Texas STAAR 2022 Grade 8 Science

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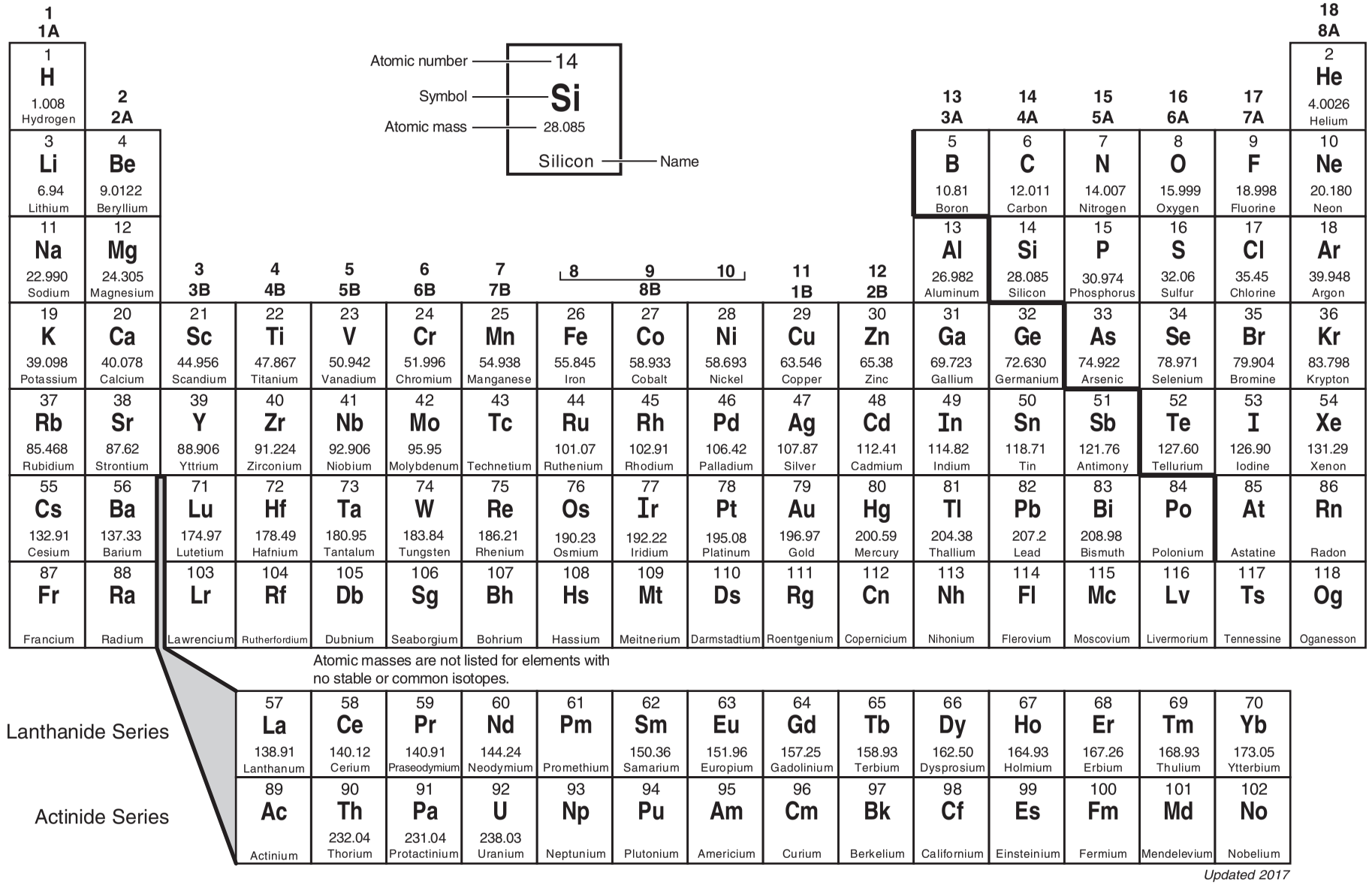
STAAR GRADE 8 SCIENCE REFERENCE MATERIALS

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)	$F = ma$

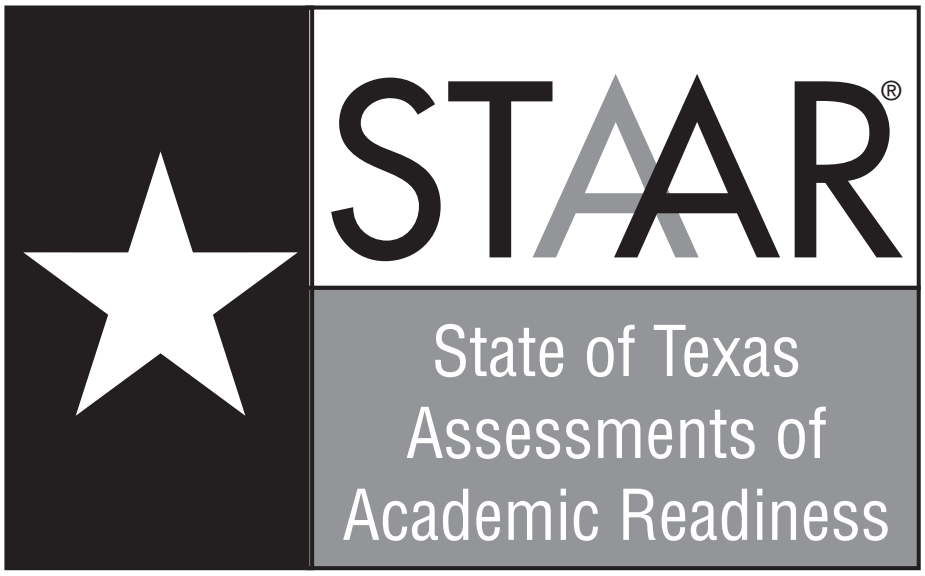
STAAR GRADE 8 SCIENCE REFERENCE MATERIALS

PERIODIC TABLE OF THE ELEMENTS



Updated 2017

Source: International Union of Pure and Applied Chemistry



GRADE 8

Science

Administered May 2022

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 A photograph of a litter of six-week-old bulldog puppies shows that the puppies are not identical.

Even though these puppies have the same parents, they do not all look alike because —

A they were produced by asexual cloning

B some of the puppies have genetic material from only one of the parents

C each puppy has a different combination of genetic material as a result of sexual reproduction

D all the puppies developed from the same fertilized egg

2 Sodium and lithium have similar chemical properties. What characteristic of these elements explains why they are chemically similar?

F Their atoms both have one valence electron.

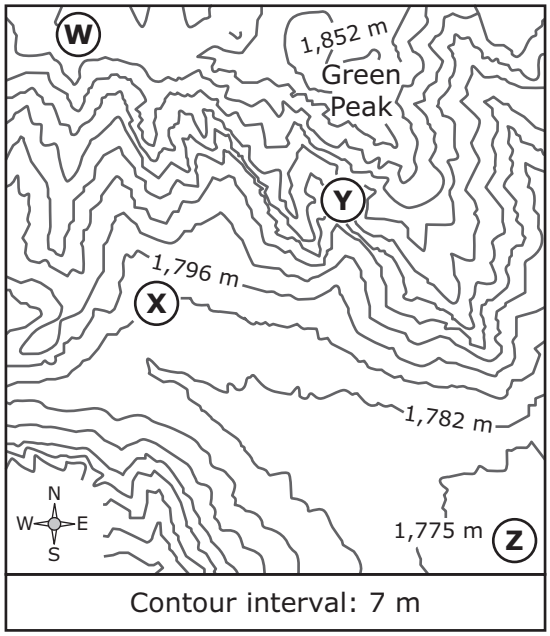
G Their atoms both have more neutrons than protons.

H Their atoms have the same number of energy levels.

J Their atoms contain equal numbers of protons and electrons.

GO ON

3 Hikers look at a topographic map of an area named Green Peak. The Green Peak area is made up of only limestone rock. The map is shown.



Which location around Green Peak is likely to experience the most erosion over time?

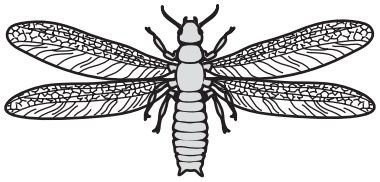
A Location W, because location W has the gentlest slope

B Location X, because location X is near the bottom of a slope

C Location Y, because location Y has the steepest slope

D Location Z, because location Z is the flattest slope

4 A student was given this partial dichotomous key and asked to determine in which of five orders the adult insect shown belongs.



Dichotomous Key

Step	Characteristic	Identification
1a	Does not have wings	Order Siphonaptera
1b	Has wings	Go to 2
2a	Has one pair of wings	Order Diptera
2b	Has two pairs of wings	Go to 3
3a	Wings are triangular	Order Ephemeroptera
3b	Wings are not triangular	Go to 4
4a	Wing pairs have a similar size and shape	Order Isoptera
4b	Wing pairs do not have a similar size and shape	Order Zoraptera

Based on the dichotomous key, in which order does the insect belong?

F Diptera

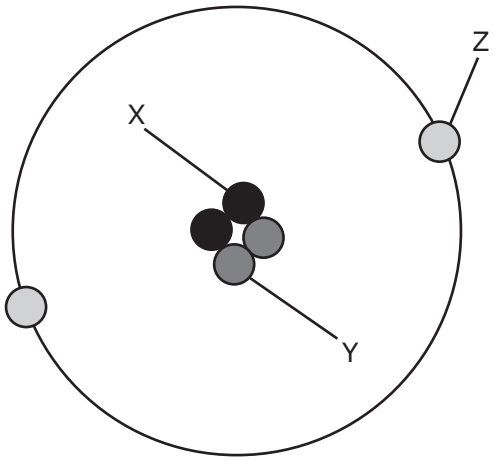
G Isoptera

H Ephemeroptera

J Zoraptera

5 The diagram shows a model of an atom. The model contains three different subatomic particles. Particles X and Y are inside the nucleus, and particle Z is outside of the nucleus.

Model of an Atom



Which statements best describe the charges on the particles in this model?

A Both particles X and Y have a positive charge.

Particle Z has a negative charge.

B Both particles X and Y have a negative charge.

Particle Z has a positive charge.

C Either particle X or particle Y has a positive charge.

Particle Z has a negative charge.

D Either particle X or particle Y has a negative charge.

Particle Z has a positive charge.

6 A photograph of a bird perched on a fence post is shown.

Which description best identifies the action-reaction pair between the bird and the fence post?

F Action: The force of the bird on the wires

Reaction: The force of the wires on the fence post

G Action: The force of the wires on the fence post

Reaction: The force of the fence post on the bird

H Action: The force of the fence post on the bird

Reaction: The force of the bird on the wires

J Action: The force of the bird on the fence post

Reaction: The force of the fence post on the bird

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7 Farmers can best reduce negative effects on the water quality of nearby streams and lakes by planting crops that —

A produce less oxygen

B produce less carbon dioxide

C need less fertilizer

D need less solar energy

8 Buffelgrass is an invasive species of grass from Africa that outcompetes native Texas grasses for space and water. Which long-term change to a Texas grassland would most likely occur due to the introduction of buffelgrass?

F The population of native grasses will increase.

G The population of native grasses will decrease.

H Buffelgrass offspring will develop traits like those of native grasses.

J Buffelgrass offspring will develop traits like those of other invasive species.

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9 Two students record the distance they each traveled in 60 seconds in the data table shown.

	Distance (m)	Time (s)
Student 1	40	60
Student 2	20	60

If the students continue at the same speed, which statement describes the total distance traveled after 90 seconds?

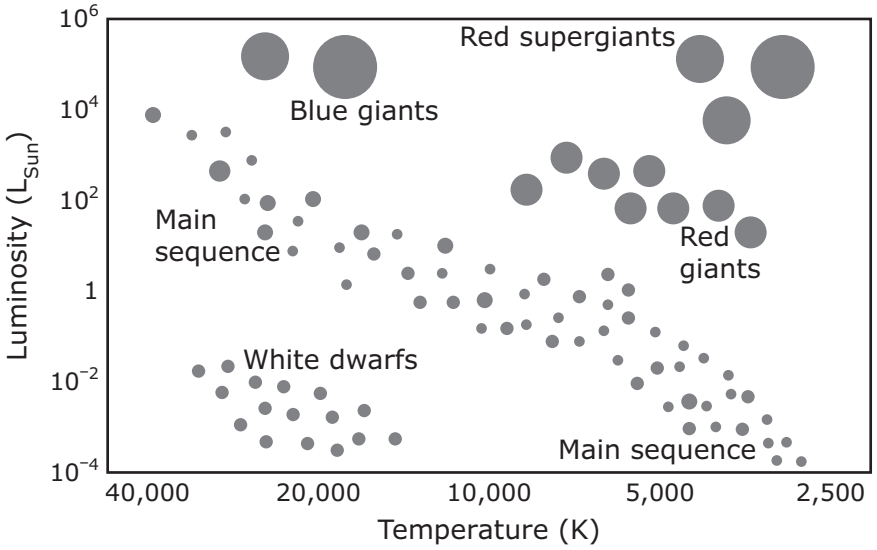
A Student 1 traveled 40 m, and student 2 traveled 20 m.

B Student 1 traveled 50 m, and student 2 traveled 30 m.

C Student 1 traveled 60 m, and student 2 traveled 30 m.

D Student 1 traveled 70 m, and student 2 traveled 25 m.

10 A Hertzsprung-Russell (H-R) diagram is shown.



A star that has a luminosity of 10^{-2} and a temperature of 20,000 K is most likely a —

F Main sequence

G White dwarf

H Blue giant

J Red giant

---

11 A sledgehammer has a mass of 3.5 kilograms. What net force, to the nearest whole newton, will a person need to apply to accelerate the sledgehammer at a rate of 4.0 m/s^2?

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

12 Students collected data on five elements. Their data are shown in the table.

Name	Atomic Number	Average Atomic Mass (amu)	Group	Period
Lithium	3	6.94	1	2
Beryllium	4	9.01	2	2
Sodium	11	22.99	1	3
Magnesium	12	24.31	2	3
Potassium	19	39.1	1	4

Which element has the same number of energy levels as lithium?

F Beryllium

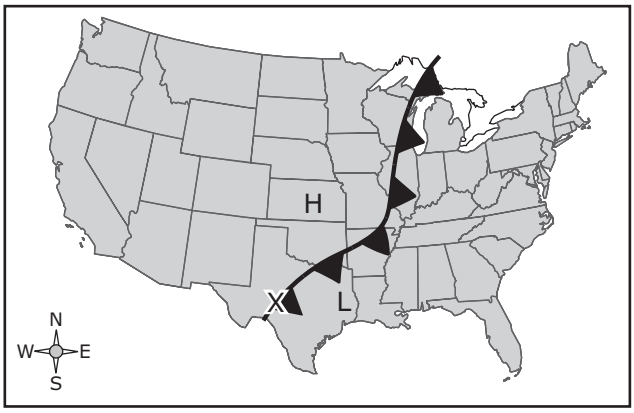
G Sodium

H Magnesium

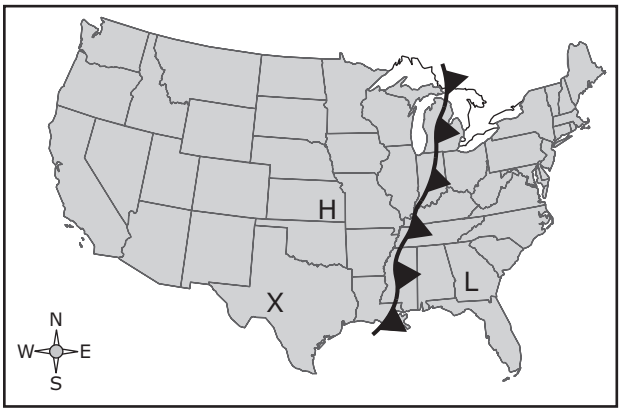
J Potassium

13 Maps of predicted weather conditions are shown.

Day 1



Day 2



Which answer choice best describes the weather at location X on Day 1 and Day 2?

A Day 1: warm and rainy

Day 2: cool with more rain

B Day 1: warm and windy

Day 2: cloudy and cold

C Day 1: clear and cool

Day 2: warm and rainy

D Day 1: cold and rainy

Day 2: clear and sunny

14 Oxygen and oxygen-containing compounds are involved in many different reactions. Which balanced equation represents a reaction that involves 14 atoms of oxygen?

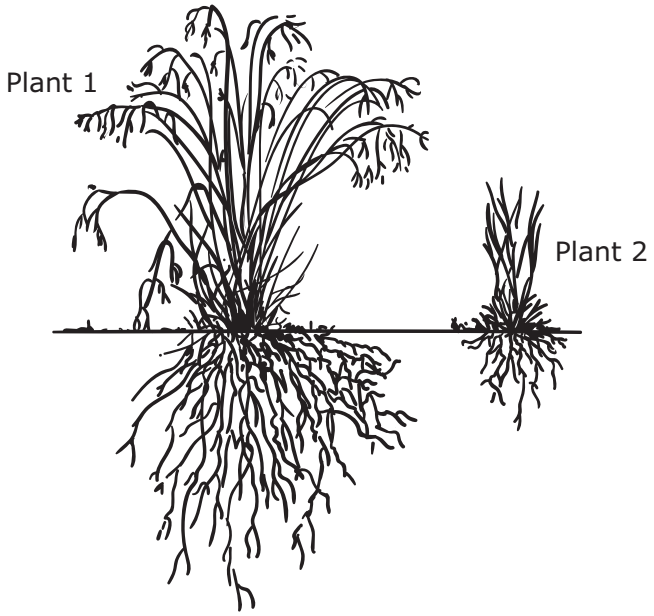
F $NH_4Cl + KOH \rightarrow NH_3 + H_2O + KCl$

G $2Na + 2H_2O \rightarrow 2NaOH + H_2$

H $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

J $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

15 Two plant species that grow in the same area are shown.



Which statement best explains a difference between Plant 1 and Plant 2?

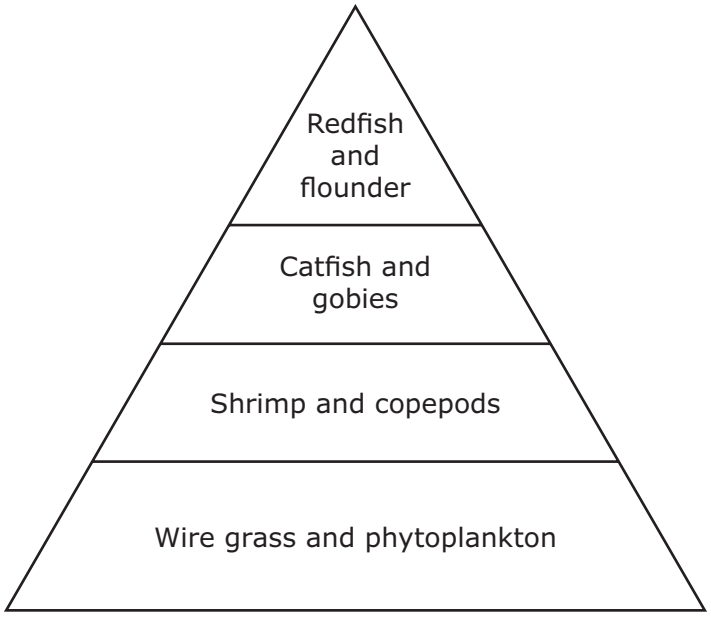
A Plant 1 obtains more water from the soil because of its root surface area and root depth.

B Plant 1 obtains more sunlight because of its root surface area and root depth.

C Plant 2 obtains more water from the soil because of its root surface area and root depth.

D Plant 2 obtains more sunlight because of its root surface area and root depth.

16 A Texas Gulf Coast energy pyramid is shown with representative organisms at each trophic level.



Which statement best describes the flow of energy through this pyramid?

F The trophic level represented by catfish and gobies receives energy directly from the producers.

G The trophic level represented by shrimp and copepods receives energy directly from the tertiary consumers.

H The trophic level represented by redfish and flounder receives energy directly from the secondary consumers.

J The trophic level represented by wire grass and phytoplankton receives energy directly from the primary consumers.

17 A student is building a model of a solar eclipse. Solar eclipses occur only during a new moon phase. Which motion best demonstrates a solar eclipse?

A The moon moves between the sun and Earth, casting a shadow of the moon on Earth.

B The sun moves between the moon and Earth, casting a shadow of the sun on Earth.

C Earth moves between the sun and the moon, casting a shadow of Earth on the moon.

D Earth moves between the sun and the moon, casting a shadow of the moon on the sun.

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18 What function do both cell membranes and cell walls perform?

F Producing energy for cellular processes

G Allowing water to move into and out of cells

H Synthesizing genetic material

J Directing the reproduction of the cell

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19 Which of these observations is an indication that a chemical reaction has occurred?

A Steam forms above boiling water.

B A solid forms when a clear solution is frozen.

C A solid forms when two clear solutions are mixed.

D Sugar crystals form on the sides of a boiling pot of sugar water.

20 Which statement best explains why the sun appears brighter to people on Earth than any other star?

F Sunlight reaches Earth's atmosphere at an angle that causes the sun's light rays to intensify.

G Unique chemical reactions in the sun's core produce a high-energy wavelength of light.

H The sun burns at a higher temperature than any other star.

J The sun is closer to Earth than any other star.

21 Students jump rope for one minute to determine changes in heart rate and breathing rate. Their data are shown in the table.

Observation	Heart Rate (beats per minute)	Breathing Rate (breaths per minute)
Before jumping	60	15
After jumping	120	35

Which table explains the functions of the two body systems that the students investigated?

A

Body system	Function
Circulatory system	To add oxygen gas to blood and remove carbon dioxide gas
Skeletal system	To sense and respond to changes in the body and environment

B

Body system	Function
Circulatory system	To pump blood around the body to carry nutrients, oxygen, and wastes
Respiratory system	To add oxygen to and remove carbon dioxide from the blood

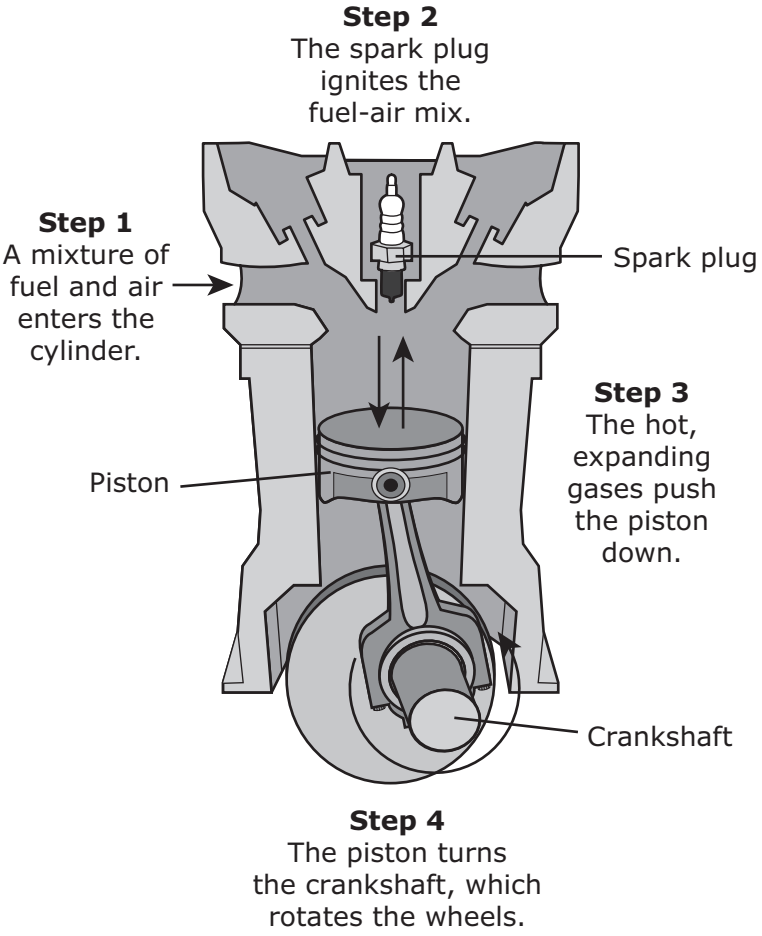
C

Body system	Function
Nervous system	To support the muscles and protect organs
Respiratory system	To pump blood around the body to carry nutrients, oxygen, and wastes

D

Body system	Function
Skeletal system	To protect organs, support body, and attach to muscles for movement
Nervous system	To sense and respond to changes in the body and environment

22 The diagram shows how a cylinder in a car engine causes the car to move.



Which description of the energy conversions in this process is correct?

F The chemical energy in the fuel-air mixture is converted to thermal energy, which is then converted to mechanical energy.

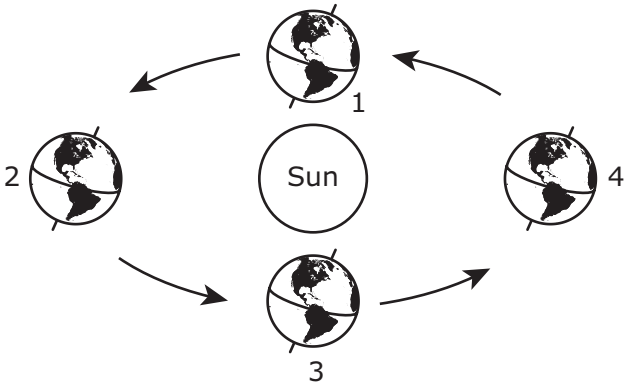
G The mechanical energy in the fuel-air mixture is converted to electrical energy, which is then converted to thermal energy.

H The electrical energy in the fuel-air mixture is converted to mechanical energy, which is then converted to thermal energy.

J The thermal energy in the fuel-air mixture is converted to electrical energy, which is then converted to mechanical energy.

23 The model shows Earth in four different positions in its orbit around the sun.

Orbit of Earth Around the Sun



Note: The drawing is not to scale.

Which statement correctly explains which position of Earth represents summer in the United States?

A Position 1, because the Western Hemisphere is facing the sun

B Position 2, because the Northern Hemisphere tilts toward the sun

C Position 3, because Earth is at its closest point to the sun in its orbit

D Position 4, because Earth is traveling at its fastest rate in its orbit

24 Students observe an unknown species during a field study. They observe that the organism is multicellular, is autotrophic, and can reproduce both sexually and asexually.

Which kingdom does this organism most likely belong to?

F Archaea

G Animalia

H Bacteria

J Plantae

25 A car initially traveling at 8.0 meters per second doubles its speed while traveling in a northeast direction.

Students used a table to record the initial and final conditions for speed and velocity. Which table is correct?

A

Initial and Final Conditions

	Speed	Velocity
Initial	8.0 m/s	8.0 m/s northeast
Final	16.0 m/s	16.0 m/s northeast

B

Initial and Final Conditions

	Speed	Velocity
Initial	8.0 m/s northeast	8.0 m/s
Final	16.0 m/s northeast	16.0 m/s

C

Initial and Final Conditions

	Speed	Velocity
Initial	8.0 m/s	0.0 m/s^2 northeast
Final	16.0 m/s	0.5 m/s^2 northeast

D

Initial and Final Conditions

	Speed	Velocity
Initial	8.0 m/s northeast	8.0 m/s northeast
Final	16.0 m/s northeast	16.0 m/s northeast

GO ON

26 Which element has chemical properties that are most similar to the chemical properties of sulfur, S?

F Silicon, Si

G Chlorine, Cl

H Selenium, Se

J Phosphorus, P

27 Early one morning students observed the moon as it appeared from Earth.

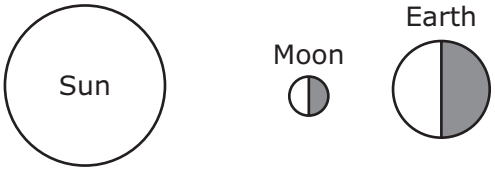
Observed Moon Phase

Which diagram shows the correct relative positions of the sun, the moon, and Earth when the moon was in the observed phase?

A

B

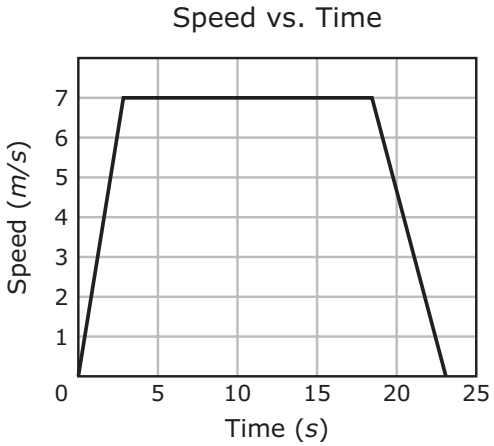
C



D

GO ON

28 The speed of an object over time is shown in the graph.



Which table describes the object's motion?

F

Time Interval (*s*)	Description of the Motion
0–3	The object's speed is increasing.
3–18	The object's speed is constant.
18–23	The object's speed is decreasing.

H

Time Interval (*s*)	Description of the Motion
0–3	The object's speed is increasing.
3–18	The object is at rest.
18–23	The object's speed is decreasing.

G

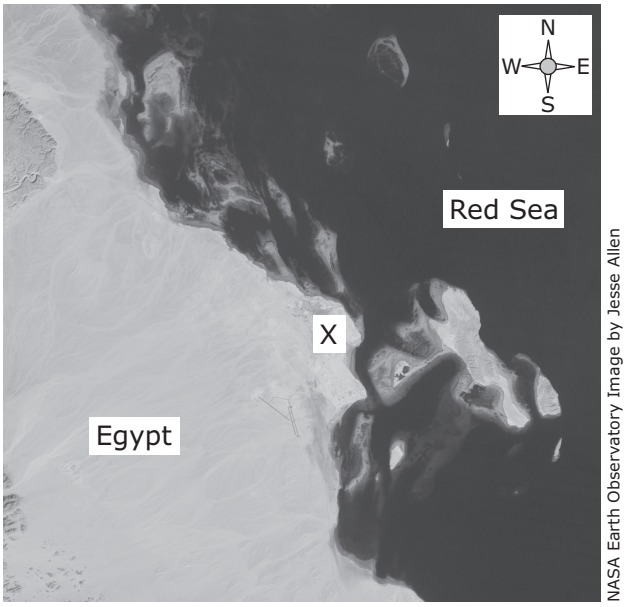
Time Interval (*s*)	Description of the Motion
0–3	The object is moving in a positive direction.
3–18	The object is at rest.
18–23	The object is moving in a negative direction.

J

Time Interval (*s*)	Description of the Motion
0–3	The object is moving at a constant speed.
3–18	The object is at rest.
18–23	The object is moving at a constant speed.

29 The photograph shows a satellite view of the desert coast of Egypt and the Red Sea.

Satellite Photograph



NASA Earth Observatory Image by Jesse Allen

Researchers predict that in the future, the land area of point X will be reduced by erosion.

Which event will cause the most weathering and erosion to the land area at point X?

A Increasing salinity of seawater near the land

B Intense rays from the sun striking the land

C Solids floating in seawater depositing on the land

D Strong storm winds blowing across the land

30 Humans depend upon food that comes from the ocean. Some human activities negatively impact these food supplies.

Which statement provides the best evidence that human activities contribute to this impact?

F Human visitors to coral reef systems break corals growing on rocks.

G Humans catch marine fish at a faster rate than the fish are able to reproduce.

H Humans raise fish in a hatchery for commercial sale.

J Humans construct artificial reefs to attract tourists.

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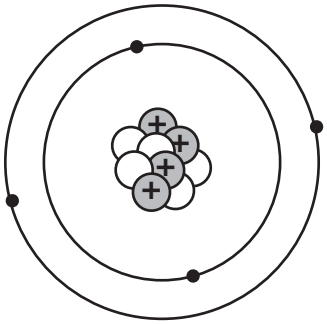
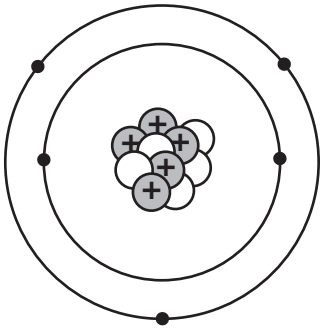
31 A student prepared diagrams to model atoms of two elements.





Atoms of which two elements are represented by these models?

A Oxygen, O, and neon, Ne

B Fluorine, F, and neon, Ne

C Silicon, Si, and phosphorus, P

D Beryllium, Be, and boron, B

32 If a fluorine atom has a mass number of 19, how many neutrons are in the atom?

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

---

33 Four students designed and built air propelled rockets that were launched into the air. Their data are recorded in the table.

Data Table

Rocket	Mass (kg)	Net Force (N)
1	0.528	12.0
2	0.426	8.0
3	0.515	12.0
4	0.477	8.0

Which rocket had the greatest acceleration?

A Rocket 1

B Rocket 2

C Rocket 3

D Rocket 4

34 Sea anemones and clown fish live together in the ocean. Which statement best describes one way sea anemones depend on clown fish for an abiotic factor in an ecosystem?

F Clown fish protect sea anemones from predatory fish.

G Clown fish decrease competition among sea anemones.

H Clown fish consume the remains of organisms paralyzed by sea anemones.

J Clown fish move water near sea anemones when dissolved oxygen levels are low.

35 The picture shows a bicyclist increasing speed while riding down a hill during a bicycle race.

Which statements accurately describe the potential and kinetic energy of this bicyclist?

A Kinetic energy increases.

Potential energy decreases.

B Kinetic energy increases.

Potential energy remains constant.

C Kinetic energy remains constant.

Potential energy decreases.

D Kinetic energy remains constant.

Potential energy increases.

36 Trees lose water through transpiration, when water evaporates from leaves. The list describes types of tree leaves that help reduce the amount of transpiration.

Tree Leaves That Reduce Transpiration

- Small leaves
- Needlelike leaves, such as on conifers
- Leaves with hairlike structures
- Leaves with waxy coverings

Which of these is most likely observed in an area experiencing a long-term drought?

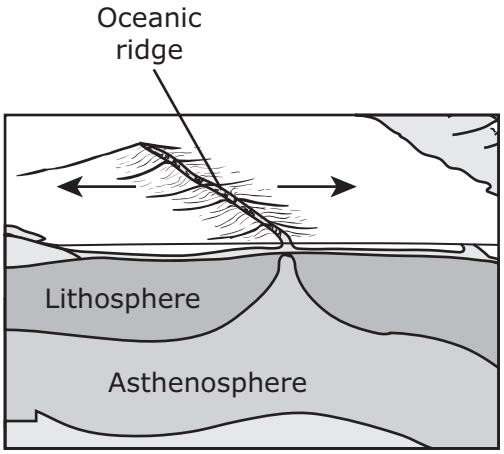
F Trees with broad leaves will be more healthy than trees with needlelike leaves.

G Trees with leaves that have waxy coverings will be more healthy than trees without wax-covered leaves.

H Trees with broad leaves will be more healthy than trees with small, flat leaves.

J Trees with leaves without any hairlike structures will be more healthy than trees with leaves covered by hairlike structures.

37 Two oceanic plates are shown in the image.



Which type of boundary results in the spreading of the oceanic ridge?

A Convergent boundary

B Subduction boundary

C Transform boundary

D Divergent boundary

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38 When a coin is tossed in the air, it travels upward, gradually slows down, momentarily reaches zero speed, then moves back downward with increasing speed. Which statement best explains this change in the coin's motion?

F The force of gravity causes the coin to change its velocity.

G The coin's inertia decreases on the way up and increases on the way down.

H The action-reaction force pair of gravity and the applied force cancel each other.

J The coin remains in its state of upward motion until the force of friction acts upon it.

39 Alpha Centauri appears as a bright object visible in the Milky Way galaxy. Alpha Centauri is actually a system of three objects. Each object produces light and rotates on its own axis. The system is an average of 4 light-years from Earth.

Based on this information, the three objects that make up the Alpha Centauri system are all —

A asteroids

B comets

C planets

D stars

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40 Students performed a lab investigation on chemical reactions. The students put on goggles and plastic gloves and then followed these steps.

1. Pour 150 milliliters of vinegar into a beaker.
2. Place a thermometer in the vinegar and record measurements.
3. Add a piece of steel wool to the beaker.
4. Observe and record thermometer measurements.
5. Remove the steel wool from the beaker.
6. Use tweezers to pull strands of the steel wool apart and observe changes.

Which observation would indicate that a chemical reaction occurred?

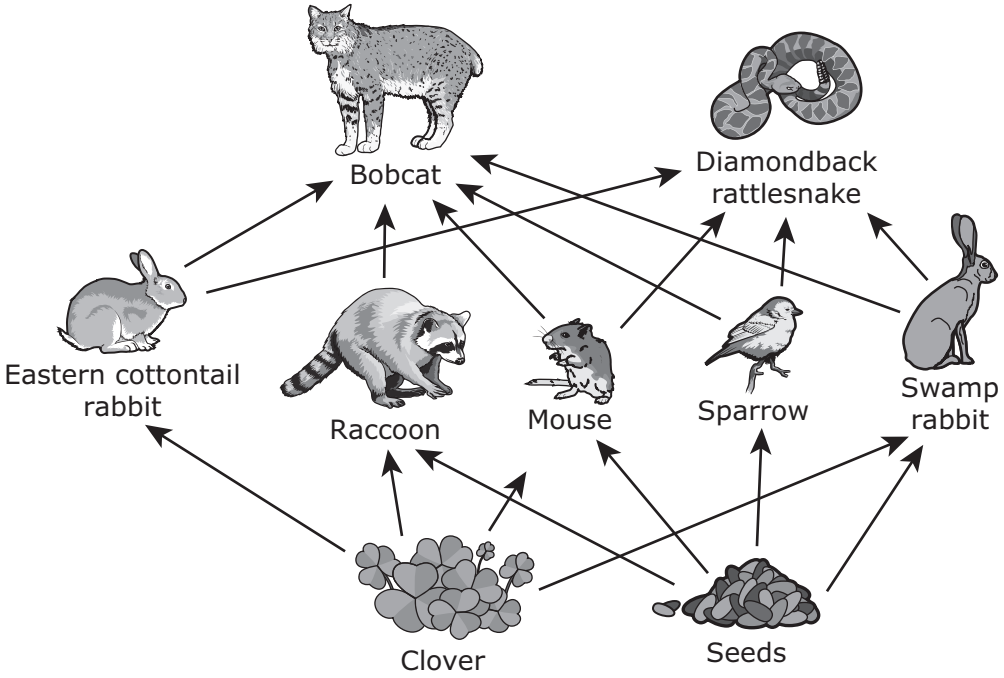
F The vinegar took the shape of the container in step 1.

G The steel wool sank into the vinegar in step 3.

H The temperature of the vinegar increased during step 4.

J The steel wool changed shape during step 6.

41 A Texas Gulf Coast food web is shown.



According to this food web, which organisms would the bobcat and diamondback rattlesnake compete for if the mouse population and swamp rabbit population decreased?

A Raccoon and sparrow

B Raccoon and Eastern cottontail rabbit

C Sparrow and seeds

D Sparrow and Eastern cottontail rabbit

42 The chart shows properties of four elements.

Element Properties

Element	Luster	Conducts Electricity	Conducts Heat	Melting Point
1	Shiny	Yes	Yes	Low
2	Dull	No	No	Low
3	Shiny	Yes	Yes	High
4	Dull	Yes	Yes	High

Based on these properties, which element is most likely a nonmetal?

F Element 1

G Element 2

H Element 3

J Element 4

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

Item Number	Reporting Category	Readiness or Supporting	Content Student Expectation	Process Student Expectation	Correct Answer
1	4	Supporting	7.14(B)		C
2	1	Readiness	8.5(B)		F
3	3	Readiness	8.9(C)	8.3(B)	C
4	4	Supporting	7.11(A)	8.2(E)	G
5	1	Readiness	8.5(A)	8.3(B)	C
6	2	Readiness	8.6(C)		J
7	3	Supporting	7.8(C)		C
8	4	Readiness	8.11(B)	8.2(E)	G
9	2	Supporting	6.8(C)	8.2(E)	C
10	3	Readiness	8.8(A)	8.2(E)	G
11	2	Readiness	8.6(A)		14
12	1	Readiness	8.5(C)	8.2(D)	F
13	3	Supporting	8.10(B)	8.3(B)	D
14	1	Readiness	8.5(D)	8.3(B)	H
15	4	Readiness	8.11(A)	8.3(A)	A
16	1	Supporting	7.5(B)	8.2(C)	H
17	3	Readiness	8.7(B)	8.3(B)	A
18	4	Supporting	7.12(D)		G
19	1	Readiness	8.5(E)		C
20	3	Supporting	8.8(B)		J
21	4	Supporting	7.12(B)	8.2(E)	B
22	2	Supporting	6.9(C)	8.2(C)	F
23	3	Readiness	8.7(A)	8.3(B)	B
24	4	Supporting	6.12(D)	8.2(E)	J
25	2	Supporting	8.6(B)	8.2(D)	A
26	1	Readiness	8.5(C)		H
27	3	Readiness	8.7(B)	8.3(B)	D
28	2	Supporting	6.8(D)	8.2(E)	F
29	3	Readiness	8.9(C)	8.2(E)	D
30	4	Supporting	8.11(C)		G
31	1	Readiness	8.5(B)	8.3(B)	D
32	1	Readiness	8.5(A)		10
33	2	Readiness	8.6(A)	8.2(D)	C
34	4	Readiness	8.11(A)	8.3(A)	J
35	2	Supporting	6.8(A)		A
36	4	Readiness	8.11(B)		G
37	3	Readiness	8.9(B)	8.3(B)	D
38	2	Readiness	8.6(C)		F
39	3	Readiness	8.8(A)		D
40	1	Readiness	8.5(E)		H
41	4	Readiness	8.11(A)	8.2(E)	D
42	1	Supporting	6.6(A)	8.2(D)	G

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
1	Option C is correct	Sexual reproduction causes variations in genetic makeup. Even though the puppies all have the same two parents, they each have different combinations of the parents' genes. This results in some differences in observable physical characteristics, such as fur color patterns.
	Option A is incorrect	Asexual cloning would produce genetically identical offspring.
	Option B is incorrect	Offspring contain genetic material from both parents and not from only one parent.
	Option D is incorrect	It would be rare for seven puppies to come from the same fertilized egg. Puppies from the same fertilized egg would have nearly identical physical characteristics.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
2	Option F is correct	Both lithium (Li) and sodium (Na) are in Group 1 of the Periodic Table (located in the first column of the Periodic Table). Elements in the same group have the same number of valence electrons that determine their bonding behavior. Both Li and Na have 1 valence electron in their outer energy level (or electron shell).
	Option G is incorrect	The number of neutrons compared to the number of protons does not explain why the elements are chemically similar. Most stable isotopes have fewer protons than neutrons.
	Option H is incorrect	Li and Na each have a different number of energy levels. Li has two energy levels (or electron shells) and is classified in Period 2 of the Periodic Table, while Na has three energy levels and is classified in Period 3. Periods are indicated by rows in the Periodic Table.
	Option J is incorrect	If both atoms contained equal numbers of protons, they would be the same element.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
3	Option C is correct	The lines in the map are called contour lines. Contour lines help indicate elevation and steepness. The closer the contour lines are together, the steeper the slope. The close contour lines around location Y indicate a steep slope. As the steepness of a slope increases, the rate of erosion increases.
	Option A is incorrect	An area with little to no slope (or a gentle slope) would have less erosion.
	Option B is incorrect	The bottom of a slope would have some erosion, but not the most erosion, over time.
	Option D is incorrect	An area with little to no slope (or a flat slope) would have less erosion.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
4	Option G is correct	The Isoptera is the insect identified when the dichotomous key is followed correctly. A dichotomous key is a tool that helps scientists classify organisms. It consists of a series of steps with descriptions of physical characteristics. The absence or presence of a given characteristic at each step directs the user closer to the identification of the organism.
	Option F is incorrect	According to the dichotomous key, the insect would have one pair of wings, which is incorrect.
	Option H is incorrect	According to the dichotomous key, the insect would have triangular wings, which is incorrect.
	Option J is incorrect	According to the dichotomous key, the insect would have wings that are not a similar size and shape, which is incorrect.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
5	Option C is correct	Particles X and Y must consist of one proton (positive charge) and one neutron (no charge). Protons and neutrons are found in the nucleus at the center of the atom. Particle Z represents electrons, which have a negative charge. Electrons are found in orbitals outside the nucleus.
	Option A is incorrect	Three different types of particles are represented in the diagram. Particle X and particle Y represent different types of particles. Only protons and neutrons are bound in the nucleus of an atom. Neutrons have no charge. Therefore, both types of particles cannot have a positive charge. Either particle X or particle Y must be a neutron.
	Option B is incorrect	Only electrons have a negative charge. Electrons are not found in the nucleus at the center of an atom. Electrons are found in orbitals outside the nucleus. Therefore, particles X and Y could not have negative charges. Also, only protons have a positive charge. Protons are not found in the orbitals outside of the nucleus at the center of the atom. Therefore, particle Z could not have a positive charge.
	Option D is incorrect	Electrons are not found in the nucleus of an atom; therefore, neither particle X nor particle Y could have a negative charge. Also, since particle Z is outside the nucleus at the center of the atom, it could not have a positive charge. Only protons have a positive charge, and protons are not found outside the nucleus.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
6	Option J is correct	Based on Newton's third law, for every action, there is an opposite and equal reaction. Therefore, interacting forces occur as action-reaction pairs. In this scenario, the bird is exerting a downward force on the fence post, while the fence post is exerting an upward force on the bird.
	Option F is incorrect	This is not an action-reaction pair. For this to be an action-reaction pair, it would have to refer to the force of the bird on the wires and the force of the wires on the bird (not the force of the wires on the fence post).
	Option G is incorrect	This is not an action-reaction pair. For this to be an action-reaction pair, it would have to refer to the force of the wires on the fence post and the force of the fence post on the wires (not the force of the fence post on the bird).
	Option H is incorrect	This is not an action-reaction pair. For this to be an action-reaction pair, it would have to refer to the force of the fence post on the bird and the force of the bird on the fence post (not the force of the bird on the wires).

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
7	Option C is correct	Planting a crop that requires fewer supplemental nutrients to grow would result in less fertilizer use and fewer nutrients in agricultural runoff that can flow into nearby waterways. Excess nutrients from fertilizers in agricultural runoff can negatively affect nearby waterways by causing harmful algal blooms.
	Option A is incorrect	Plants produce oxygen through photosynthesis. Plants would not produce less oxygen unless photosynthesis is disrupted. If less oxygen is produced, it could increase the negative effects of water quality. Low oxygen levels in the water bodies can have negative effects on many types of aquatic organisms.
	Option B is incorrect	Although plants produce carbon dioxide during respiration, the carbon dioxide produced by plants does not have a negative effect on water quality.
	Option D is incorrect	Plants convert sunlight (solar energy) into chemical energy through photosynthesis. Needing less solar energy will not decrease the negative effects of water quality.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
8	Option G is correct	The native grass population will decrease since buffelgrass is competing against it for the same resources.
	Option F is incorrect	The native grass population will not increase since the buffelgrass is outcompeting it for space and water.
	Option H is incorrect	The buffelgrass would not develop traits like those of the native grasses since the native grass population is competing for the same resources and the buffelgrass is outcompeting the native grasses.
	Option J is incorrect	Since the buffelgrass is successful in its competition against the native grasses, it will continue to survive and reproduce. Therefore, the buffelgrass offspring would not develop traits like other invasive species if they are currently fit to survive as is.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
9	Option C is correct	Speed is a measure of distance over time. Student 1 travels 40 meters in 60 seconds. Student 2 travels 20 meters in 60 seconds. After an additional 30 seconds (90 seconds total), student 1 would travel another 20 meters for a total of 60 meters, and student 2 would travel another 10 meters for a total of 30 meters.
	Option A is incorrect	This response describes the distance traveled by each student after 60 seconds, not 90 seconds.
	Option B is incorrect	Moving at a constant speed of 40 meters per 60 seconds, student 1 would move more than an additional 10 meters in 30 seconds.
	Option D is incorrect	Both students are moving at a constant speed. Therefore, for student 1 to travel 70 meters and student 2 to travel 25 meters in 90 seconds, student 1 would have to increase speed and student 2 would have to decrease speed.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
10	Option G is correct	White dwarf stars are found to be around 20,000 K and 10^{-2} luminosity. The student correctly interpreted the H-R diagram to identify the white dwarfs.
	Option F is incorrect	The student likely referred to only the luminosity and not to the temperature.
	Option H is incorrect	The student likely referred to only the temperature and not to the luminosity.
	Option J is incorrect	The student likely referred to the incorrect luminosity (10^{2} instead of 10^{-2}) and not to the temperature.

Item #	Rationale	
11	14, 14.0, or 14.00 is correct	The force was obtained by multiplying 3.5 kg x 4.0 m/s^2 using the formula: $F = ma$ $F = (3.5\ kg) \times (4.0\ m/s^2)$ $F = 14\ N$

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
12	Option F is correct	Beryllium is in the same period as lithium. Elements in the same period have the same number of energy levels.
	Option G is incorrect	Sodium is in the same group as lithium. Elements in the same group do not have the same number of energy levels. They have the same number of valence electrons.
	Option H is incorrect	Magnesium is not in the same period as lithium and therefore does not have the same number of energy levels.
	Option J is incorrect	Potassium is in the same group as lithium. Elements in the same group do not have the same number of energy levels. They have the same number of valence electrons.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
13	Option D is correct	A cold front results in cold, rainy weather. Location X is on a cold front on Day 1. On Day 2, once the cold front has passed, the weather is clear and sunny. A high pressure (H) area, as shown behind the front on the map, is typically associated with clear and settled weather.
	Option A is incorrect	A cold front does not result in warm weather on Day 1. On Day 2, once the cold front has passed, the rain should stop.
	Option B is incorrect	A cold front does not result in warm weather on Day 1. On Day 2, once the cold front has passed, the weather is clear, not cloudy.
	Option C is incorrect	A cold front does not result in clear skies. On Day 2, once the cold front has passed, the temperature is cool, not warm, and the rain stops.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
14	Option H is correct	There are 14 atoms of oxygen balanced on each side of this equation.
	Option F is incorrect	There is only 1 atom of oxygen on each side of this equation.
	Option G is incorrect	There are only 2 atoms of oxygen on each side of this equation.
	Option J is incorrect	There are only 6 atoms of oxygen on each side of this equation.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
15	Option A is correct	Plant 1 has a larger root system than Plant 2 and will therefore be able to absorb a greater amount of water from the soil.
	Option B is incorrect	Plant 1 obtains more sunlight than Plant 2 because it has more leaves and stems available to perform photosynthesis, not because of its greater root surface area and root depth. The root system is not responsible for capturing sunlight.
	Option C is incorrect	Plant 2 would not obtain more water than Plant 1 because Plant 2 has a smaller root surface area and root depth than Plant 1.
	Option D is incorrect	Plant 2 would not obtain more sunlight because it has fewer leaves and stems available to perform photosynthesis. Additionally, the root system is not responsible for capturing sunlight.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
16	Option H is correct	An energy pyramid represents feeding relationships in a community by showing the amount of energy transferred from one feeding position in a food web (trophic level) to the next. The efficiency of energy transfer typically decreases from the base (bottom) of the pyramid (producers) to the top of the pyramid (top consumers). In this energy pyramid, the secondary consumers are the catfish and gobies, which are below the redfish and flounder. Therefore, the redfish and flounder receive energy directly from them.
	Option F is incorrect	The catfish and gobies do not receive energy directly from the producers. Instead, they receive energy directly from the primary consumers.
	Option G is incorrect	The shrimp and copepods do not receive energy directly from the tertiary consumers. Instead, they receive energy directly from the producers.
	Option J is incorrect	The wire grass and phytoplankton do not receive energy directly from the primary consumers. Instead, as producers, they receive energy directly from the sun.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
17	Option A is correct	A solar eclipse occurs when the moon moves between the sun and Earth and casts a shadow of the moon on Earth.
	Option B is incorrect	The sun does not move between the moon and Earth. The sun is in a fixed location and has planets and various celestial bodies orbiting it. Also, the sun is a light source, which neither Earth nor the moon can cast a shadow on.
	Option C is incorrect	A lunar eclipse occurs when Earth moves between the sun and the moon and Earth casts its shadow on the moon.
	Option D is incorrect	A lunar eclipse occurs when Earth moves between the sun and the moon. As the sun is a light source, neither the moon nor Earth can cast a shadow on the sun.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
18	Option G is correct	Both cell membranes and cell walls allow water to move into and out of cells.
	Option F is incorrect	The mitochondria produce energy for cellular processes.
	Option H is incorrect	The nucleus contains the genetic material and directs protein synthesis within the ribosomes.
	Option J is incorrect	The nucleus controls growth and reproduction within the cell.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
19	Option C is correct	The formation of a solid or precipitate by mixing two clear solutions indicates that a chemical (nonreversible) change has occurred.
	Option A is incorrect	The formation of steam, or water vapor from liquid water, is a change of state, which is a physical change.
	Option B is incorrect	Freezing a liquid into a solid is a change of state, which is a physical change.
	Option D is incorrect	Crystallization indicates a physical (reversible) change as no new material is formed. The solid sugar crystals can be dissolved again in the liquid.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
20	Option J is correct	The sun is a closer distance to Earth than any other star, which results in it appearing brighter to people on Earth.
	Option F is incorrect	When the sun's light rays reach Earth's atmosphere, they do not intensify. The rays are absorbed, and some are reflected.
	Option G is incorrect	The sun's core does produce energy (heat and light), but this is not the reason why the sun appears brighter than any other star to people on Earth. Other stars have chemical reactions similar to those in the sun.
	Option H is incorrect	The sun does not burn at a higher temperature than any other stars. There are many stars in the universe that burn at much higher temperatures than the sun.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
21	Option B is correct	The circulatory system and respiratory system are the correct body systems that the students investigated, and the functions described are correct for each of those body systems.
	Option A is incorrect	The skeletal system's function is not to sense and respond to changes in the body and environment (that is the nervous system's function).
	Option C is incorrect	The nervous system's function is not to support muscles and protect organs (that is the skeletal system's function). The respiratory system's function is not to pump blood around the body to carry nutrients, oxygen, and wastes (that is the circulatory system's function).
	Option D is incorrect	Both the skeletal system and nervous system functions are correct, but these two body systems are not the ones that the students investigated.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
22	Option F is correct	The fuel-air mixture stores chemical potential energy, which is then converted into thermal energy (by the spark plug igniting in step 2). This energy is then converted to mechanical energy (in steps 3 and 4) when the hot gases push the piston down, which turns the crankshaft.
	Option G is incorrect	The fuel-air mixture stores chemical potential energy, not mechanical energy. This energy is then converted into thermal energy, not electrical energy.
	Option H is incorrect	The fuel-air mixture stores chemical potential energy, not electrical energy. Also, the chemical energy is first converted into thermal energy, not mechanical energy.
	Option J is incorrect	The fuel-air mixture stores chemical potential energy, not thermal energy. Also, the chemical energy is first converted into thermal energy, not electrical energy.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
23	Option B is correct	When the Northern Hemisphere tilts toward the sun, the United States is in the summer season.
	Option A is incorrect	Position 1 has the United States being in the spring season. It shows all hemispheres facing the sun, not just the Western Hemisphere.
	Option C is incorrect	Position 3 has the United States being in the fall season. Earth is at its closest point to the sun (perihelion) during the winter season, not summer; therefore, this does not explain the occurrence of the summer season in the United States.
	Option D is incorrect	Position 4 has the United States being in the winter season. Earth travels at the same rate as it orbits the sun.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
24	Option J is correct	Organisms in the Plantae kingdom are multicellular, autotrophic, and known to reproduce both sexually and asexually.
	Option F is incorrect	Organisms in the Archaea kingdom are unicellular, can be autotrophic and/or heterotrophic, and reproduce asexually.
	Option G is incorrect	Organisms in the Animalia kingdom are not autotrophic.
	Option H is incorrect	Most organisms in the Bacteria kingdom live as single-celled organisms. There are some myxobacteria (slime bacteria) that can form multicellular colonies, but they are heterotrophs, consuming nutrients in soil.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
25	Option A is correct	Speed does not include the direction of an object's movement, while velocity includes the direction of an object's movement. Since the speed of the car is doubled, its velocity is also doubled in a northeast direction.
	Option B is incorrect	Speed does not include the direction of an object's movement, while velocity includes the object's direction.
	Option C is incorrect	The velocity includes acceleration calculations and units (m/s^2).
	Option D is incorrect	Speed does not include the direction of an object.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
26	Option H is correct	Selenium (Se) and sulfur (S) are both nonmetals found in Group 16 of the Periodic Table. They have similar chemical properties because they have the same number of electrons (6) in their outermost (valence) shell. Valence electrons in the outermost shell of an atom determines how it will bond with other atoms.
	Option F is incorrect	Silicon (Si) is a metalloid found in Group 14 of the Periodic Table, while sulfur (S) is in Group 16. Si contains 4 valence electrons in its outermost shell, while S contains 6 valence electrons. A difference in the number of valence electrons indicates that these two elements are chemically dissimilar.
	Option G is incorrect	Chlorine (Cl) is a nonmetal found in Group 17 of the Periodic Table, while sulfur (S) is in Group 16. Cl contains 7 valence electrons in its outermost shell, while S contains 6 valence electrons. A difference in the number of valence electrons indicates that these two elements are chemically dissimilar.
	Option J is incorrect	Phosphorus (P) is a nonmetal found in Group 15 of the Periodic Table, while sulfur (S) is in Group 16. P contains 5 valence electrons in its outermost shell, while S contains 6 valence electrons. A difference in the number of valence electrons indicates that these two elements are chemically dissimilar.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
27	Option D is correct	This diagram shows a waning crescent, which is the moon phase observed by the students.
	Option A is incorrect	This diagram shows the moon as a full moon, which is not the moon phase observed by the students.
	Option B is incorrect	This diagram shows the moon as a waxing gibbous, which is not the moon phase observed by the students.
	Option C is incorrect	This diagram shows the moon as a new moon, which is not the moon phase observed by the students.

Item #	Rationale	
28	Option F is correct	On a speed versus time graph, when there is a positive slope, the object's speed is increasing. When there is no slope (flat line), the object's speed is constant, and when there is a negative slope, the object's speed is slowing down (decreasing).
	Option G is incorrect	The object is not at rest during the 3-second to 18-second time interval. A negative direction implies that the object is moving backward, which is not the case based on the speed versus time graph.
	Option H is incorrect	The object is not at rest during the 3-second to 18-second time interval.
	Option J is incorrect	The object is not moving at a constant speed during the zero- to 3-second time interval and from the 18-second to 23-second time interval. The object is also not at rest from the 3-second to 18-second time interval.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
29	Option D is correct	Strong storm winds would cause the most weathering and erosion to the desert land area at point X.
	Option A is incorrect	The salinity of the seawater near the land area at point X is not likely to have a significant impact on the future rate of weathering and erosion.
	Option B is incorrect	The intense rays from the sun in this desert region would contribute to weathering over time. However, the strong storm winds would cause both weathering and a significant amount of erosion as they move pieces of rock and sand from the desert at point X.
	Option C is incorrect	Solids washing up on the shore would result in deposition rather than weathering and erosion of the land.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
30	Option G is correct	If fish are being caught at a faster rate than they can reproduce, then the food supply will decrease over time. The numerical data gathered to calculate this rate could provide evidence that human activities are having a negative impact on food supplies from the ocean.
	Option F is incorrect	Breaking corals is destructive to local marine ecosystems, but it does not provide direct evidence that food supplies that humans depend on from the ocean are being negatively impacted.
	Option H is incorrect	Humans raising fish in a hatchery could positively impact the food supply from the ocean, as it could decrease the demand to harvest certain fish species for food from the ocean.
	Option J is incorrect	Humans constructing artificial reefs could positively impact the food supply by potentially creating habitat for marine life that would ultimately increase the food supply from the ocean. Regardless, data related to harvestable marine life present before and after the artificial reef construction would need to be evaluated.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
31	Option D is correct	Beryllium has an atomic number of 4, which means it has 4 protons. The element on the left side of the diagram has 4 protons (positively charged circles in the model). Boron has an atomic number of 5, which means it has 5 protons. The element on the right side of the diagram has 5 protons.
	Option A is incorrect	Oxygen has an atomic number of 8 and neon has an atomic number of 10, which means the elements would have 8 and 10 protons respectively.
	Option B is incorrect	Fluorine has an atomic number of 9 and neon has an atomic number of 10, which means the elements would have 9 and 10 protons respectively.
	Option C is incorrect	Silicon has an atomic number of 14 and phosphorus has an atomic number of 15, which means the elements would have 14 and 15 protons respectively.

Item #	Rationale	
32	10, 10.0, or 10.00 is correct	Fluorine has an atomic number of 9. The stem provides the mass number of 19. To get the number of neutrons, the atomic number is subtracted from the mass number: 19 – 9 = 10 neutrons

Item #	Rationale	
33	Option C is correct	The student calculated the acceleration of Rocket 3 to be about 23.301 m/s^2. This is the largest acceleration of all the rockets recorded. $F = ma$ 12.0 N = (0.515 kg) x a a = 23.301 m/s^2
	Option A is incorrect	The student calculated the acceleration of Rocket 1 to be 22.727 m/s^2, which is not the largest acceleration of all the rockets recorded. $F = ma$ 12.0 N = (0.528 kg) x a a = 22.727 m/s^2
	Option B is incorrect	The student calculated the acceleration of Rocket 2 to be 18.779 m/s^2, which is not the largest acceleration of all the rockets recorded. $F = ma$ 8.0 N = (0.426 kg) x a a = 18.779 m/s^2
	Option D is incorrect	The student calculated the acceleration of Rocket 4 to be 16.771 m/s^2, which is not the largest acceleration of all the rockets recorded. $F = ma$ 8.0 N = (0.477 kg) x a a = 16.771 m/s^2

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
34	Option J is correct	Water is an abiotic (nonliving) factor.
	Option F is incorrect	Predatory fish are biotic (living) factors.
	Option G is incorrect	Competition is a biotic factor.
	Option H is incorrect	Predation and scavenging are biotic factors.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
35	Option A is correct	Gravitational potential energy is defined by the energy stored in an object due to its height (vertical position) from the ground. The greater the height of an object, the greater its gravitational potential energy. As the bike travels down the hill, the height decreases, which causes the potential energy to decrease. Kinetic energy is the energy of motion. The kinetic energy of an object is directly proportional to the square of its speed. Therefore, as the speed of the bicycle increases down the hill, its kinetic energy increases.
	Option B is incorrect	Kinetic energy increases, but potential energy does not remain constant because of the height decreasing.
	Option C is incorrect	Potential energy decreases, but kinetic energy does not remain constant because of the potential energy being converted into kinetic energy.
	Option D is incorrect	Kinetic energy does not remain constant because of the decreasing height and conversion of potential energy to kinetic energy. The decrease in height decreases potential energy instead of increasing it.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
36	Option G is correct	Trees with leaves that have waxy coverings would have a decreased rate of transpiration, which would be beneficial during a long-term drought.
	Option F is incorrect	Broader leaves provide trees with a greater surface area to absorb more sunlight, but these leaves could also provide more surface area to lose water. Therefore, it is likely that there would be a smaller number of trees with broad leaves living in an area experiencing a long-term drought.
	Option H is incorrect	Small leaves would be more beneficial than broad leaves during a long-term drought because of the smaller surface area, which would cause decreased transpiration.
	Option J is incorrect	Trees with leaves without any hairlike structures would be less healthy because of increased transpiration. Having hairlike structures on their leaves would be more beneficial to trees during a long-term drought as they would prevent the trees from losing water by adding protection from wind and heat.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
37	Option D is correct	Divergent boundaries move away from each other, causing ridges.
	Option A is incorrect	Convergent boundaries move toward each other, causing volcanoes, mountains, or trenches.
	Option B is incorrect	Subduction boundaries occur when one plate moves below another plate.
	Option C is incorrect	Transform boundaries slide past each other but do not cause ridges.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
38	Option F is correct	Gravity is the force that causes the coin to fall toward the center of Earth. Gravity causes the coin to change direction while in the air and fall back down.
	Option G is incorrect	The coin's inertia would cause it to keep moving upward if the force of gravity was not acting on it to change its direction and move it back down. However, the inertia would not decrease on the way up and increase on the way down.
	Option H is incorrect	Action-reaction pairs refer to forces acting on different objects and not on the same object. Action-reaction pairs also do not cancel each other out. Forces can only cancel each other if they are acting on the same single object, not on different objects.
	Option J is incorrect	The coin will continue moving upward until the force of gravity acts on it. There is some air resistance (friction), but that does not cause the coin to change direction to be moving downward.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
39	Option D is correct	A star produces its own light and rotates around its axis.
	Option A is incorrect	An asteroid does not produce its own light, but it could rotate around its axis.
	Option B is incorrect	A comet does not produce its own light, but it could rotate around its axis.
	Option C is incorrect	A planet does not produce its own light, but it does rotate around its axis.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
40	Option H is correct	A change in the temperature of the reacting substance without the addition of an external heat source is indicative of a chemical change.
	Option F is incorrect	Vinegar taking the shape of the container is a physical property and is not indicative of a chemical change.
	Option G is incorrect	The steel wool sinking into the vinegar is not indicative of a chemical change. It is still steel wool and has not changed properties.
	Option J is incorrect	The steel wool changing shape is a physical change and is not indicative of a chemical change.

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Item #	Rationale	
41	Option D is correct	Like the mouse and swamp rabbit, both the sparrow and the Eastern cottontail rabbit are consumed by the bobcat and diamondback rattlesnake. Therefore, when the mouse and swamp rabbit populations decrease, the bobcat and diamondback rattlesnake will compete for these two organisms.
	Option A is incorrect	The raccoon is consumed by only the bobcat. Therefore, the diamondback rattlesnake and the bobcat would not be competing for this organism. The sparrow is consumed by both though.
	Option B is incorrect	The raccoon is consumed by only the bobcat. Therefore, the diamondback rattlesnake and the bobcat would not be competing for this organism. The Eastern cottontail rabbit is consumed by both though.
	Option C is incorrect	The bobcat and diamondback rattlesnake do not consume seeds and therefore would not compete for them. However, both organisms consume sparrows.

2022 STAAR Grade 8 Science Rationales

Item #	Rationale	
42	Option G is correct	Characteristics of a nonmetal include a dull luster, an inability to conduct electricity and/or heat, and a low melting point. Element 2 fits this description.
	Option F is incorrect	Element 1 does not fit the characteristics of a nonmetal because it is shiny and conducts heat and electricity.
	Option H is incorrect	Element 3 does not fit the characteristics of a nonmetal because it is shiny, conducts heat and electricity, and has a high melting point.
	Option J is incorrect	Element 4 does not fit the characteristics of a nonmetal because it conducts heat and electricity and has a high melting point.