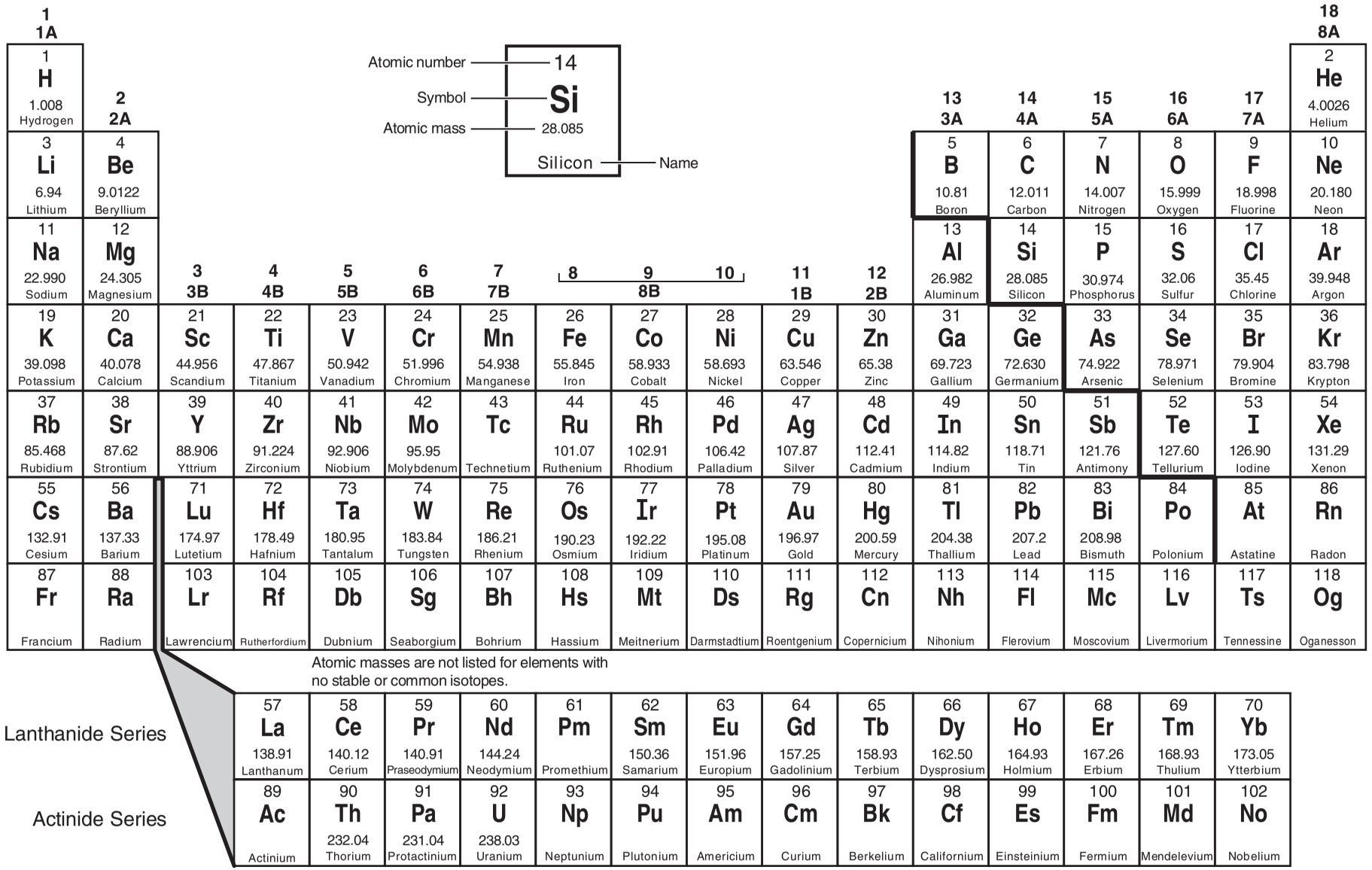
Density = $\frac{\text{mass}}{\text{volume}}$ $D = \frac{m}{V}$

Average speed = $\frac{\text{total distance}}{\text{total time}}$ $s = \frac{d}{t}$

Net force = (mass)(acceleration) $F = ma$

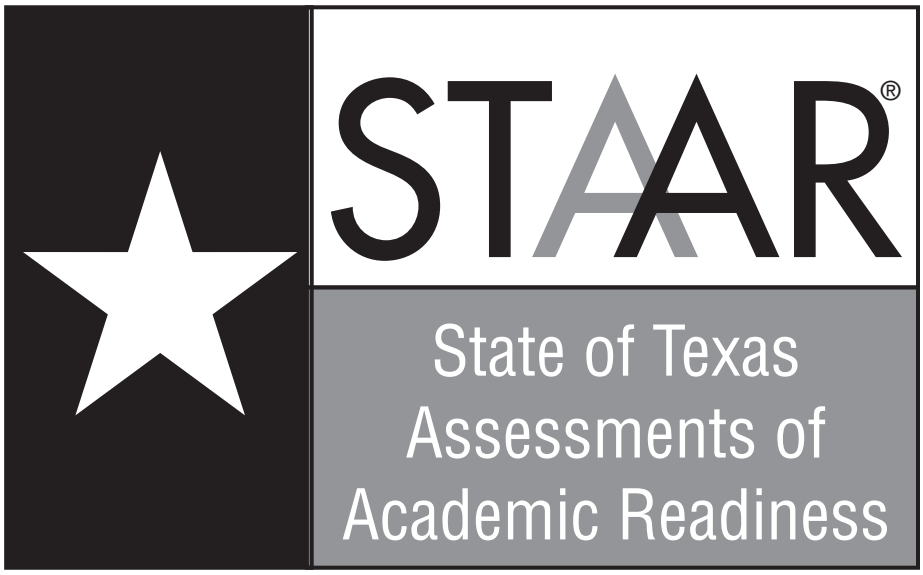
STAAR GRADE 8 SCIENCE REFERENCE MATERIALS

PERIODIC TABLE OF THE ELEMENTS



Updated 2017

Source: International Union of Pure and Applied Chemistry



GRADE 8

Science

Administered May 2021

RELEASED

DIRECTIONS

Read each question carefully. For a multiple-choice question, determine the best answer to the question from the four answer choices provided. For a griddable question, determine the best answer to the question. Then fill in the answer on your answer document.

1 Immediately after a forest fire, the primary consumers in the area will compete most for which biotic factor?

A Food

B Space

C Oxygen

D Sunlight

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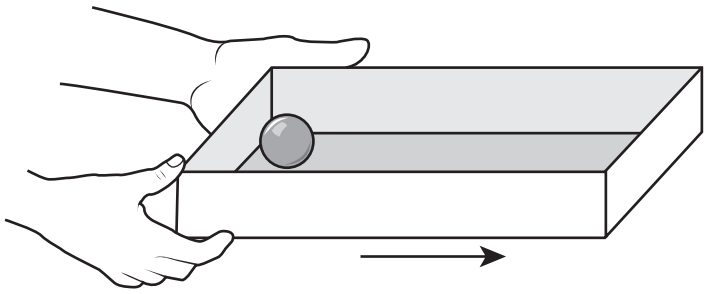
2 A steel ball is at one end of a box that is moving forward as shown. The box suddenly stops.



According to Newton's first law, what happens to the steel ball just after the box stops?

F Because of friction, the ball continues rolling forward at the same speed.

G Because of friction, the ball rolls forward at an increased speed.

H Because of inertia, the ball continues rolling forward at the same speed.

J Because of inertia, the ball rolls forward at an increased speed.

3 Students mixed two liquids in a beaker and listed their observations.

Observations
Liquid 1 was colorless.
Liquid 2 was colorless.
The mixture of liquids 1 and 2 formed a colorless solution.
Small, solid particles formed and fell to the bottom of the beaker.

Based on these observations, which statement contains the best evidence that a chemical reaction occurred?

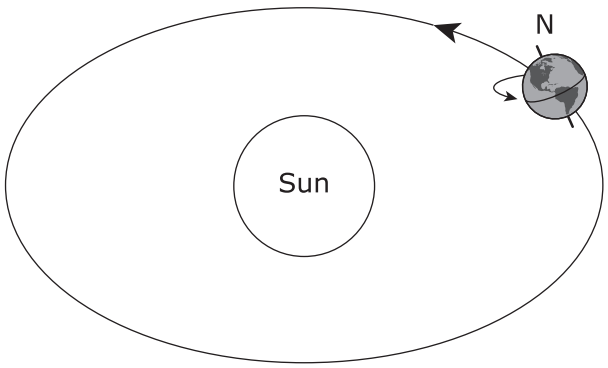
A There is a change in shape.

B There is a change in volume.

C The two liquids mix into a solution.

D The two liquids form a new substance.

4 The diagram shows Earth in its orbit around the sun when very little light is visible at Earth's South Pole.



Which statement is true when Earth is in the position shown?

F It is August in the Northern Hemisphere.
It is April in the Southern Hemisphere.

G It is summer in the Northern Hemisphere.
It is winter in the Southern Hemisphere.

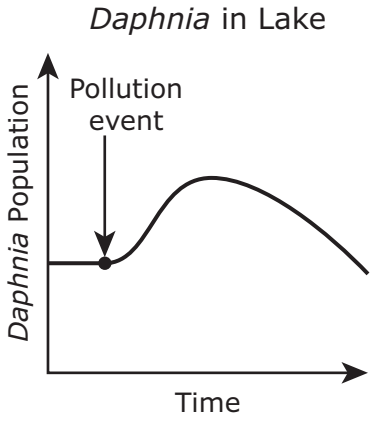
H The number of hours of daylight is greater in the Southern Hemisphere than in the Northern Hemisphere.

J Spring begins earlier in the year in the Southern Hemisphere than it does in the Northern Hemisphere.

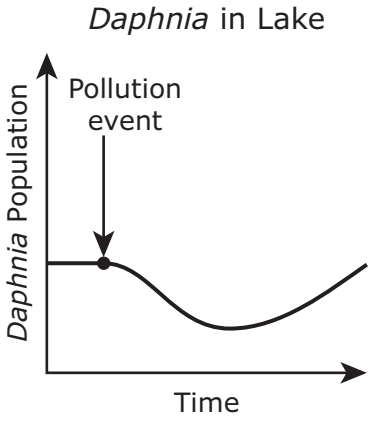
5 Tiny organisms called *Daphnia* live in lakes and ponds where they consume algae. A lake with a stable population of algae and *Daphnia* was contaminated by pollution, resulting in the death of many algae.

Which graph shows the most likely trend in the *Daphnia* population in the lake shortly before and after the pollution event?

A



C



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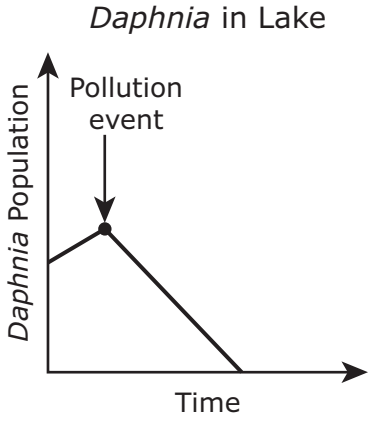
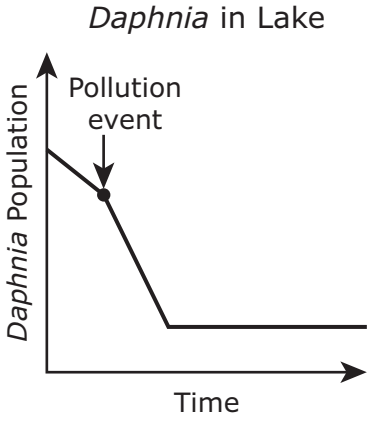


D



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6 A student pushes a 51.5 kilogram bookshelf across a smooth floor with a net force of 67 N.

What is the approximate acceleration of the bookshelf?

F 1.3 m/s^2

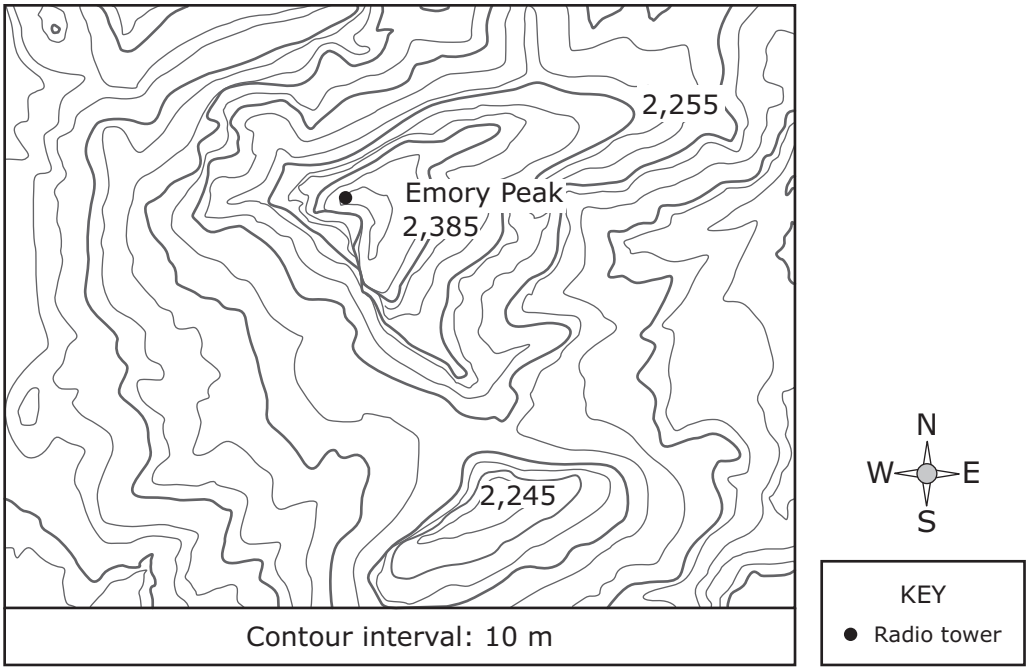
G 3,450.5 m/s^2

H 15.5 m/s^2

J 0.77 m/s^2

7 A topographic map provides details about Emory Peak in Big Bend National Park. A radio tower on Emory Peak is indicated.

Emory Peak Topographic Map



Based on the topographic map, if a park ranger hiked due west from the radio tower, the ranger's path would —

A cross a canyon with a river running through it

B cross another peak in the park

C be flat and then go up a steep slope

D go down a steep slope and then become flatter

---

8 Which pair of elements are nonmetals and gases at room temperature and normal atmospheric pressure?

F Fluorine, F, and chlorine, Cl

G Boron, B, and aluminum, Al

H Hydrogen, H, and cesium, Cs

J Cobalt, Co, and nickel, Ni

9 A farmer digs a small pond in a pasture. The farmer adds young individuals from two species of algae-eating fish to the pond and plants some reeds around the edges of the pond. The farmer wants the pond to be a sustainable ecosystem.

Which of the following would be most helpful in increasing the pond ecosystem's sustainability?

A Decreasing the number of plant species around the edges of the pond

B Introducing older fish of the same species into the population of algae-eating fish

C Having a greater diversity of living organisms in the pond

D Adding gravel between the water and where the reeds are planted

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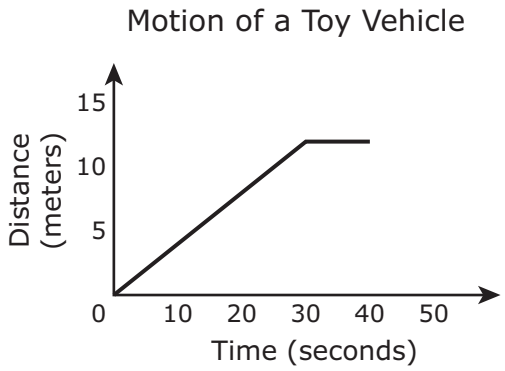
10 A student investigates the motion of a toy vehicle. The student graphs 40 seconds of data from the investigation.



Which statement best describes the motion of the toy vehicle during the first 30 seconds of the investigation?

F The vehicle was traveling at a constant speed.

G The vehicle was accelerating at a constant rate.

H The speed of the vehicle was increasing.

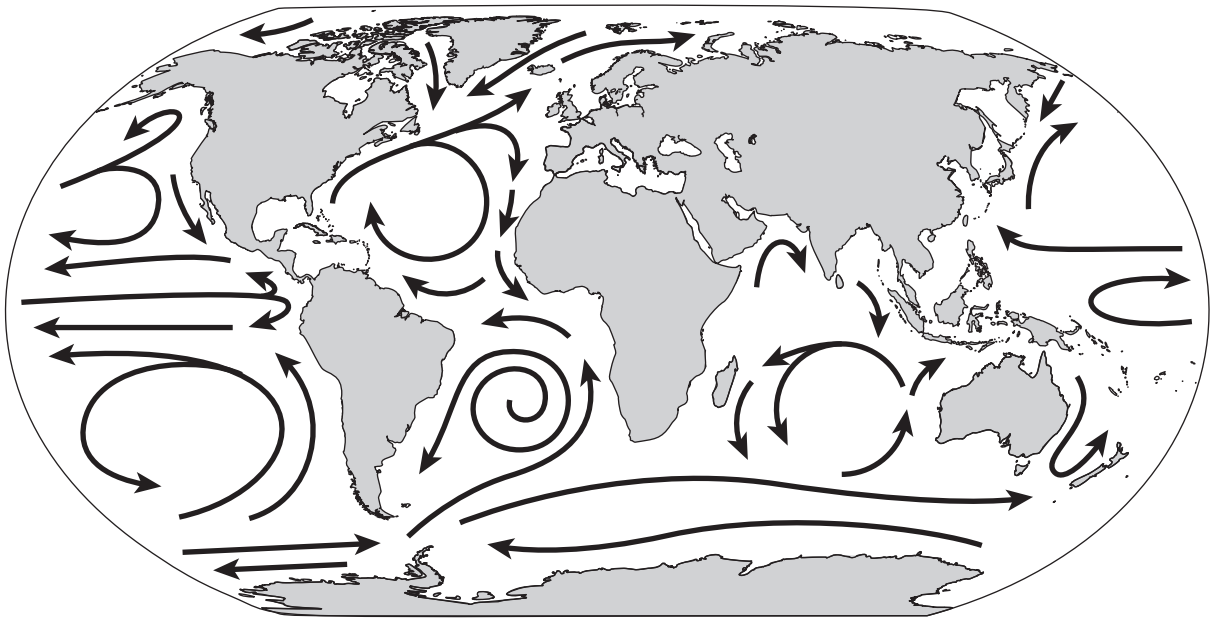
J The acceleration of the vehicle was increasing.

11 How many neutrons are in the nucleus of a potassium atom with a mass number of 39?

Record your answer and fill in the bubbles on your answer document. Be sure to use the correct place value.

GO ON

12 Major surface currents of the ocean are shown in the diagram.



Ocean currents affect weather patterns by —

F regulating when tides occur in coastal areas

G trapping heat at the equator to regulate the global climate

H distributing heat from the uneven absorption of solar energy

J increasing the rate of evaporation to transport water to areas experiencing droughts

13 Students view two different cells under a microscope. They record their observations in the table shown.

Cell	Organelles Observed
1	Vacuoles Nucleus Cell Membrane
2	Vacuoles Nucleus Chloroplast Cell Wall

Based on the organelles observed, the students determine that cell 2 is a plant cell because it has an organelle that —

A allows water to enter and exit the cell

B contains genetic information

C stores water and nutrients

D produces its own food

---

14 Which statements correctly compare metals and nonmetals?

F Metals tend to be good conductors of thermal energy.
Nonmetals tend to be good insulators of thermal energy.

G Metals are dull and brittle.
Nonmetals are shiny and malleable.

H Metals are good insulators of electricity.
Nonmetals tend to be good conductors of electricity.

J Metals cannot be stretched into thin wires.
Nonmetals can be stretched into thin wires.

15 Roller coasters are popular attractions at amusement parks. A cart on a roller coaster approaches the highest point on the coaster. As the cart reaches the top, it slows down.

Which statement best describes the energy of the roller coaster as it slows down while traveling to the top of the coaster?

A The cart gains both kinetic and potential energy.

B The cart gains kinetic energy and loses potential energy.

C The cart loses kinetic energy and gains potential energy.

D The cart loses both kinetic and potential energy.

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16 Students recorded the dates in May on which they observed a full moon and a last quarter moon.

May

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	01	02	03	04 Full	05	06
07	08	09	10	11 Last quarter	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

On which date will they most likely be able to observe a new moon?

F May 13

G May 18

H May 25

J May 31

17 The names and chemical formulas of four substances are shown in the chart.

Substance Formulas

Name	Chemical Formula
Carbonic acid	H_2CO_3
Nitric acid	HNO_3
Phosphoric acid	H_3PO_4
Sulfuric acid	H_2SO_4

Which substance listed in the chart is made up of the most atoms?

A Carbonic acid

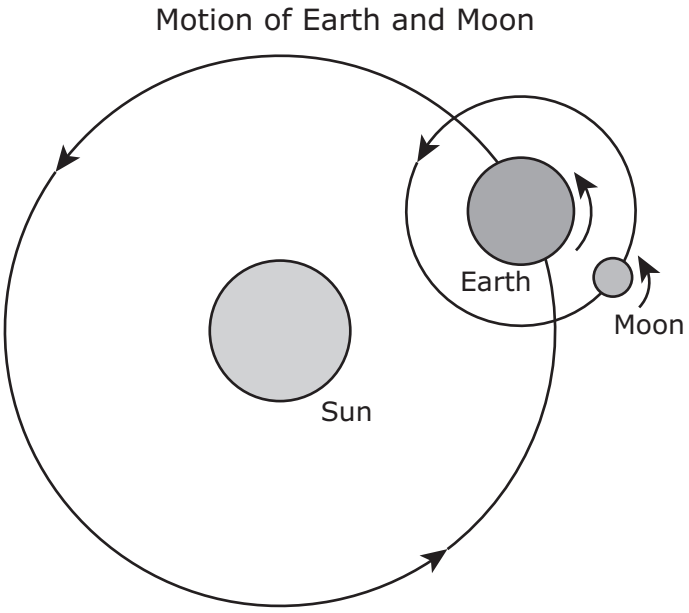
B Nitric acid

C Phosphoric acid

D Sulfuric acid

GO ON

18 An image of the Earth-moon-sun system is shown.



The moon remains in orbit around Earth because of the force of —

F Earth's rotation

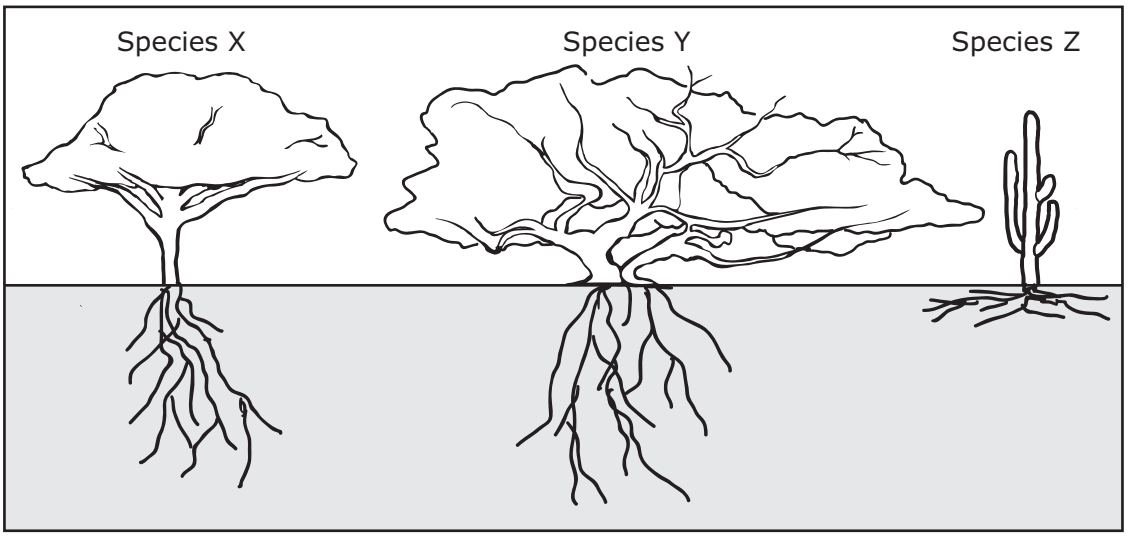
G the moon's rotation

H Earth's gravity

J the sun's gravity

GO ON

19 Three different species of plants that live in the desert are shown.



Species Z can successfully share the same environment with the other plants shown because species Z absorbs water —

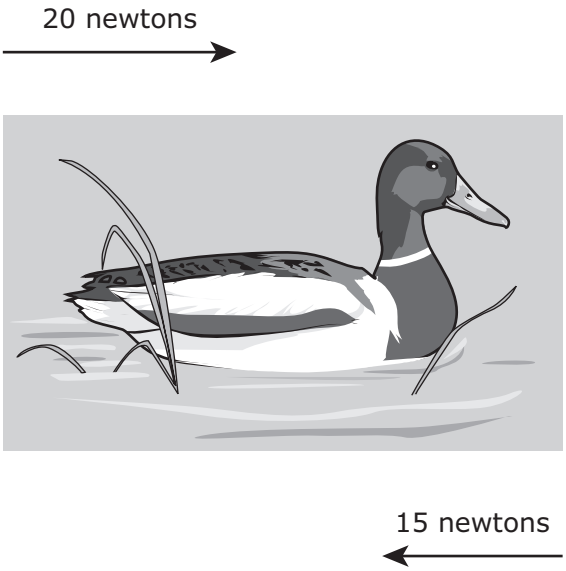
A found deep underground, and species X absorbs water near the soil surface

B found deep underground, and species X absorbs water found deep underground

C near the soil surface, and species Y absorbs water near the soil surface

D near the soil surface, and species Y absorbs water found deep underground

20 The diagram shows a duck swimming in a stream in the opposite direction the stream is flowing. The duck pushes against the water, so the water pushes the duck forward with 20 newtons of force. The water also exerts 15 newtons of resistive force against the duck.



Which statement best describes the resulting motion of the duck?

F The duck will stop moving.

G The duck will stop and then start moving again.

H The duck will continue moving in its current direction.

J The duck will move in the direction that the stream is flowing.

21 A student measures the mass and volume of a small cube made of an unknown metal. The mass of the cube is 25.0 g, and the volume of the cube is 3.19 cm^3. The student is told that the cube is a sample of one of the four metals listed in the table.

Density of Four Metals

Metal	Density (g/cm^3)
Gold	19.30
Iron	7.85
Silver	10.50
Tin	7.28

Based on the data given, the unknown metal is most likely —

A gold

B iron

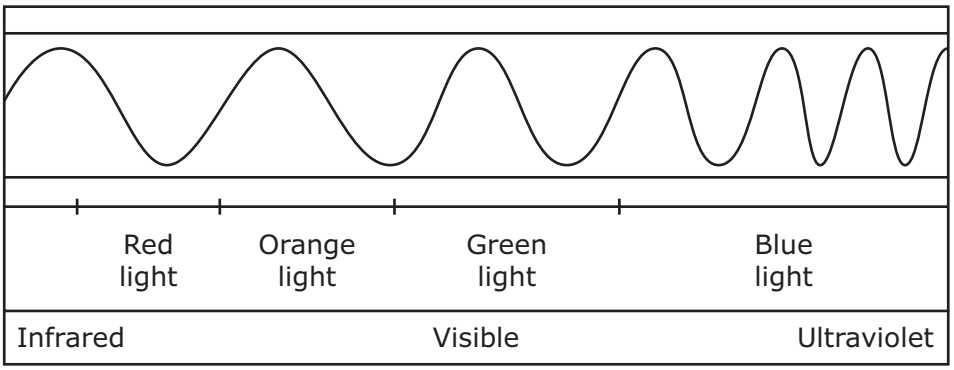
C silver

D tin

GO ON

22 The temperature of a star determines the wavelength of visible light that is produced. The visible part of the electromagnetic spectrum is shown.

Light Spectrum



Stars with the highest temperatures will emit most of their light at wavelengths that are near —

F red light

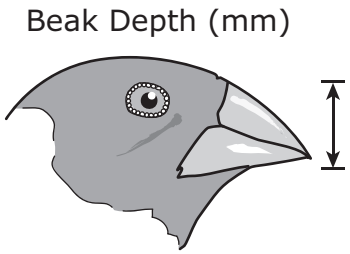
G orange light

H green light

J blue light

GO ON

23 There is a range of beak depths in a population of a certain species of seed-eating bird. Scientists observed the feeding behavior of the seed-eating birds and recorded their observations in the table.



Average Beak Depth (millimeters)	Observations
11.0	The birds took 10 seconds to crack open the large seeds.
10.5	The birds took 15 seconds to crack open the large seeds.
8.0 or less	The birds were unable to open the large seeds and ate small seeds instead.

Which statement best predicts the change in subsequent populations of these seed-eating birds if the availability of small seeds decreases?

A Birds with a large beak depth will require less food in order to survive and reproduce.

B Birds with a large beak depth will have an advantage over birds with a small beak depth and will be better able to survive and reproduce.

C Birds with a small beak depth will have an advantage over birds with large beak depths and will be better able to survive and reproduce.

D Neither birds with a small beak depth nor birds with a large beak depth will have a reproductive advantage.

24 Students build a circuit. The circuit has wires that connect a battery to a switch and a fan.

Which energy transformations happen when the students close the circuit and the blades of the fan begin to spin?

F Chemical to mechanical to electrical

G Electrical to chemical to mechanical

H Chemical to electrical to mechanical

J Mechanical to electrical to chemical

---

25 Students create a table that lists processes observed in nature.

Process	Change
1	Fungus decomposing organic matter
2	Leaves using carbon dioxide to make sugar
3	Plants using nitrogen to make protein
4	Water evaporating from salt water

Which process describes only a physical change?

A Process 1

B Process 2

C Process 3

D Process 4

26 The diagram shows a wildflower and a dichotomous key that can be used to identify the wildflower.

Key to Wildflowers with White Petals

1a	Flower has seven petals.....	Starflower
1b	Flower has five petals.....	Go to 2
2a	Petals are deeply grooved and divided.....	Chickweed
2b	Petals appear smooth, in a single piece.....	Go to 3
3a	Petals are very long, narrow, and pointed.....	Bowman's root
3b	Petals are wide and round.....	Common strawberry

Based on the key, what is the name of this wildflower?

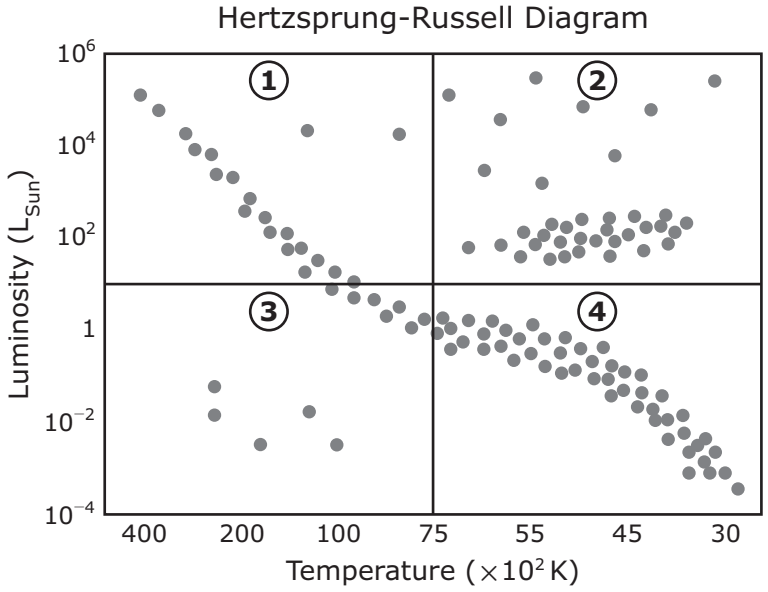
F Starflower

G Chickweed

H Bowman's root

J Common strawberry

27 The Hertzsprung-Russell diagram shown is divided into four sections.



Which section of the diagram includes the coolest, brightest stars?

A Section 1

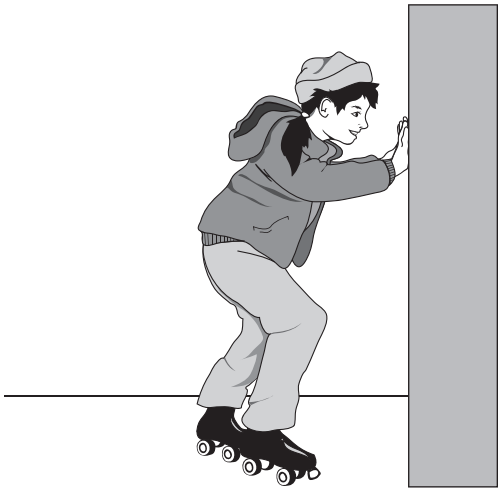
B Section 2

C Section 3

D Section 4

GO ON

28 A skater pushes off a wall and skates backward for a few meters before stopping.



Which statement best describes an action–reaction force pair in this situation?

F The wall pushes on the skater when the skater pushes on the wall.

G The wheels slow down, and the skater stops.

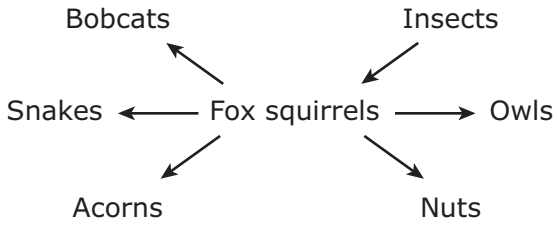
H The skater exerts a force on the wall, and the wheels exert a force on the floor and begin to turn.

J The friction of the floor decreases when the wheels roll on the floor.

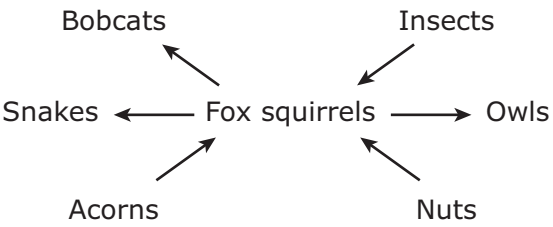
29 Fox squirrels are common in Texas. Fox squirrels primarily eat acorns and nuts from trees but also eat insects. Some predators of fox squirrels include owls, snakes, and bobcats.

Which diagram best represents how energy would flow to and from the fox squirrel?

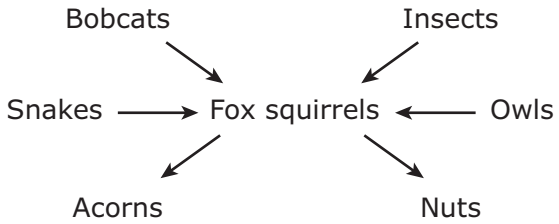
A



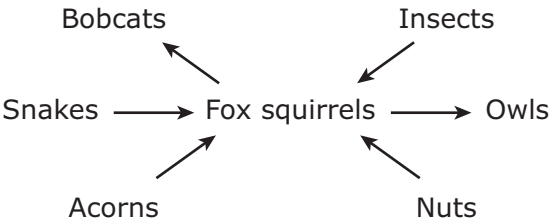
C



B



D



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30 Which two body systems are primarily responsible for locomotion?

F Skeletal system and muscular system

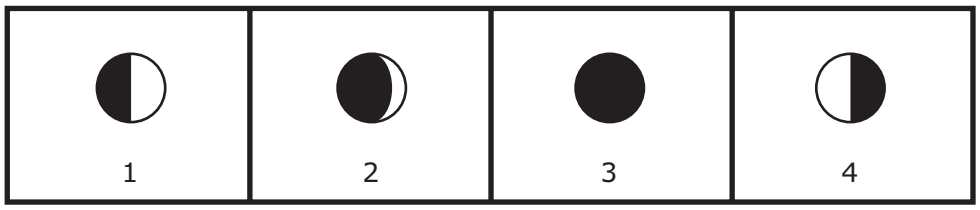
G Nervous system and circulatory system

H Respiratory system and digestive system

J Integumentary system and excretory system

31 The diagram models four lunar phases.

Lunar Phases



During which lunar phase is the tide highest?

A Phase 1

B Phase 2

C Phase 3

D Phase 4

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32 A horse trainer records the distance a horse travels during three different trials.

Horse's Traveling Times and Distances

Trial	Time (minutes)	Distance (kilometers)
1	15	4.5
2	30	9.0
3	45	13.5

What is the horse's average speed in kilometers per minute?

33 Which statement best describes cell theory?

A Cells are part of complex organisms that work together to produce new cells.

B Cells perform a single life function, and most cells come from existing cells.

C Cells use energy from food to be able to perform life functions and work together to produce new cells.

D Cells are the basic unit of structure for all organisms, and all cells come from existing cells.

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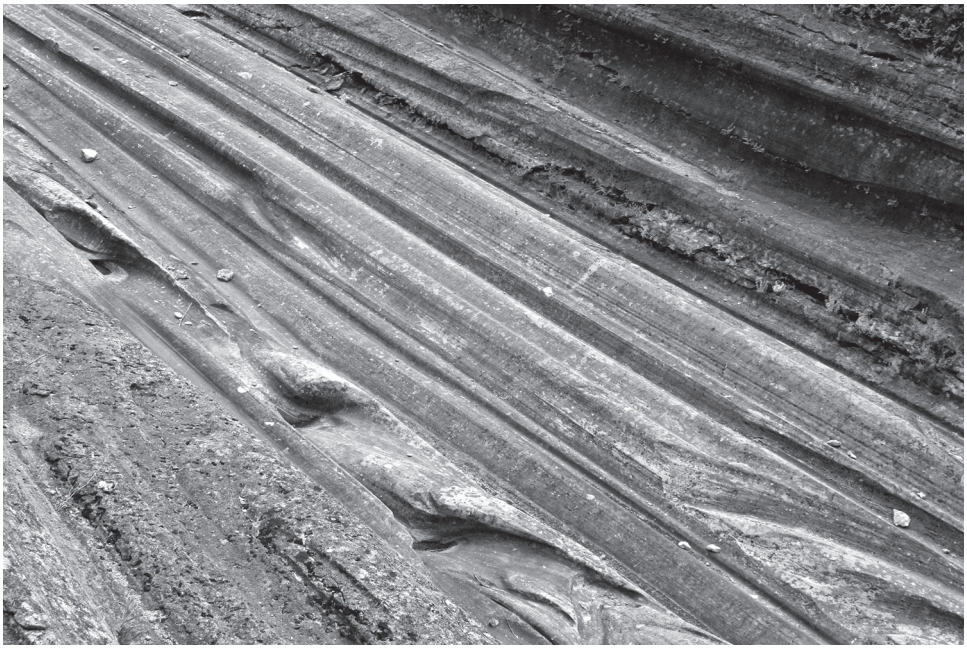
34 This picture shows scratches in bedrock that were caused by a moving glacier. These scratches are called glacial striations.



Glacial striations in the bedrock of South Africa indicate that glaciers once moved across the African continent. The presence of glaciers on the surface of Africa is evidence that —

F the tectonic plate under Africa was closer to the South Pole at one time

G the equator was not always where it is currently located

H volcanoes did not exist until after faults occurred in Earth's crust

J the location of the North Pole and the South Pole changed

35 Which pair of elements has reactivity that is similar to chlorine, Cl?

A Fluorine, F, and argon, Ar

B Fluorine, F, and iodine, I

C Sulfur, S, and bromine, Br

D Sulfur, S, and argon, Ar

---

36 Plants that live on the floors of densely populated forests must compete for sunlight. Which type of leaves are most likely found on plants that are best suited to living on the floor of a dense forest?

F Leaves that are needle-shaped

G Leaves that are smallest

H Leaves that store the greatest amount of water

J Leaves with the greatest amount of surface area

---

37 Two solutions are mixed and react to produce the solid precipitate AgCl. The chemical reaction is shown by the balanced chemical equation.

$$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$$

What happens to the total mass as the reaction takes place?

A The mass increases.

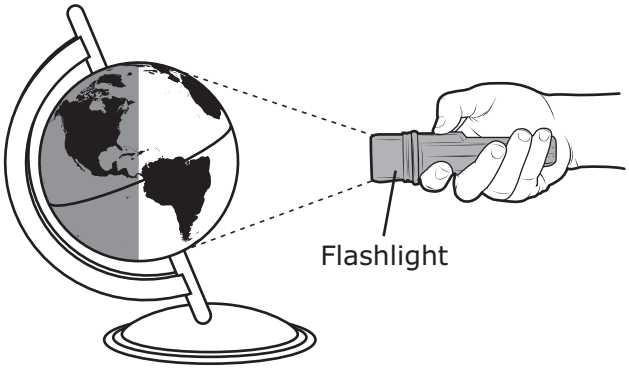
B The mass decreases.

C The mass remains constant.

D The mass first decreases and then increases.

38 Students make a model using a globe and a flashlight.

Model



Which answer choice best explains the change from daytime to nighttime on Earth?

F The sun stops sending light to Earth at night.

G Earth moves farther away from the sun at night.

H The tilt of Earth causes less light to reach Earth at night.

J Earth rotates and causes different parts of Earth to experience night.

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39 A toy truck is at rest on the floor. Which statement describes the forces acting on the toy truck?

A The forces are balanced so motion occurs.

B The forces are balanced so no motion occurs.

C The forces are unbalanced so motion occurs.

D The forces are unbalanced so no motion occurs.

40 One of the properties that makes copper, Cu, useful for household wiring is its ability to conduct electricity. Which other element is most likely to conduct electricity?

F Gold, Au

G Radon, Rn

H Bromine, Br

J Nitrogen, N

---

41 *Parus major* is a bird species that depends on caterpillars as a food source for its young. Caterpillars are most abundant during spring. The yearly increase in temperatures during springtime has gradually shifted, resulting in caterpillars developing approximately two weeks earlier than in the past.

How will the changes in the availability of caterpillars most likely affect future populations of *P. major*?

A *P. major* will change their food source to plant leaves.

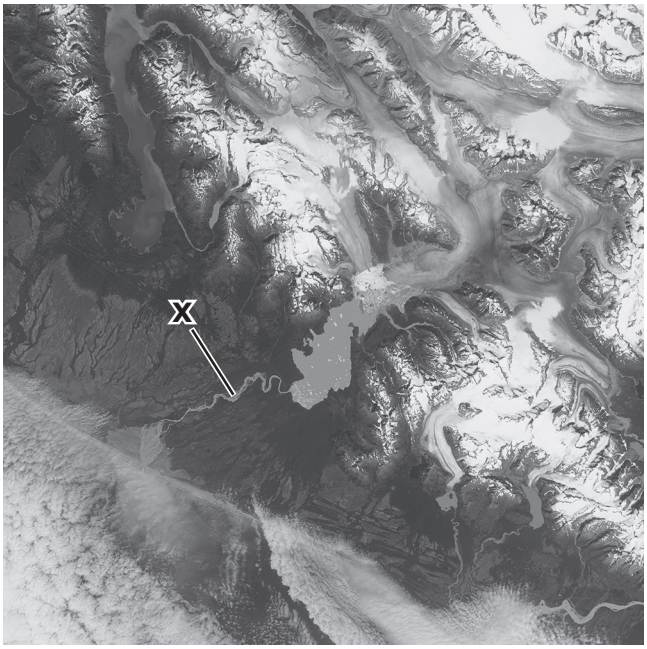
B *P. major* will lay their eggs earlier in the year.

C *P. major* will decrease the number of eggs laid at a time.

D *P. major* will hunt caterpillars earlier in the day when temperatures are cooler.

42 The satellite photograph shows geological features, including a glacier.

Satellite Photograph of Glacier



NASA Earth Observatory image by Robert Simmon

As the glacier melts, water travels toward the ocean along the geological feature labeled X. When water erodes soil along this feature, the feature will most likely become —

F straight

G dry

H shorter

J wider

BE SURE YOU HAVE RECORDED ALL OF YOUR ANSWERS ON THE ANSWER DOCUMENT.

STOP

Item Number	Reporting Category	Readiness or Supporting	Content Student Expectation	Process Student Expectation	Correct Answer
1	4	Readiness	8.11(A)		A
2	2	Readiness	8.6(C)		H
3	1	Readiness	8.5(E)	8.2(E)	D
4	3	Readiness	8.7(A)	8.3(B)	G
5	4	Readiness	8.11(B)	8.2(E)	C
6	2	Readiness	8.6(A)	8.4(A)	F
7	3	Readiness	8.9(C)	8.2(E)	D
8	1	Readiness	8.5(C)		F
9	4	Supporting	7.10(B)	8.3(A)	C
10	2	Supporting	8.6(B)	8.2(E)	F
11	1	Readiness	8.5(A)		20
12	3	Supporting	8.10(C)	8.3(A)	H
13	4	Supporting	7.12(D)	8.2(C)	D
14	1	Supporting	6.6(A)		F
15	2	Supporting	6.8(A)	8.3(A)	C
16	3	Readiness	8.7(B)	8.2(E)	G
17	1	Readiness	8.5(D)		C
18	3	Supporting	6.11(B)	8.3(B)	H
19	4	Readiness	8.11(A)	8.2(E)	D
20	2	Readiness	8.6(A)	8.3(A)	H
21	1	Supporting	6.6(B)	8.2(E)	B
22	3	Supporting	8.8(C)	8.3(A)	J
23	4	Readiness	8.11(B)		B
24	2	Supporting	6.9(C)	8.4(A)	H
25	1	Supporting	7.6(A)	8.3(A)	D
26	4	Supporting	7.11(A)	8.2(C)	H
27	3	Readiness	8.8(A)	8.3(B)	B
28	2	Readiness	8.6(C)		F
29	1	Supporting	7.5(B)	8.3(B)	C
30	4	Supporting	7.12(B)		F
31	3	Supporting	8.7(C)	8.3(B)	C
32	2	Supporting	6.8(C)		0.3
33	4	Supporting	7.12(F)	8.3(A)	D
34	3	Readiness	8.9(B)	8.3(A)	F
35	1	Readiness	8.5(B)	8.2(E)	B
36	4	Readiness	8.11(A)	8.3(A)	J
37	1	Readiness	8.5(E)	8.2(E)	C
38	3	Readiness	8.7(A)	8.3(B)	J
39	2	Readiness	8.6(A)		B
40	1	Readiness	8.5(C)	8.2(E)	F
41	4	Readiness	8.11(B)	8.2(E)	B
42	3	Readiness	8.9(C)	8.2(E)	J

2021 STAAR Grade 8 Science Rationales

Item#	Rationale	
1	Option A is correct	A biotic factor is a living part of an ecosystem. Primary consumers obtain energy by consuming plants. Plants are living, so plants are considered biotic.
	Option B is incorrect	Space is not a living part of the ecosystem. Space is an abiotic factor.
	Option C is incorrect	Oxygen is not a living part of the ecosystem. Oxygen is an abiotic factor.
	Option D is incorrect	Sunlight is not a living part of the ecosystem. Sunlight is an abiotic factor.

Texas Education Agency
Student Assessment Division
August 2021

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Item#	Rationale	
2	Option H is correct	Inertia is the tendency of an object to resist changes in its motion. Inertia causes the ball to continue moving in the same direction and at the same speed.
	Option F is incorrect	Friction is a force that acts in the opposite direction of the motion and will cause changes in speed and/or direction. Friction would cause the ball to slow down, not to continue rolling forward at the same speed.
	Option G is incorrect	Friction would cause the ball to slow down, not roll forward at an increasing speed.
	Option J is incorrect	Inertia causes the ball to continue the motion it had already, not to increase in speed.

Item#	Rationale	
3	Option D is correct	A chemical reaction results in the formation of a new substance with different properties. The two liquids formed small, solid particles, which are a new substance. This is evidence that a chemical reaction occurred.
	Option A is incorrect	A change in shape is not evidence that a chemical reaction occurred, but it can be evidence that a physical change occurred.
	Option B is incorrect	A change in volume is not evidence that a chemical reaction occurred, but it can be evidence that a physical change occurred.
	Option C is incorrect	Two liquids mixing into a solution is not evidence that a chemical change occurred, but it can be evidence that a physical change occurred.

Item#	Rationale	
4	Option G is correct	The tilt of Earth's axis causes the seasons because of the angle at which the sunlight strikes Earth's surface. When a pole is tilted toward the sun, there is more direct sunlight on that hemisphere, causing the higher temperatures of summer. In the diagram, it is summer in the Northern Hemisphere and winter in the Southern Hemisphere.
	Option F is incorrect	The months of the year are the same, regardless of the season each hemisphere is experiencing. If it is August in the Northern Hemisphere, it would also be August in the Southern Hemisphere.
	Option H is incorrect	The number of hours of daylight and darkness is determined by how directly sunlight is striking Earth. When a location is tilted away from the sun, that location receives fewer hours of daylight than it does when it is tilted toward the sun. The number of hours of daylight is less, not greater, in the Southern Hemisphere than in the Northern Hemisphere because the Southern Hemisphere is tilted away from the sun.
	Option J is incorrect	The seasons of the year are opposite from one hemisphere to another. In the Northern Hemisphere, spring begins in March, but in the Southern Hemisphere, spring begins in September.

Item#	Rationale	
5	Option C is correct	Pollution resulted in the death of many algae. Because *Daphnia* consume algae, the population of *Daphnia* would decrease after the pollution event. Because the pollution event killed many algae but not all, the *Daphnia* population would recover once the algae population increased.
	Option A is incorrect	This graph shows an increase in the *Daphnia* population after the pollution event. The pollution event resulted in the death of many algae. This means that the population decreased after the pollution event.
	Option B is incorrect	Because the pollution event killed many algae, but not all of them, the *Daphnia* population would recover once the algae population did.
	Option D is incorrect	This graph shows that the *Daphnia* population decreased, but the population did not recover.

2021 STAAR Grade 8 Science Rationales

Item#	Rationale	
6	Option F is correct	The value 1.3 m/s^2 was obtained by rearranging the formula Force = mass × acceleration to solve for acceleration. $a = F/m = 67\ N/\ 51.5\ kg = 1.3\ m/s^2$
	Option G is incorrect	The value 3,425.05 is obtained by multiplying mass and force.
	Option H is incorrect	The value 15.5 is obtained by subtracting mass from force.
	Option J is incorrect	The value 0.77 is obtained by dividing mass from force.

Item#	Rationale	
7	Option D is correct	The spacing of the contour lines shows how steep or gentle the slope of the surface is. Contour lines that are close together represent a steep slope. Contour lines that are far apart represent a gentle slope. The contour lines are close together and then become farther apart as the park ranger travels west from the radio tower.
	Option A is incorrect	Contour lines crossing a river are bent to form a V that points upstream. Since a river would flow downhill from the peak and the contour lines are not bent to point up the hill, there is no river present.
	Option B is incorrect	A peak is represented by contour lines arranged in a circle. There are no peaks to the west of the radio tower.
	Option C is incorrect	A flat path is represented by contour lines that are far apart. A steep slope is represented by lines that are close together.

Item#	Rationale	
8	Option F is correct	Fluorine and chlorine are nonmetals that are gases at room temperature.
	Option G is incorrect	Boron is a metalloid, and aluminum is a metal.
	Option H is incorrect	Hydrogen is a nonmetal gas at room temperature, but cesium is a metal that is a solid at room temperature.
	Option J is incorrect	Cobalt and nickel are metals.

Item#	Rationale	
9	Option C is correct	Sustainability of an ecosystem comes from having high species diversity within the ecosystem. Having a greater diversity of living organisms in the pond would increase the biodiversity. If the biodiversity of the pond is increased, the sustainability of the pond would increase.
	Option A is incorrect	The pond's sustainability would not increase because decreasing the number of plant species anywhere in the pond leads to a decrease in biodiversity.
	Option B is incorrect	Introducing older fish of the same species would not increase the sustainability of the pond because the biodiversity is not increased.
	Option D is incorrect	Adding gravel anywhere in the pond would not increase the pond's sustainability because the biodiversity is not increased.

Item#	Rationale	
10	Option F is correct	The slope (distance/time) of a distance vs. time graph represents the speed of the object. The graph shows a constant slope, which means the speed is constant.
	Option G is incorrect	Acceleration refers to a change in speed or direction. The speed is not changing because the slope of the graph is not changing in the first 30 seconds of the investigation.
	Option H is incorrect	The graph shows a constant slope between 0 and 30 seconds, not an increasing slope.
	Option J is incorrect	The acceleration of the vehicle is not changing. Because the speed is constant, there is no acceleration.

Item#	Rationale	
11	20 and any equivalent values are correct	The mass number represents the number of protons and neutrons in the nucleus of an atom. The atomic number represents the number of protons in an atom. The mass number for potassium is 39. The atomic number for potassium is 19. To obtain the number of neutrons in the nucleus of an atom, subtract the atomic number from the mass number. Mass number – atomic number = number of neutrons. 39 protons and neutrons – 19 protons = 20 neutrons.

Item#	Rationale	
12	Option H is correct	Oceans are heated by the sun's energy. Ocean currents transport warm water from the equator toward the poles and cold water from the poles back to the tropics.
	Option F is incorrect	Ocean currents do not control tides. The gravitational pull of the moon on Earth regulates tides.
	Option G is incorrect	Ocean currents do not trap heat to control the global climate. Ocean currents distribute heat.
	Option J is incorrect	Ocean currents do not choose to travel to areas experiencing drought.

Item#	Rationale	
13	Option D is correct	Plant cells use chloroplasts to obtain energy to produce their own food.
	Option A is incorrect	Both plant and animal cells store nutrients in vacuoles.
	Option B is incorrect	Both plant and animal cells contain genetic information in a nucleus.
	Option C is incorrect	Both plant and animal cells allow water to enter and exit the cell through the cell membrane.

Item#	Rationale	
14	Option F is correct	Both metals and nonmetals are able to transfer thermal energy; the difference is in the speed of transfer and the degree to which the transfer occurs.
	Option G is incorrect	Nonmetals tend to be dull and brittle. Metals tend to be shiny and malleable.
	Option H is incorrect	Metals tend to be good conductors of electricity.
	Option J is incorrect	In general, metals can be stretched into thin wires. In general, nonmetals cannot be stretched into thin wires.

Item#	Rationale	
15	Option C is correct	The amount of kinetic energy an object has depends on its motion and speed. The amount of potential energy an object has depends on its position. As the cart of a roller coaster approaches the highest point, its potential energy increases because it is getting higher above the earth, but its kinetic energy is decreasing because it slows down as it goes up the hill.
	Option A is incorrect	The cart loses kinetic energy and gains potential energy.
	Option B is incorrect	The cart loses kinetic energy and gains potential energy.
	Option D is incorrect	The cart loses kinetic energy and gains potential energy.

Item#	Rationale	
16	Option G is correct	On May 18 there will be a new moon. A new moon would be visible approximately 5–7 days after a last quarter moon.
	Option F is incorrect	On May 13 there will still be a last quarter moon. Moon phases last about 3–4 days each.
	Option H is incorrect	On May 25 there will be a first quarter moon. A first quarter moon follows a new moon.
	Option J is incorrect	On May 31 there will be a full moon. A full moon is visible after a first quarter moon.

Item#	Rationale	
17	Option C is correct	The subscript 3 on the symbol for hydrogen, H, indicates that there are 3 hydrogen atoms. There is no subscript on the symbol for phosphorus, P, so this indicates that there is 1 phosphorus atom. The subscript 4 on the symbol for oxygen, O, indicates that there are 4 oxygen atoms. The total number of atoms in phosphoric acid = 3 hydrogen atoms + 1 phosphorus atom + 4 oxygen atoms = 8 total atoms.
	Option A is incorrect	The subscript 2 on the symbol for hydrogen, H, indicates that there are 2 hydrogen atoms. There is no subscript on the symbol for carbon, C, so this indicates that there is 1 carbon atom. The subscript 3 on the symbol for oxygen, O, indicates that there are 3 oxygen atoms. The total number of atoms in carbonic acid = 2 hydrogen atoms + 1 carbon atom + 3 oxygen atoms = 7 total atoms.
	Option B is incorrect	There is no subscript on the symbol for hydrogen, H, so this indicates that there is 1 hydrogen atom. There is no subscript on the symbol for nitrogen, N, so this indicates that there is 1 nitrogen atom. The subscript 3 on the symbol for oxygen, O, indicates that there are 3 oxygen atoms. The total number of atoms in nitric acid = 1 hydrogen atom + 1 nitrogen atom + 3 oxygen atoms = 5 total atoms.
	Option D is incorrect	The subscript 2 on the symbol for hydrogen, H, indicates that there are 2 hydrogen atoms. There is no subscript on the symbol for sulfur, S, so this indicates that there is 1 sulfur atom. The subscript 4 on the symbol for oxygen, O, indicates that there are 4 oxygen atoms. The total number of atoms in sulfuric acid = 2 hydrogen atoms + 1 sulfur atom + 4 oxygen atoms = 7 total atoms.

Item#	Rationale	
18	Option H is correct	Earth’s gravity is the attractive force that causes the moon to remain in orbit around Earth.
	Option F is incorrect	Earth’s rotation is not an attractive force. Therefore, Earth’s rotation cannot cause the moon to remain in orbit around Earth.
	Option G is incorrect	The moon’s rotation is not an attractive force. Therefore, the moon’s rotation cannot cause the moon to remain in orbit around Earth.
	Option J is incorrect	The sun’s gravity is an attractive force. The sun’s gravity keeps the Earth in orbit around the sun, not the moon around Earth.

Item#	Rationale	
19	Option D is correct	Species Z has short, mostly horizontal roots. Short roots absorb water near the soil surface. Species Y has long, mostly vertical roots. Long roots absorb water deep underground.
	Option A is incorrect	Species Z does not absorb water deep underground because Species Z has short, mostly horizontal roots. Short roots absorb water near the soil surface. Species X absorbs water mostly deep underground because Species X has long, mostly vertical roots.
	Option B is incorrect	Species Z does not absorb water deep underground because Species Z has short, mostly horizontal roots.
	Option C is incorrect	Species Y absorbs water mostly deep underground because Species Y has long, mostly vertical roots.

2021 STAAR Grade 8 Science Rationales

Item#	Rationale	
20	Option H is correct	Because 20N is greater than 15N, the net force of 5N will cause the duck to move to the right.
	Option F is incorrect	The duck will not stop moving because the duck exerts a net force of 5N to the right.
	Option G is incorrect	The duck will not stop moving because the duck exerts a net force of 5N to the right.
	Option J is incorrect	The water is exerting 15 newtons of resistive force against the duck. 20 newtons is greater than 15 newtons, so the duck will move in the direction of the 20N force.

Item#	Rationale	
21	Option B is correct	The density of the unknown metal was obtained using the equation Density = mass/volume. D = 25.0 g/3.19 cm^3 = 7.83 g/cm^3. The density of iron is 7.85 g/cm^3. This value is the closest to the density value for the unknown metal. Therefore, the unknown metal is most likely iron.
	Option A is incorrect	The density of gold is 19.30 g/cm^3. Since the density of the unknown metal is 7.83 g/cm^3, the unknown metal is not gold.
	Option C is incorrect	The density of silver is 10.50 g/cm^3. Since the density of the unknown metal is 7.83 g/cm^3, the unknown metal is not silver.
	Option D is incorrect	The density for tin is 7.28 g/cm^3. Since the density of the unknown metal is 7.83 g/cm^3, the unknown metal is not tin.

Item#	Rationale	
22	Option J is correct	Stars that emit most of their visible light at wavelengths that are near blue light are the hottest. Stars with the shortest wavelength are the hottest stars.
	Option F is incorrect	Stars that emit most of their visible light at this wavelength are not as hot as stars with a shorter wavelength.
	Option G is incorrect	Stars that emit most of their visible light at this wavelength are not as hot as stars with a shorter wavelength.
	Option H is incorrect	Stars that emit most of their visible light at this wavelength are not as hot as stars with a shorter wavelength.

Item#	Rationale	
23	Option B is correct	Larger beaks will be needed to crack open the larger seeds. Birds with smaller beaks will not be able to access the food from the larger seeds.
	Option A is incorrect	A change in the availability of a type of seed will not affect how much food a bird requires.
	Option C is incorrect	Birds with a small beak depth will not have an advantage over birds with a large beak depth because larger beaks are needed to crack open larger seeds.
	Option D is incorrect	Birds with a large beak depth will have an advantage because larger beaks are needed to crack open larger seeds.

Item#	Rationale	
24	Option H is correct	Chemical energy is energy stored in chemical bonds. Batteries store chemical energy that can be transformed into electrical energy. Electrical energy is the energy of moving electrons. Mechanical energy is the energy an object has due to its motion (kinetic energy) or its position (potential energy). Mechanical energy is used to spin the blades of the fan.
	Option F is incorrect	Mechanical energy is not being converted to electrical energy as the blades spin. On the contrary, electrical energy is being converted to mechanical energy as the blades begin to spin.
	Option G is incorrect	Electrical energy is not being converted to chemical energy. Instead, chemical energy is converted to electrical energy, which causes the blades to spin.
	Option J is incorrect	Mechanical energy is not being converted to electrical energy, and electrical energy is not being converted to chemical energy. This order is reversed.

Item#	Rationale	
25	Option D is correct	A chemical change results in the formation of a new substance with different chemical properties. A physical change does not form substances with different chemical properties. Although the outward appearance of a substance is changed, the chemical composition remains unchanged. Water evaporating from salt water does not form substances with different chemical properties and is therefore a physical change.
	Option A is incorrect	Fungus decomposing organic matter results in a new substance and is therefore a chemical change.
	Option B is incorrect	Leaves using carbon dioxide to make sugar results in a new substance and is therefore a chemical change.
	Option C is incorrect	Plants using nitrogen to make protein results in a new substance and is therefore a chemical change.

Item#	Rationale	
26	Option H is correct	Bowman's root has these characteristics: 1b. Flower has five petals. 2b. Petals appear smooth, in a single piece. 3a. Petals are very long, narrow, and pointed.
	Option F is incorrect	Starflower does not have these characteristics: 1b. Flower has five petals. 2b. Petals appear smooth, in a single piece. 3a. Petals are very long, narrow, and pointed.
	Option G is incorrect	Chickweed does not have these characteristics: 2b. Petals appear smooth, in a single piece.
	Option J is incorrect	Common strawberry does not have these characteristics: 3a. Petals are very long, narrow, and pointed.

Item#	Rationale	
27	Option B is correct	The stars in section 2 are the coolest and brightest stars. According to the H-R diagram, the stars in section 2 have the lowest temperature values and the highest luminosity values. The stars in section two have a temperature range of 75×10^2 K to 30×10^2 K and a luminosity range of 10 to 10^6.
	Option A is incorrect	The stars in section 1 are the hottest and brightest stars. The stars in section 1 have a temperature range of 400×10^2 to 75×10^2, and a luminosity range of 10 to 10^6.
	Option C is incorrect	The stars in section 3 are the hottest and dimmest stars. The stars in section 3 have a temperature range of 400 x 102 to 75×10^2, and a luminosity range of 10^{-4} to 10.
	Option D is incorrect	The stars in section 4 are the coolest and dimmest stars. The stars in section 3 have a temperature range of 75×10^2 K to 30×10^2 K and a luminosity range of 10^{-4} to 100.

Item#	Rationale	
28	Option F is correct	When two objects interact with each other, those two objects are exerting forces upon each other. The forces that the interacting objects exert on each other are called action and reaction forces. The action force is the force applied by the first object (the skater) on the second object (the wall). The reaction force is the force applied by the second object (the wall) on the first object (the skater). Action-reaction pairs are equal yet opposite in direction.
	Option G is incorrect	This interaction is not an action-reaction pair. This interaction is an example of friction. Friction would cause the wheels to slow down, which, in turn, causes the skater to eventually stop.
	Option H is incorrect	This interaction is not an action-reaction pair. An action-reaction pair occurs between two objects. An example of an action-reaction pair is the wheels exerting a force on the floor and the floor exerting a force on the wheels.
	Option J is incorrect	This interaction is not an action-reaction pair. Friction contributes to changes in acceleration and velocity.

Item#	Rationale	
29	Option C is correct	The arrows in a food web represent the direction of energy flow. In this food web, energy flows from acorns, insects, and nuts to fox squirrels because fox squirrels eat acorns, insects, and nuts. The energy flows from fox squirrels to bobcats, snakes, and owls because bobcats, snakes, and owls are predators of fox squirrels.
	Option A is incorrect	The energy does not flow from fox squirrels to acorns and nuts because acorns and nuts do not eat fox squirrels. Instead, the energy flows from acorns and nuts to fox squirrels because fox squirrels eat acorns and nuts.
	Option B is incorrect	The energy does not flow from fox squirrels to acorns and nuts because acorns and nuts do not eat fox squirrels. Instead, the energy flows from acorns and nuts to fox squirrels because fox squirrels eat acorns and nuts. The energy does not flow from the bobcats, snakes, and owls to fox squirrels because fox squirrels do not eat bobcats, snakes, and owls. Instead, the energy flows from fox squirrels to bobcats, snakes, and owls because bobcats, snakes, and owls eat fox squirrels.
	Option D is incorrect	All the arrows are reversed. Therefore, the energy flow is reversed for all organisms in this food web.

Item#	Rationale	
30	Option F is correct	The human skeletal system provides structure and support for the body. The muscular system connects to the skeletal system, which allows for movement.
	Option G is incorrect	The nervous system transmits messages and controls body functions. The circulatory system transports nutrients and oxygen to cells throughout the body and transports carbon dioxide and waste products away from the body.
	Option H is incorrect	The respiratory system delivers oxygen to the cells and removes carbon dioxide from the circulatory system. The digestive system ingests food, breaks down the food, and processes the nutrients from the food.
	Option J is incorrect	The integumentary system protects against disease, creates a barrier against outside environments, protects internal organs, and regulates body temperature. The excretory system removes waste products from the body.

Item#	Rationale	
31	Option C is correct	This is an image of a new moon. A tide is the periodic rising and falling of the ocean surface. The rise and fall of the oceans are caused by the gravitational interaction between Earth, the moon, and the sun. High tides and low tides occur every day. Spring tides are when there is the biggest difference between high and low tide. During spring tides, the high tide is highest and the low tide is lowest. Spring tides occur during a new and full moon when the Earth, the moon, and the sun are aligned. The pull of the sun's gravity and the moon's gravity are in line with each other.
	Option A is incorrect	This is an image of a first quarter moon. The tide is very small during a first quarter moon. Neap tides occur during the first or third quarter moon. Neap tides are when the difference between high and low tides is the least. During the first and third quarter moon, the pull of the moon's gravity is at a right angle to the pull of the sun's gravity, so the tide is at its lowest.
	Option B is incorrect	This is an image of a waxing crescent. The tide is small during a waxing crescent.
	Option D is incorrect	This is an image of a third quarter moon. The tide is very small during a third quarter moon. Neap tides occur during the first or third quarter moon. Neap tides are when the difference between high and low tides is the least. During the first and third quarter moon, the pull of the moon's gravity is at a right angle to the pull of the sun's gravity, so the tide is at its lowest.

Item#		Rationale
32	0.3 and any equivalent values are correct	The average speed for each trial was obtained by using the equation *Speed = distance/time*. The units used are kilometers, km, per minute, min. The average speed for Trial 1 is S = d/t = 4.5 km/15 min = 0.3 km/min. The average speed for Trial 2 is S = d/t = 9.0 km/30 min = 0.3 km/min. The average speed for Trial 3 is S = d/t = 13.5 km/45 min = 0.3 km/min. The average speed for all trials was obtained by using the equation *Average = sum of the data/sample size*. The average of the speed for all trials is (0.3 km/min + 0.3 km/min + 0.3 km/min)/3 = 0.9 km/min/3 = 0.3 km/min.

Item#	Rationale	
33	Option D is correct	The components of the cell theory are: 1. All living organisms are made up of cells. 2. Cells are the basic unit of life. 3. All cells come from preexisting cells.
	Option A is incorrect	This is not a component of cell theory.
	Option B is incorrect	Many cells perform several life functions. All cells, not most, come from existing cells.
	Option C is incorrect	Cells are the basic unit of life for all organisms, not the basic unit of structure.

Item#	Rationale	
34	Option F is correct	There are no glaciers present in Africa at this time. In order for Africa to have scratches made by a glacier, Africa had to have been closer to the South Pole.
	Option G is incorrect	The equator is an imaginary line that divides the Northern Hemisphere and the Southern Hemisphere. The equator has not changed locations.
	Option H is incorrect	Volcanoes are formed when tectonic plates move away from each other or when tectonic plates collide. The formation of glaciers is not related to the formation of volcanoes.
	Option J is incorrect	The North Pole and the South Pole have reversed in polarity many times in Earth's history. Evidence of this is found on some rocks in the ocean floor, not in the presence of glaciers.

Item#	Rationale	
35	Option B is correct	Chlorine, Cl, is in Group 17. All elements in Group 17 have 7 valence electrons. Valence electrons, located in the outermost energy level of an electron cloud, determine the chemical properties of an element. Reactivity, which refers to the ability of an element to react with other elements, is a chemical property. Fluorine, F, and iodine, I, have 7 valence electrons. Because these elements have 7 valence electrons, these elements are in Group 17. Chlorine is also in Group 17; therefore, fluorine and iodine both have reactivities that are similar to chlorine.
	Option A is incorrect	Argon, Ar, is in Group 18. Therefore, argon has 8 valence electrons. An element with 8 valence electrons will have reactivity that is similar to other elements that have 8 valence electrons. Since chlorine has 7 valence electrons, their reactivities are not similar.
	Option C is incorrect	Sulfur, S, is in Group 16. Therefore, sulfur has 6 valence electrons. Bromine, Br, is in Group 2. Therefore, bromine has 2 valence electrons. Since chlorine has 7 valence electrons, its reactivity is not similar to either sulfur or bromine.
	Option D is incorrect	Sulfur and argon have a different number of valence electrons than chlorine has. Therefore, sulfur and argon have different reactivities than chlorine.

Item#	Rationale	
36	Option J is correct	Leaves with the greatest amount of surface area allow for the greatest amount of sunlight to be absorbed.
	Option F is incorrect	Leaves that are needle-shaped have a small amount of surface area. A leaf with a small amount of surface area cannot absorb as much sunlight as a leaf with a large amount of surface area.
	Option G is incorrect	Leaves that are the smallest have a small amount of surface area. A leaf with a small amount of surface area cannot absorb as much sunlight as a leaf with a large amount of surface area.
	Option H is incorrect	Leaves that store the greatest amount of water do not necessarily allow the plant to compete for sunlight. A large surface area is needed for the leaf to compete for sunlight.

Item#	Rationale	
37	Option C is correct	According to the law of conservation of mass, mass is not created or destroyed in a chemical reaction. The total mass is conserved, which means that the amount of mass remains the same before and after a chemical reaction occurs.
	Option A is incorrect	The mass will not increase. The mass will remain the same before and after the chemical reaction occurs.
	Option B is incorrect	The mass will not decrease. The mass will remain the same before and after the chemical reaction occurs.
	Option D is incorrect	The mass will not decrease nor increase. The mass will remain the same before and after the chemical reaction occurs.

Item#	Rationale	
38	Option J is correct	Earth rotates on its axis, an imaginary line running through the center of Earth from the North Pole to the South Pole. This causes day and night because different parts of Earth are illuminated by the sun while Earth rotates.
	Option F is incorrect	The sun does not stop sending light to Earth at night.
	Option G is incorrect	Earth does not move farther away from the sun at night.
	Option H is incorrect	The tilt of Earth causes less light to reach Earth all the time the Earth is tilted away from the sun, not just at night.

Item#	Rationale	
39	Option B is correct	There are two primary forces acting on the toy truck. The primary forces acting on the toy truck are the toy truck's weight due to gravity and the force of the floor on the toy truck. Both of these forces are balanced. As a result, the truck is at rest, or motionless.
	Option A is incorrect	When the forces are balanced, no motion occurs.
	Option C is incorrect	When the forces are unbalanced, motion occurs.
	Option D is incorrect	The truck is at rest, so it is motionless. It is motionless because the forces are balanced.

Item#	Rationale	
40	Option F is correct	Copper is a metal. Metals are generally good conductors of electricity. Gold is also a metal, so gold is also generally a good conductor of electricity.
	Option G is incorrect	Radon is a nonmetal. Nonmetals generally do not conduct electricity.
	Option H is incorrect	Bromine is a nonmetal. Nonmetals generally do not conduct electricity.
	Option J is incorrect	Nitrogen is a nonmetal. Nonmetals generally do not conduct electricity.

Item#	Rationale	
41	Option B is correct	Since temperature changes are causing caterpillars to develop approximately two weeks earlier, birds that are able to produce eggs earlier so they can rear young while caterpillars are available will have higher reproductive success than birds that cannot.
	Option A is incorrect	*P. major* cannot immediately change food sources.
	Option C is incorrect	*P. major* cannot choose how many eggs are laid.
	Option D is incorrect	The caterpillars are developing two weeks earlier. Hunting caterpillars earlier during the day when the temperature is cooler will have no effect on the abundance of caterpillars available.

2021 STAAR Grade 8 Science Rationales

Item#	Rationale	
42	Option J is correct	The geological feature labeled X is a body of water, such as a river. The geological feature becomes wider because the soil is being carried away by the water.
	Option F is incorrect	The geological feature labeled X is a body of water, such as a river. The water travels along this path but does not straighten the path.
	Option G is incorrect	The geological feature labeled X is a body of water, such as a river. Water eroding soil along this feature will not make the feature dry. The presence of water prevents this feature from becoming dry.
	Option H is incorrect	The geological feature labeled X is a body of water, such as a river. The water travels along this path but does not shorten the path.