

Missouri MAP Grade 8 Science Practice

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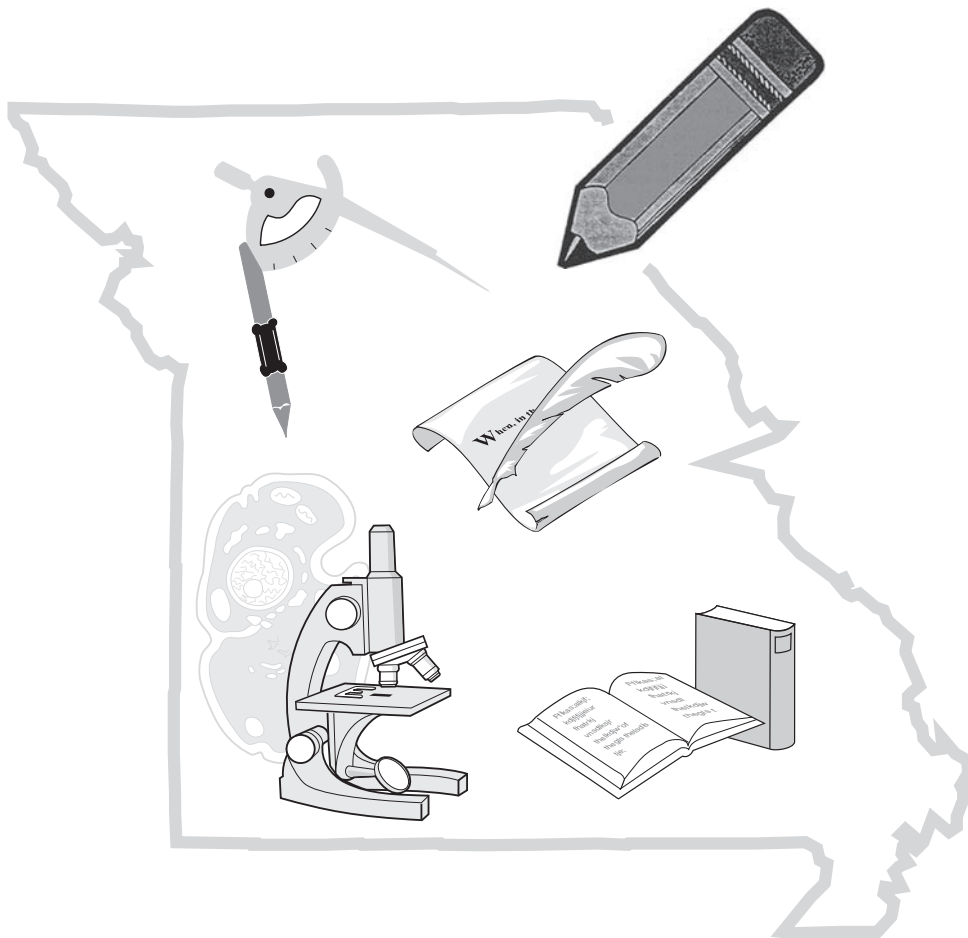
Rubric Materials
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Name: _____

District/School: _____

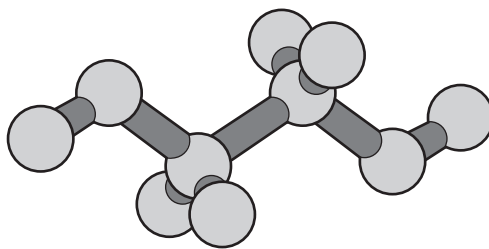
Missouri Assessment Program

Released Practice Form Grade 8 Science



1. A student creates a ball-and-stick model to represent the atomic scale of a substance.

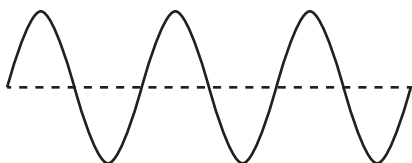
Student Model



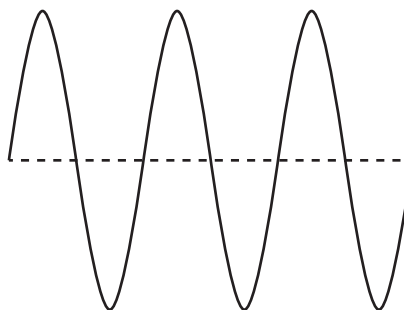
Which of these **best** describes the model?

- A. 1 molecule with 10 atoms
 - B. 1 element with 10 molecules
 - C. 10 molecules representing 10 elements
 - D. 10 elements representing 10 molecules
2. The drawings show two waves.

Wave 1



Wave 2



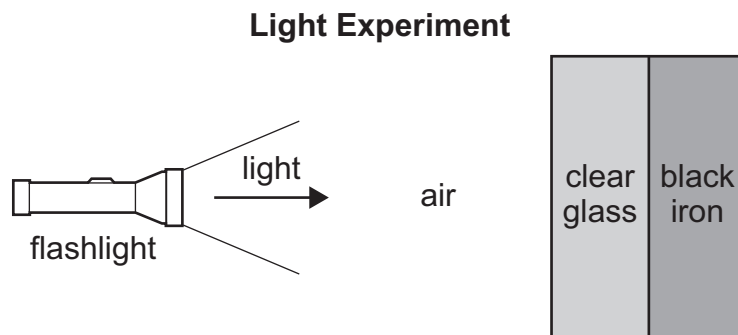
Which statement **best** compares these two waves?

- A. Wave 1 has a higher frequency because it has a longer wavelength than wave 2.
- B. Wave 1 has a higher frequency because it has a higher amplitude than wave 2.
- C. Wave 2 has more energy because it has a higher amplitude than wave 1.
- D. Wave 2 has more energy because it has a higher frequency than wave 1.

3. Circle a word in each set of options to **best** describe relationships between interacting parts of the human body.

The human body is composed of systems with interacting parts. Organ systems are made of (organs / organelles / tissues), which are composed of specialized cells that work together to form (organs / organelles / tissues). Each cell of the human body contains (organs / organelles / tissues) with a specific function.

4. During an experiment, a teacher uses a flashlight and shines the light toward a pane of clear glass with a black iron backing. A diagram of the experiment is shown.



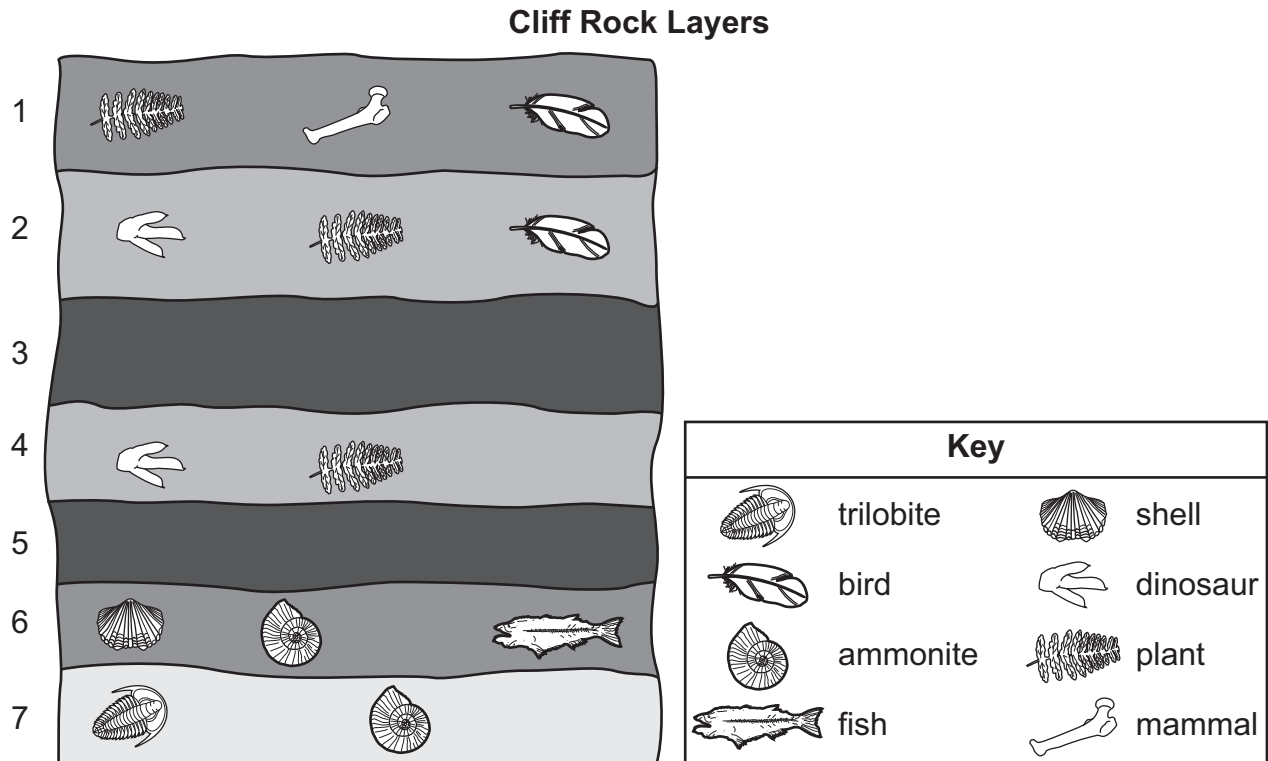
Part A: Describe the path of the light as it travels from the flashlight to the air.

Part B: Describe the path of the light as it travels from the air to the pane of clear glass.

4. **Continued.** Please refer to the previous page for task explanation.

Part C: Explain why the students would **not** see the light travel through the black iron backing.

5. A scientist hiking in a desert observes a cliff. The scientist makes a drawing of the layers of rock in the cliff and the types of fossils observed in the layers. Based on observations, the scientist determines layers 3 and 5 were formed from cooled lava. The scientist's drawing is shown.



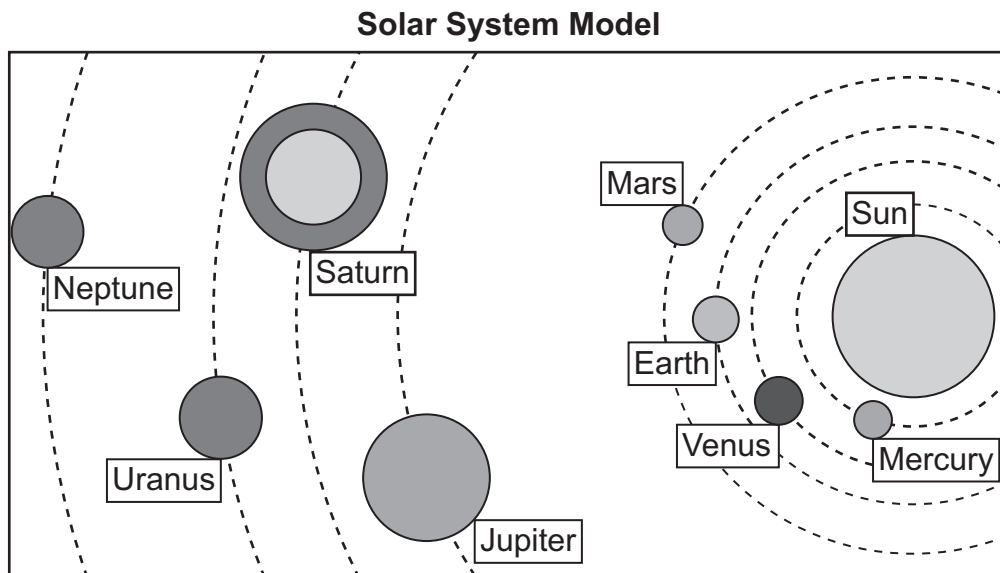
Part A: Identify the oldest layer in the rock cliff and explain your reasoning for the layer chosen.

5. **Continued.** Please refer to the previous page for task explanation.

Part B: Explain how the environment has changed over time at this location. Include evidence in your explanation.

Part C: A scientist claims that volcanic eruptions caused dinosaurs to become extinct at this location. Decide whether you agree or disagree with the scientist's claim and then explain your decision.

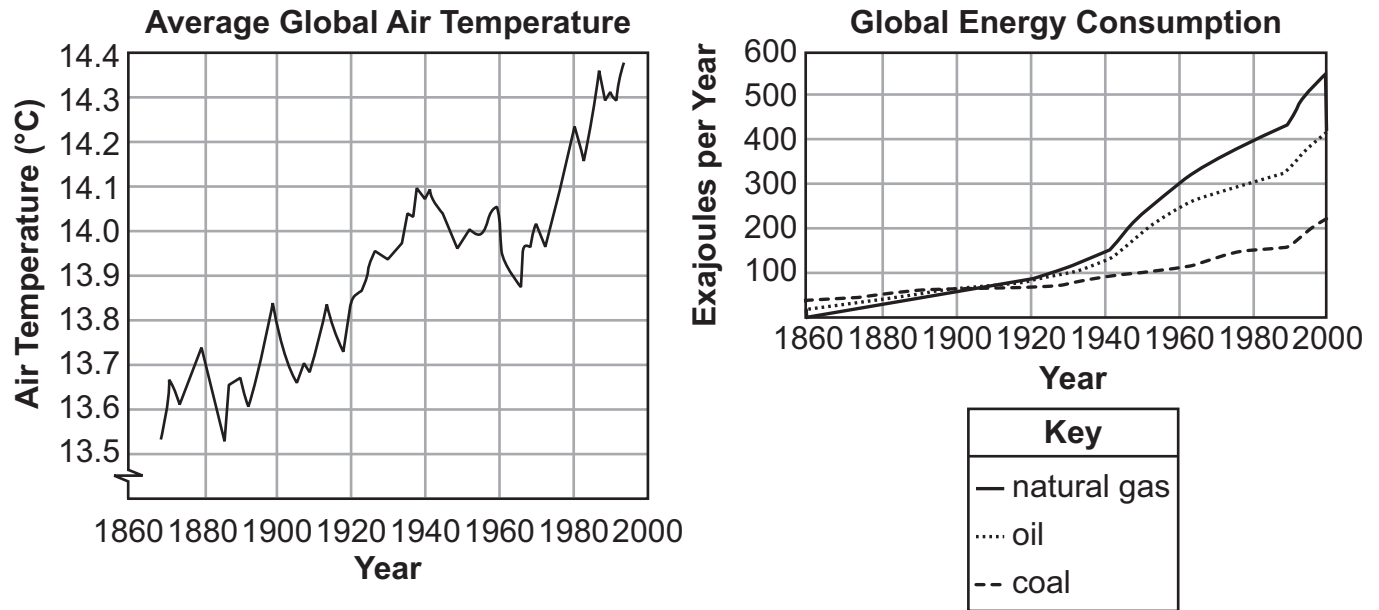
6. A student makes a model of the solar system on a poster board. The student uses foam balls to represent objects in the solar system. The student's model is shown.



Part A: Explain one error concerning the size of the foam balls in the model.

Part B: Explain one error concerning distances between foam balls in the model.

7. The graphs show the average global air temperatures and global fossil fuel consumption from about 1860 to 2000.



Part A: Describe the overall pattern of change in average global temperatures from 1860 to 2000.

Part B: A student claims the change in average global air temperatures is a result of burning fossil fuels. Explain whether the student's claim is plausible based on the data.

7. **Continued.** Please refer to the previous page for task explanation.

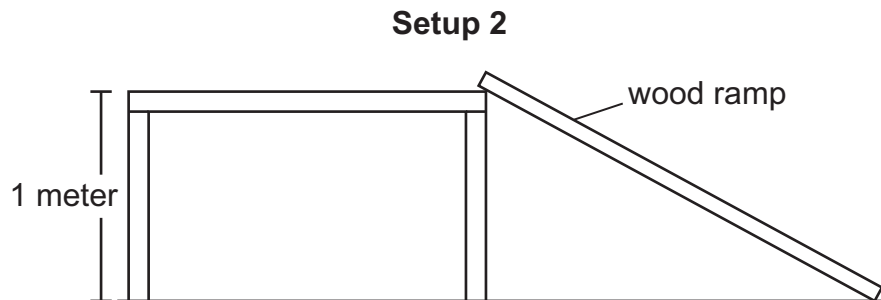
Part C: Describe two possible changes to the environment **most likely** caused by the pattern shown in the average global air temperatures.

Energy in Motion

Students want to design an investigation to learn about energy and motion. They start their investigation by making two setups.

For Setup 1 they attach three shelves at the following heights: 1 meter, 2 meters, and 3 meters. The students place a 1-kilogram ball at each shelf height. The students observe the ball stays at rest when set on each of the shelves.

For Setup 2 they build a ramp using wood and a table.


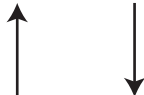


They roll the 1-kilogram ball from the top of the ramp and record the speed of the ball as it travels down the ramp.

Setup 2 Data

Time in Motion (seconds)	Ball Speed (meters per second)
0	0
1	2
2	4

8. One student is drawing a model to represent the investigation for Setup 1. Complete the student’s model using the following steps.
- Draw a ball on one of the three shelves where it will have the most potential energy.
 - Write the number of the type of force that causes the ball to have the most potential energy in the box.
 - Draw the arrow to show the direction of the force that causes the ball to have the most potential energy in the box.

Model Components	
Ball	
Type of Force	1. electrical 2. magnetic 3. gravitational
Direction of Force	

3-meter shelf

2-meter shelf

1-meter shelf

Type of Force

Direction of Force

9. Based on the data collected for Setup 2, a student made the following claim about the energy of the ball.

Student Claim

As the ball travels down the ramp the kinetic energy increases and the potential energy stays the same.

Which statement **best** evaluates the student’s claim?

- A. The claim is incorrect because the potential energy increases when the speed of the ball increases.
- B. The claim is incorrect because the potential energy of the ball is being transferred to kinetic energy as it travels down the ramp.
- C. The claim is correct because the speed of the ball increases, causing the ball to remain in motion as it travels beyond the ramp.
- D. The claim is correct because the speed of the ball is the same as its kinetic energy, and the speed of the ball increases as it travels down the ramp.

10. A student adds a material to the ramp that causes less friction between the ramp and the 1-kilogram ball. The student plans on rolling the ball from the top of the modified ramp.

Circle the word or phrase from each set of options to complete the statements that **best** predict the results from using the modified ramp.

Less friction acting on the ball will create (balanced / unbalanced) forces resulting in the speed of the ball to (increase / decrease / stay the same) as it travels down the ramp.

The ball traveling down the modified ramp with less friction will have (a slower speed than / a faster speed than / the same speed as) the ball traveling down the first ramp.

11. **This question has two parts.**

A student shapes a piece of clay into a small cube. The student places the clay cube at the bottom of the ramp in Setup 2. The student rolls the 1-kilogram ball down the ramp and observes the collision between the ball and the clay cube.

Part A: Select one variable the student could change to Setup 2 to reduce the force of the ball during the collision.

- A. Replace the wood ramp with a ramp made of smoother material.
- B. Reduce the height of the ramp from 1 meter to 0.5 meters.

Part B: Which statement provides the **best** support for the variable you selected in Part A?

- A. This would decrease the force of friction acting on the ball causing it to increase in speed.
- B. This would increase the force of friction acting on the ball causing it to decrease in speed.
- C. This would increase the potential energy of the ball resulting in an increase in kinetic energy.
- D. This would decrease the potential energy of the ball resulting in a decrease in kinetic energy.

12. The student switches the ball used in Setup 1 with a ball that has a mass of 2 kilograms. Another student states that the potential energy of the 2-kilogram ball would be the same as the potential energy of the 1-kilogram ball since they would be placed at the same heights.

Which statement **best** explains whether the student's statement is correct or incorrect?

- A. The statement is correct because the gravitational force acting on objects with different masses is the same.
 - B. The statement is incorrect because an object with more mass has less potential energy due to increased air resistance.
 - C. The statement is incorrect because more force is needed to lift an object with more mass to the same height as an object with less mass.
 - D. The statement is correct because the potential energy of any object with mass is based on an object's height above the ground and the speed at which it travels.
13. A student rolls a 3-kilogram ball down the same ramp used in Setup 2. The speed of the ball after 2 seconds was 4 meters per second. The student concludes that the kinetic energy of the 3-kilogram ball is identical to the 1-kilogram ball after it has rolled down the ramp for 2 seconds.

Explain whether the student's conclusion is correct or incorrect. Use evidence from the investigation to support your answer.

The Unexpected Effects of Wolves in Yellowstone National Park

In the 1920s, wolves were officially removed from Yellowstone National Park. Wolves are predators that occasionally prey on domesticated animals, and people were afraid that they might also harm humans. They used hunting and other methods to remove all of the wolves from Yellowstone.

By the 1990s, the Yellowstone ecosystem had significantly changed. One major difference was the reduction of aspen, cottonwood, and willow trees growing along streams. Yellowstone was experiencing a drought, and without any wolves to prey on elk, the elk population was at its highest level. Elk eat young trees and shrubs, especially in winter when the snow covers up shorter plants. During this period, nearly all of the young trees were eaten by elk before they could grow to maturity. This loss affected many animals, including the birds that nest in trees, the bison that compete with elk for the young trees, and the beavers that use the trees as a source of food and shelter.

In 1995 and 1996, a total of 21 wolves were released into Yellowstone. Since then, scientists have been recording observations in the Yellowstone ecosystem. For example, they observed wolves often eating only about half of a prey animal and the rest of the animal was then eaten by scavengers. Scientists also observed more young trees and shrubs growing to maturity. The return of the trees has seemed to slow the water flow in streams and it provides beavers material to build dams and shelters. Beaver dams are barriers across moving water. The dams slow the streams even further and trap sediments in areas where new willow trees can grow.

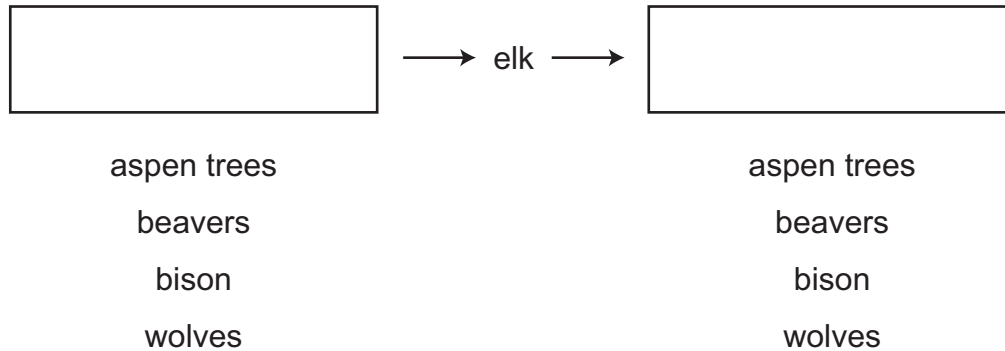
Estimated Population Changes after Wolves are Released into Yellowstone

Year	Wolves (Number of Individuals)	Elk (Number of Individuals)	Bison (Number of Individuals)	Beavers (Number of Colonies)
1995	14	16,000	800	2
2000	119	15,000	500	3
2005	118	7,000	1,500	10
2010	97	5,000	1,700	12

The overall effect of the wolves seems to be helping to restore a balance in the Yellowstone ecosystem. Although much work still needs to be done.

14. This question has two parts.

Part A: Circle an organism from each set of options to complete the model of the food chain that occurs in the Yellowstone ecosystem.



Part B: Circle the phrase in the set of options to **best** describe the model in Part A.

This food chain model shows the (flow of energy / cycling of matter) in the ecosystem.

15. The table shows the change in the size of willow tree stems in sample areas of the Yellowstone ecosystem between 1995 and 2010.

Year	Average Willow Tree Stem Diameter (cm)
1995	8
2000	18
2005	25
2010	32

Which conclusion about the number of beaver colonies between 2000 and 2010 is **best** supported by the data?

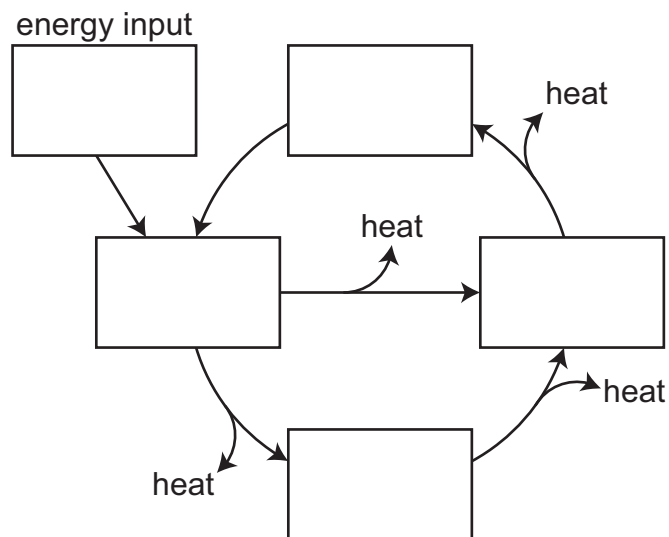
- A. The number of beaver colonies decreased because the amount of available food for beavers decreased.
- B. The number of beaver colonies increased because the beavers adapted to a change in the food sources available.
- C. The number of beaver colonies increased because the amount of available resources for food and shelter increased.
- D. The number of beaver colonies decreased because the beavers were unable to use the resources for food and to build shelters.

16. Grizzly bears, black bears, eagles, and ravens are scavengers in the Yellowstone ecosystem. Based on the information, which statement explains how the reintroduction of wolves has **most likely** affected the populations of scavengers?
- A. Scavenger populations likely decreased because wolves prey on scavengers.
 - B. Scavenger populations likely decreased because wolves and scavengers compete for the same resources.
 - C. Scavenger populations likely increased because wolves provide a food source for scavengers.
 - D. Scavenger populations likely increased because wolves provide habitat for scavengers when the wolves create and abandon their dens.
17. Which statement **best** explains how the reduction in the elk population might have affected the bison population?
- A. Fewer elk led to fewer bison being preyed on by wolves.
 - B. Fewer elk consumed young trees, increasing the food available for bison.
 - C. Fewer elk led to an increase in competition for resources between elk and bison.
 - D. Fewer elk consumed young trees, decreasing the variety of food sources available for both species.
18. How can beaver activity change conditions in the Yellowstone ecosystem to result in an increase in the beaver population?
- A. by building dams that continue to slow the water and encourage willow trees to grow
 - B. by building dams that reduce the height of the water so that more willow trees can grow
 - C. by helping willow trees grow taller so that they become more useful for beavers when they build dams
 - D. by helping to move soil from streambanks so that more willow trees will fall into the water and create natural log dams

19. Identify where the components should be placed in the model to show the relationships between living and nonliving components of the Yellowstone ecosystem.

Write the number of each component in one of the boxes in the model.

Simplified Model of Energy Flow and Cycling of Matter



- ① Consumers: elk, bison, wolves
- ② decomposers
- ③ the sun
- ④ Producers: aspen and willow trees
- ⑤ nutrients, minerals, and gases

20. Less snow falls during a warmer-than-normal winter in the Yellowstone ecosystem. The thinner snow cover on the ground allows for more plants to be visible than when the snow cover is thick.

Part A: Describe how a winter with less snowfall might affect the populations of willow, aspen, and cottonwood trees.

Part B: Describe how a winter with less snowfall might affect the population of elk.

Part C: Some scientists predict that, over time, the average thickness of the snow cover in the Yellowstone ecosystem will decrease as global air temperatures increase. Predict a long-term effect of the reduced snow cover in the Yellowstone ecosystem on the beaver population. Be sure to support your prediction using evidence.

21. Scientists in a different area with an ecosystem similar to that of Yellowstone are considering different solutions for protecting trees in hopes of restoring the ecosystem to its previous levels of biodiversity. One scientist recommends placing fences that are two meters in height around areas of existing trees rather than introducing wolves to the ecosystem.

Complete the chart by selecting **one** likely advantage and **one** likely disadvantage of using fences to protect the trees.

	Advantage to the Solution	Disadvantage to the Solution
young trees would be able to grow to maturity		
birds would have limited access to trees for building nests		
the elk population would increase as the adult tree population would increase		
beavers would be unable to access the trees for food and to build their shelters		

1. A student is comparing characteristics of three toy cars.

Characteristics of Three Toy Cars

Toy Car	Speed (meters/second)	Mass (kilograms)	Kinetic Energy (Joules)
1	2	1	2
2	2	2	4
3	2	4	8

Circle a word or phrase from each set of options to complete the following sentence based on the data provided in the table.

As the (speed / mass) increases, the kinetic energy of the car (increases / decreases / stays the same).

2. Students are given two solid substances and two liquid substances to mix together in different combinations. The data table shows the initial observations and final observations for each combination of substances.

Combination	Initial Observations When Mixed Together	Final Observations
Solid A and Liquid A	bubbles immediately form but quickly disappear	no solid visible
Solid A and Liquid B	solid falls to bottom of liquid and slowly dissolves	small amount of solid still visible at bottom of liquid
Solid B and Liquid A	bubbles immediately form and continue forming for 15 seconds	small amount of solid still visible at bottom of liquid
Liquid A and Liquid B	temperature of solution decreases by 14°C	no visible color change

Complete the chart to identify whether a chemical reaction or a physical change occurred when the substances were combined.

	Chemical Reaction	Physical Change
Solid A and Liquid A		
Solid A and Liquid B		
Solid B and Liquid A		
Liquid A and Liquid B		

3. The chart shows some distances between objects in the universe.

Universe Information

Objects in the Universe	Approximate Distance between Objects
Earth and the moon	382,500 kilometers
Earth and the sun	149.6 million kilometers
Neptune and the sun	4,495.1 million kilometers
Earth and the star Proxima Centauri	40,208,000 million kilometers

Identify where each measurement should be placed in the model to compare distances in the universe. Write the number from each measurement in one of the boxes in the model.

Comparing Distances in the Universe

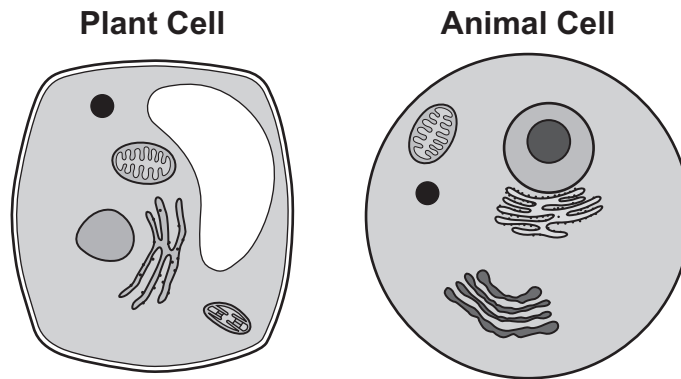
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Longest Distance

Shortest Distance

- ① Distance from Earth to the sun
- ② Distance from Earth to the moon
- ③ Distance across our solar system
- ④ Distance across the Milky Way galaxy

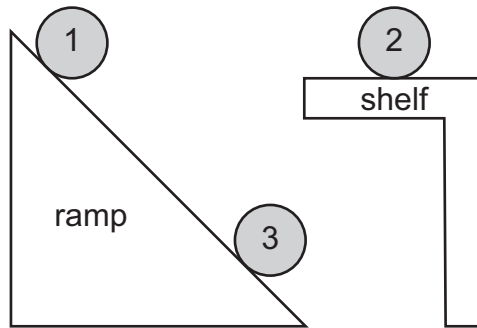
4. The diagrams show a plant cell and an animal cell.



Part A: Identify two organelles that are present in plant cells that are absent from animal cells.

Part B: Explain why one of the organelles identified in Part A is **not** necessary for animal cells to survive.

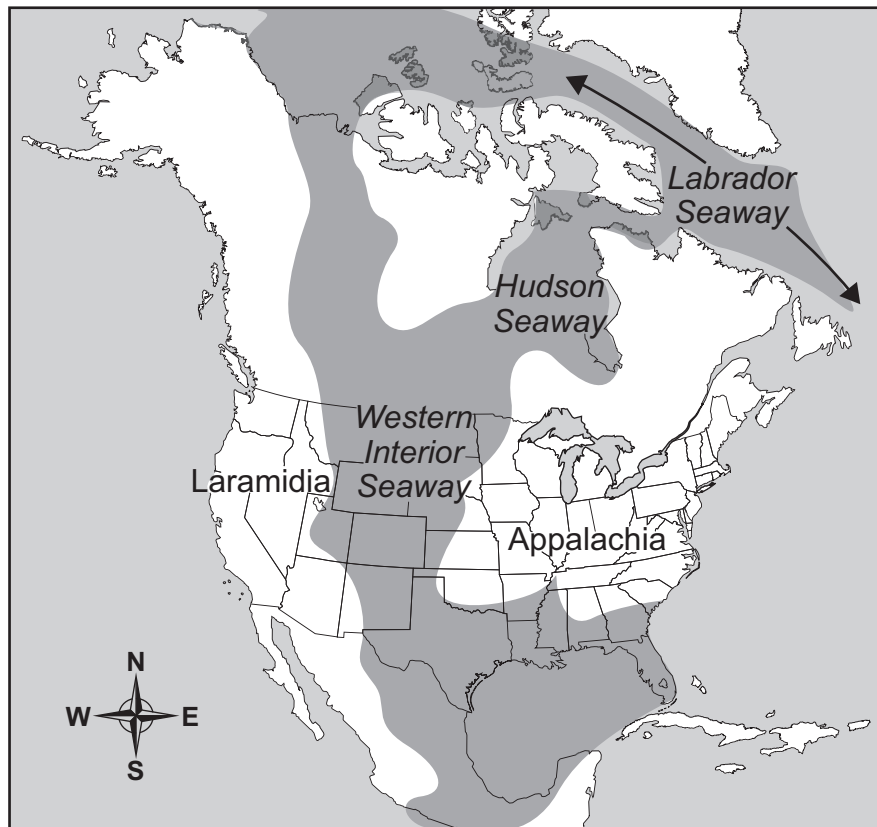
5. A student draws a diagram to model the potential energy of objects. The diagram includes three rubber spheres of equal mass, one ramp, and one shelf.



Part A: Identify two spheres that have the same potential energy. Explain how this can be determined from the diagram.

Part B: Identify two spheres that have unequal potential energy. Identify the sphere which has more potential energy.

6. The map shows how North America looked approximately 100 million years ago. There are five main areas labeled on the map.

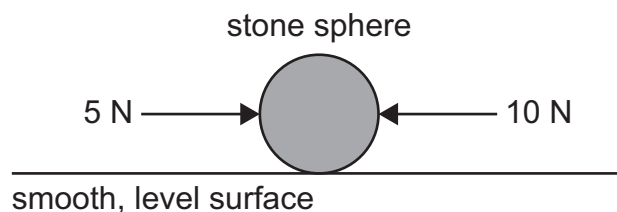


Part A: Identify the main areas of North America on the map where people would expect to find 100-million-year-old sedimentary rocks that contain fossils of microscopic ocean organisms.

6. **Continued.** Please refer to the previous page for task explanation.

Part B: Oil and gas are formed from the remains of microscopic ocean organisms. A student claims that the oil and gas deposits in Missouri are about 100 million years old. Based on the map, decide whether you agree or disagree with the student's claim and then explain your decision.

7. The diagram shows the forces applied to a stone sphere on a smooth surface.



Part A: Describe the motion of the stone sphere based on the forces shown in the diagram.

Part B: The same sphere is placed on a rough surface, and the same horizontal forces are acting on the sphere. Describe how the motion of the sphere will **most likely** change when the stone sphere is placed on the rougher surface.

Changes in Organisms over Time

Using fossil evidence, scientists can learn how organisms have changed over long periods of time. The chart shows information about how traits of ancestors of the modern horse have changed.

Characteristics of Four Horse Species

Horse Species	Estimated Time When Present	Characteristics
<i>Hyracotherium</i>	55 million years ago	Small, fox-sized animal with a short face and low-crowned teeth
<i>Orohippus</i>	45–52 million years ago	Similar in size to <i>Hyracotherium</i> but with a slimmer body, slimmer legs, and a longer head
<i>Mesohippus</i>	32–37 million years ago	Taller and longer than <i>Orohippus</i> ; eyes rounder and set wider apart and farther back than those of <i>Hyracotherium</i>
<i>Miohippus</i>	25–32 million years ago	Larger than <i>Mesohippus</i> , with a longer head and extra material on its upper molars, which allowed it to chew tougher plants

People such as farmers and scientists can affect the traits of organisms, including horses, cattle, and corn. Fossil evidence supports the idea that modern corn, also known as maize, is a descendent of teosinte plants. Over time, people chose to plant teosinte seeds from the larger and more productive plants. The size and number of kernels produced in each generation increased and, over thousands of years of breeding, resulted in modern corn plants.



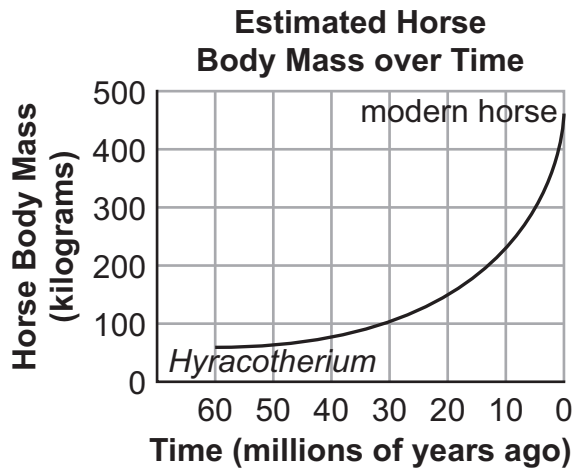
corn



teosinte

Modern cattle are often bred for traits such as high milk production, muscle growth, and small or no horns. Aurochs are one of the earlier cattle species and are ancestors of many modern cattle species. Aurochs were large cattle with long horns, fed on grasses and other plants, and lived in grassland habitats of Europe and Asia. The large horns helped the aurochs protect themselves and their offspring from predators. Most modern cattle have more traits that are desired by people rather than traits that would help them survive in the wild.

8. Use the graph to answer the question.



Select **two** statements that would **best** explain the change in horses' body mass over millions of years.

- A. There was increased food availability.
- B. There was decreased food availability.
- C. Horses with larger body masses were less likely to survive and reproduce.
- D. Horses with larger body masses were more likely to survive and reproduce.
- E. Large body mass occurred in individuals as they became adults.

9. A scientist finds a site that contains fossils of *Orohippus*, *Mesohippus*, and *Miohippus*.

Identify the species of horse fossils that would be found in the uppermost layer of rock and in the bottommost layer of rock. Use data from the chart to explain your answer.

Species of fossil found in uppermost layer of rock:

Species of fossil found in bottommost layer of rock:

10. During the period when aurochs existed on Earth, they were preyed on by large predators. Some individual aurochs had stronger muscles than others. Using an understanding of natural selection, which statement explains why there would **most likely** be an increase in the stronger-muscle trait in a population of aurochs?
- A. Individuals with stronger muscles have a large body mass, and they would be preyed on more than other aurochs.
 - B. Since having stronger muscles is an inherited trait, it would be passed on to every individual in the population that was not preyed on.
 - C. Individuals with stronger muscles would be more likely to run away from predators, and this trait would be passed on to their future offspring.
 - D. Since having stronger muscles would require individuals to consume more food, they would be more exposed to predators than the other aurochs.
11. There have been studies of a population of cattle that had once been raised by people and then released into the wild. Over hundreds of years of the cattle being in the wild, the average length of their horns increased. Currently an adult male's horn can be over 165 centimeters in length.

Circle a word or phrase in each set of options to complete the explanation of why the length of horns of these cattle **most likely** increased while they were living in the wild.

The population of cattle likely had (no / some) genetic variation causing



(all cattle to have long horns / some of the cattle to have longer horns than others).

Long horns are a (beneficial / harmful) trait. Cattle with longer horns are (less / better) able to survive and reproduce.

12. This question has two parts.

Some birds will eat corn seeds and teosinte seeds. The chart shows the characteristics of these two types of seeds.

Characteristics of Corn and Teosinte Seeds

Corn Seeds	Teosinte Seeds
	
<ul style="list-style-type: none">• usually yellow in color• seeds are exposed because they are not covered by a casing• seeds remain on the plant's cob after they mature	<ul style="list-style-type: none">• dark brown in color• tough, hard seed casing surrounds each seed• seeds easily release from the stalk of the plant after they mature

Part A: Corn and teosinte plants are grown in the same area. Which type of plant would likely be more successful at producing offspring that would develop into new plants?

- A. corn
- B. teosinte

Part B: Select **two** reasons to support your answer in Part A.

- A. The seeds are large.
- B. The seeds have a protective structure.
- C. The seeds are more easily consumed by birds.
- D. The seeds that fall to the ground are difficult for birds to see.
- E. The seeds remain on the plant rather than falling to the ground.

13. Scientists have developed new techniques for producing organisms with desirable traits. Genetic modification allows scientists to insert genetic material from one organism into another organism. For example, one type of genetically modified corn contains genetic material from a species of bacterium. The genetically modified corn plants produce a specific substance that causes pests to die when they feed on these corn plants.

Which statement **best** describes how genetic modification technology differs from the technique used with teosinte plants thousands of years ago?

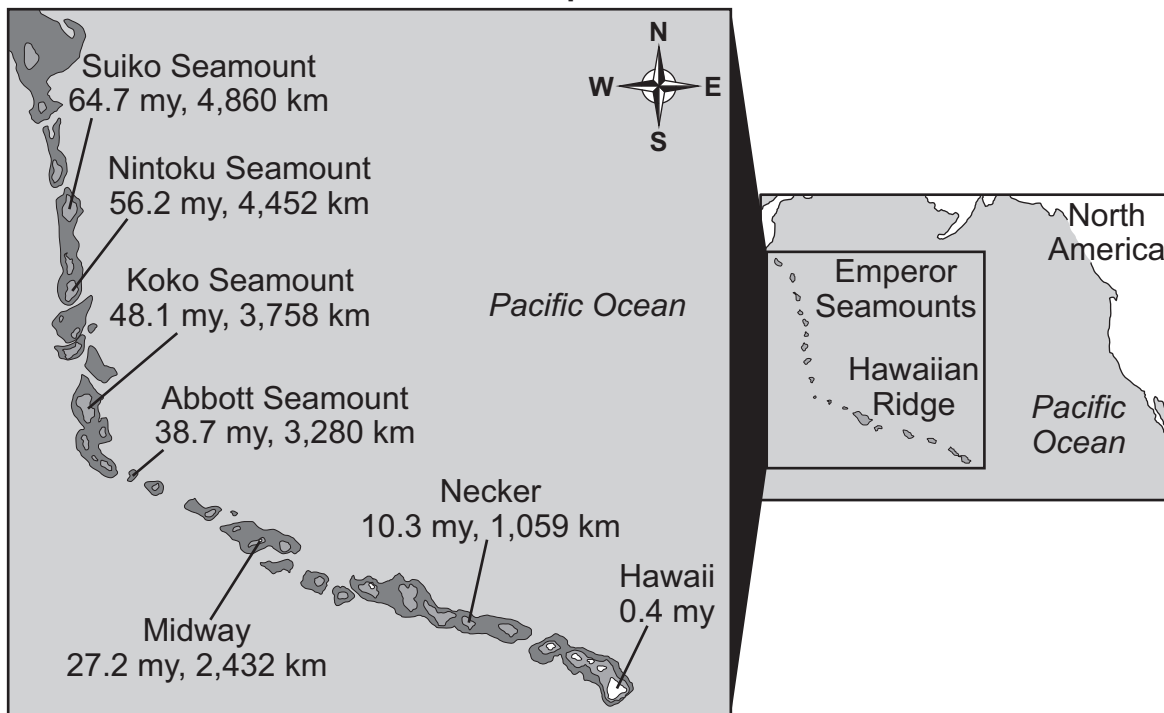
- A. Genetic modification technology is available to more people.
- B. Genetic modification technology requires a longer time to create a change in a species.
- C. Genetic modification technology introduces completely new traits into an unrelated organism.
- D. Genetic modification technology influences which traits are passed from parents to offspring.

The Hawaiian–Emperor Seamount Chain

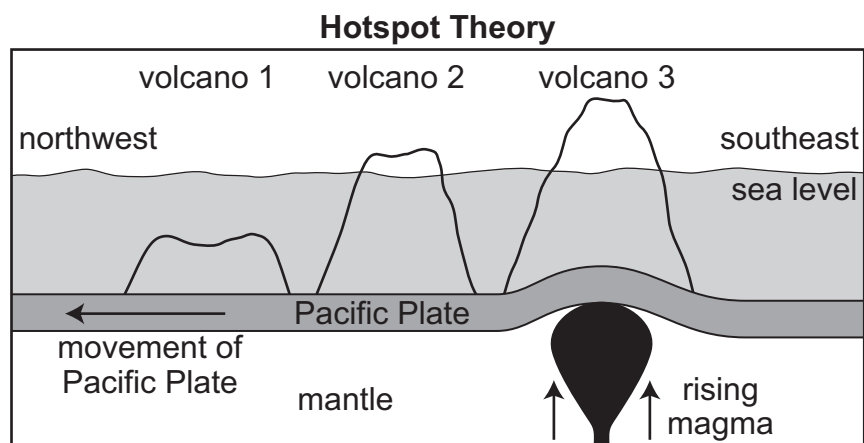
The Hawaiian–Emperor Seamount Chain is a mountain range in the Pacific Ocean. All mountains in the Hawaiian–Emperor Seamount Chain were formed from volcanic activity. Most of the mountains are classified as seamounts. The difference between an island and a seamount is that an island rises above sea level and a seamount does not.

Scientists determined the ages of the rocks that form the mountains of the Hawaiian–Emperor Seamount Chain. The map shows for each seamount or island its location, its age in millions of years (my), and its distance from the island of Hawaii.

The Hawaiian–Emperor Seamount Chain



The island of Hawaii is the only island in the Hawaiian–Emperor Seamount Chain currently experiencing volcanic activity. Scientists have proposed a theory that states that the mountains of the Hawaiian–Emperor Seamount Chain form at a hotspot where magma rises from Earth's mantle. As the Pacific Plate moves, new volcanic mountains form over the hotspot. The diagram shows the hotspot theory.



14. Based on the hotspot theory diagram, circle a word or phrase in each set of options to complete the statement.

Energy from (the sun / Earth's interior) causes (ocean currents / convection in the mantle)
and the movement of the (hotspot / Pacific Plate).

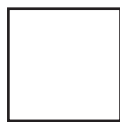
15. The mountains in the Hawaiian–Emperor Seamount Chain are experiencing both constructive Earth processes that build land and destructive Earth processes that break down land.

Identify whether each of the sentences below describes a constructive or a destructive Earth process. Write the number of each sentence in one of the two categories.

Constructive Earth Processes	Destructive Earth Processes

- ① Lava crystallizes into volcanic rock.
- ② Volcanic rock is weathered and eroded.
- ③ Magma moves from Earth's mantle to the crust.
- ④ A seamount transforms into an island.
- ⑤ Erosion transforms an island into a seamount.

16. Select **three** statements that provide evidence to support that the hotspot theory could explain the formation of the Hawaiian–Emperor Seamount Chain.
- A. Older islands are farther from the hotspot than younger islands.
 - B. Younger islands are farther from the hotspot than older islands.
 - C. The oldest mountains in the Hawaiian–Emperor Seamount Chain are islands.
 - D. The oldest mountains in the Hawaiian–Emperor Seamount Chain are seamounts.
 - E. The age of the mountains increases as the distance between the mountains and Hawaii increases.
 - F. The age of the mountains increases as the distance between the mountains and Hawaii decreases.
17. Write the number of each event in the model to show the correct sequence of events in the development of Koko Seamount.



48 Million Years Ago

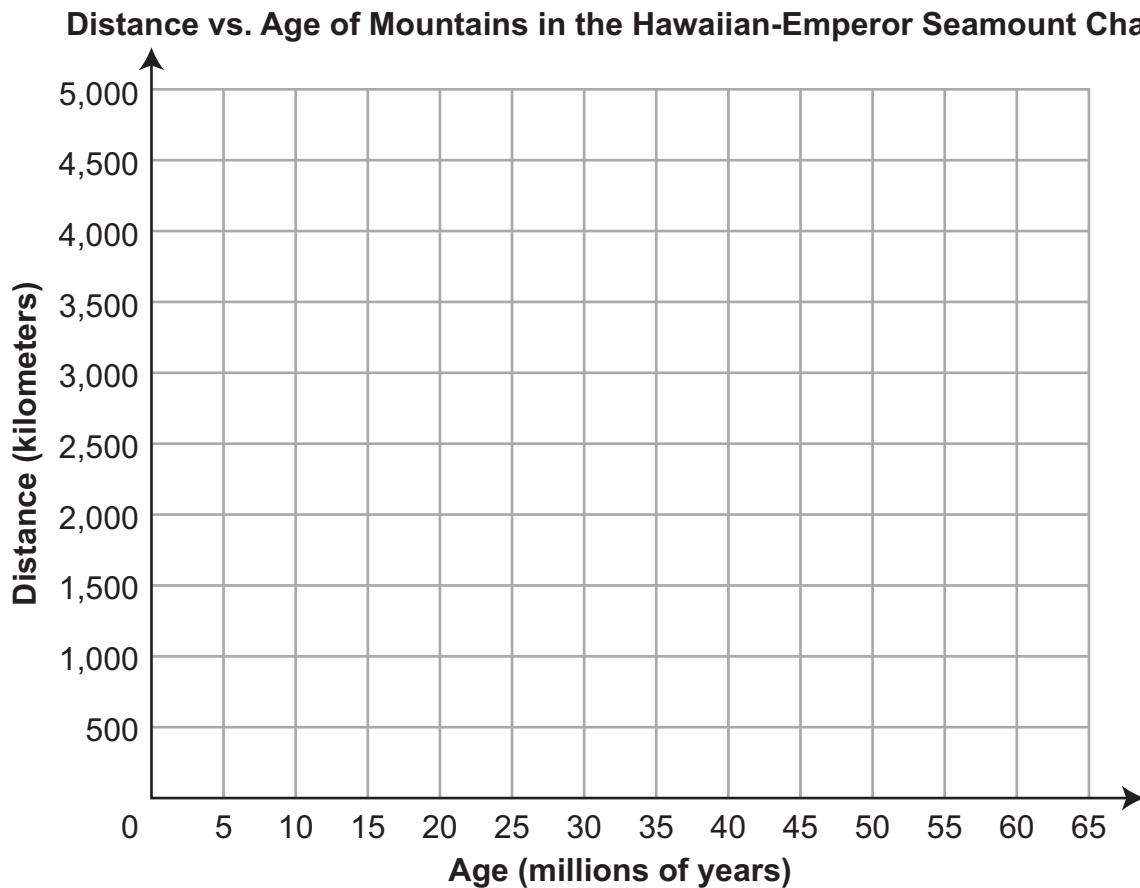


Today

- ① The Pacific Plate moves Koko off the hotspot.
- ② Erosion transforms the volcanic island into a seamount.
- ③ Magma erupts to Earth's surface above the hotspot.
- ④ Lava cools into volcanic rock and collects to form an island.

18. This question has two parts.

Part A: Using the information from the map, make a graph to compare the approximate distance from Hawaii and approximate age of the mountains in the Hawaiian–Emperor Seamount Chain. In your graph, be sure to include data from the seven mountains.

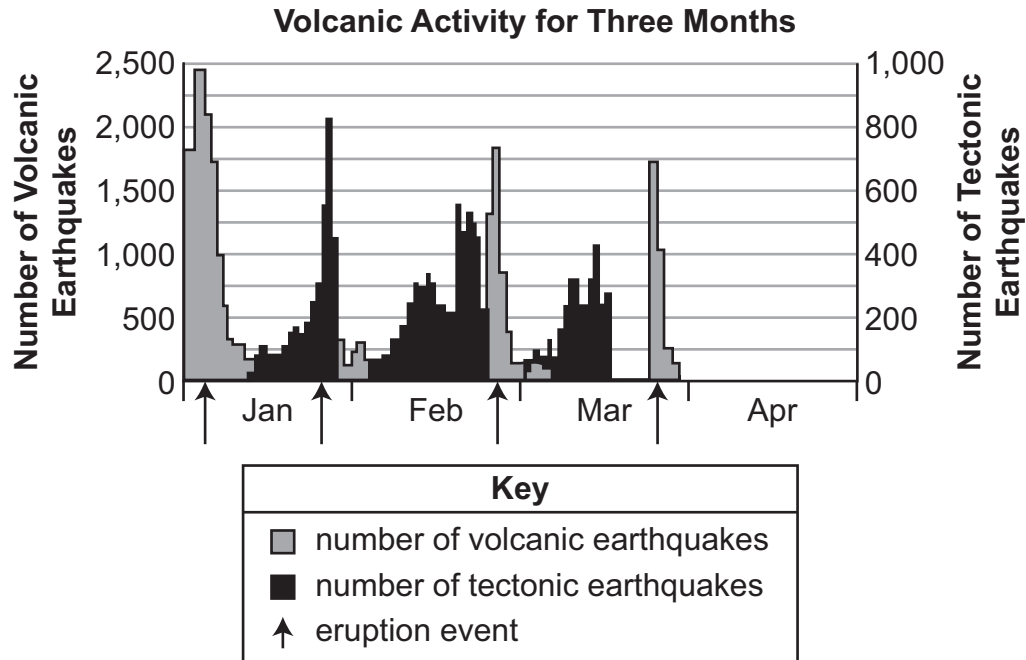


Part B: Circle a word or phrase in each set of options to make a conclusion based on the data in the graph.

As the Pacific Plate moves (northwest / southeast), the age of each mountain (increases / decreases / stays the same) as the distance from the hotspot (increases / decreases / stays the same).

19. The Pacific Plate has not always moved in the direction that it is moving today. Based on the information from the map, which statement explains when the Pacific Plate **most likely** changed direction?
- A. The direction changed about 25 million years ago because the mountains changed from islands to seamounts.
 - B. The direction changed about 35 million years ago because there are fewer mountains in the chain before that age.
 - C. The direction changed about 40 million years ago because the pattern in the location of mountains changed.
 - D. The direction changed about 65 million years ago because Suiko Seamount is the oldest mountain.
20. Which statement **best** explains how erosion transforms an island into a seamount?
- A. Energy from the sun causes sediments to be deposited on the island and compacted into sedimentary rock.
 - B. Energy from the sun causes the movement of wind and water, which transports sediments from the island to the ocean.
 - C. Energy from Earth's interior causes sediments to be deposited on the island and compacted into sedimentary rock.
 - D. Energy from Earth's interior causes the movement of wind and water, which transports sediments from the island to the ocean.

21. One of the volcanoes on the island of Hawaii is experiencing volcanic activity. A team of researchers at a volcanic monitoring site recorded two types of earthquakes for three months.



Part A: Describe a recommendation the researchers should make to people in the area about the risk for eruption events in April after the most recent activity in March.

Part B: Based on the data, describe a difference in the warning time given to people preceding volcanic events compared to the warning time preceding a tornado. Explain how the warning time can have a positive effect on mitigating the hazards of a volcanic eruption.

ITEM TYPES

CR – Constructed Response

EBSR – Evidence-Based Selected Response

MC – Multiple Choice

MS – Multi-Select Response

SA – Short Answer

TE – Technology Enhanced

WP – Writing Prompt

Session	Item	Type	MLS Code	Answer	Point(s)	Point Breakdown
1	1	MC	6-8.PS.1.A.1	A	1	
1	2	MC	6-8.PS.4.A.1	C	1	
1	3	TE (Online) MS (Paper)	6-8.LS.1.A.3	organs, tissues, organelles	1	
1	4	CR	6-8.PS.4.A.2		3	Please see the Grade 8 Science Scoring Rubric Guide – Page 2
1	5	CR	6-8.ESS.1.C.1		3	Please see the Grade 8 Science Scoring Rubric Guide – Page 3
1	6	CR	6-8.ESS.1.B.1		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 4
1	7	CR	6-8.ESS.3.D.1		4	Please see the Grade 8 Science Scoring Rubric Guide – Page 5
1	8	TE (Online) CR (Paper)	6-8.PS.3.A.2	Shelf Draw ball on 3-meter shelf Type of Force 3 Direction of Force Down Arrow	2	<ul style="list-style-type: none"> • 2 points for all correct • 1 point for 2 correct • 0 points for 1-0 correct
1	9	MC	6-8.PS.3.A.2	B	1	
1	10	TE (Online) MS (Paper)	6-8.PS.2.A.2	unbalanced, increase, a faster speed	1	
1	11	TE (Online) MC (Paper)	6-8.PS.2.A.1	Part A B Part B D	2	Part A <ul style="list-style-type: none"> • 1 point for correct answer Part B <ul style="list-style-type: none"> • 1 point for correct answer only if Part A is correct
1	12	MC	6-8.PS.3.A.2	C	1	
1	13	CR	6-8.PS.3.A.1		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 6
1	14	TE (Online) MS (Paper)	6-8.LS.2.B.1	Part A aspen trees, wolves Part B flow of energy	2	Part A <ul style="list-style-type: none"> • 1 point for all correct Part B <ul style="list-style-type: none"> • 1 point for correct
1	15	MC	6-8.LS.2.C.1	C	1	
1	16	MC	6-8.LS.2.A.2	C	1	
1	17	MC	6-8.LS.2.A.1	B	1	
1	18	MC	6-8.LS.2.A.2	A	1	

ITEM TYPES

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Session	Item	Type	MLS Code	Answer	Point(s)	Point Breakdown
1	19	TE (Online) CR (Paper)	6-8.LS.2.B.1	energy input 3 Counterclockwise from top 5, 4, 1, 2	2	<ul style="list-style-type: none"> 2 points for all correct 1 point for 4 correct 0 points for 3-0 correct
1	20	CR	6-8.LS.2.C.1		3	Please see the Grade 8 Science Scoring Rubric Guide – Page 7
1	21	TE (Online) MS (Paper)	6-8.LS.2.C.2	Advantage to the Solution young trees would be able to grow to maturity Disadvantage to the Solution beavers would be unable to access the trees for food and to build their shelters	2	Advantage to the Solution <ul style="list-style-type: none"> 1 point for correct answer Disadvantage to the Solution <ul style="list-style-type: none"> 1 point for correct answer
2	1	TE (Online) MS (Paper)	6-8.PS.3.A.1	mass, increases	1	
2	2	TE (Online) MS (Paper)	6-8.PS.1.A.2	Chemical Reaction Solid A and Liquid A, Solid B and Liquid A, Liquid A and Liquid B Physical Change Solid A and Liquid B	2	<ul style="list-style-type: none"> 2 points for all 4 correct 1 point for 3 correct 0 points for 2-0 correct
2	3	TE (Online) CR (Paper)	6-8.ESS.1.B.1	From Left to Right 4, 3, 1, 2	2	<ul style="list-style-type: none"> 2 points for all correct 1 point for 3 correct 0 points for 2-0 correct
2	4	CR	6-8.LS.1.A.2		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 8
2	5	CR	6-8.PS.3.A.2		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 9
2	6	CR	6-8.ESS.3.A.1		3	Please see the Grade 8 Science Scoring Rubric Guide – Page 10
2	7	CR	6-8.PS.2.A.2		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 11
2	8	MS	6-8.LS.4.C.1	A, D	1	
2	9	CR	6-8.LS.4.A.1		2	Please see the Grade 8 Science Scoring Rubric Guide – Page 12
2	10	MC	6-8.LS.4.B.1	C	1	

ITEM TYPES

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Session	Item	Type	MLS Code	Answer	Point(s)	Point Breakdown
2	11	TE (Online) MS (Paper)	6-8.LS.4.B.1	some, some of the cattle to have longer horns than others, beneficial, better	2	<ul style="list-style-type: none"> • 2 points for all 4 correct • 1 point for 3 correct • 0 points for 2-0 correct
2	12	TE (Online) MS (Paper)	6-8.LS.1.B.1	<p>Part A B</p> <p>Part B B, D</p>	2	<p>Part A</p> <ul style="list-style-type: none"> • 1 point for correct answer <p>Part B</p> <ul style="list-style-type: none"> • 1 point for all correct answers only if Part A is correct • 0 points for 1-0 correct answers
2	13	MC	6-8.LS.4.B.2	C	1	
2	14	TE (Online) MS (Paper)	6-8.ESS.2.A.1	Earth's Interior, convection in the mantle, Pacific Plate	1	
2	15	TE (Online) CR (Paper)	6-8.ESS.2.A.1	<p>Constructive Earth Processes 1, 3, 4</p> <p>Destructive Earth Processes 2, 5</p>	2	<ul style="list-style-type: none"> • 2 points for all 5 correct • 1 point for 4 correct • 0 points for 3-0 correct
2	16	MS	6-8.ESS.2.B.1	A, D, E	2	<ul style="list-style-type: none"> • 2 points for all 3 • 1 point for 2 correct • 0 points for 1-0 correct
2	17	TE (Online) SA (Paper)	6-8.ESS.2.A.1	From left to right 3, 4, 1, 2	2	<ul style="list-style-type: none"> • 2 points for all 4 correct • 1 point for 3 correct • 0 points for 2-0 correct
2	18	TE (Online) CR (Paper)	6-8.ESS.2.B.1	<p>Part A Please see the Grade 8 Science Scoring Rubric Guide – Page 13</p> <p>Part B northwest, increases, increases</p>	4	Please see the Grade 8 Science Scoring Rubric Guide – Page 13
2	19	MC	6-8.ESS.2.A.2	C	1	
2	20	MC	6-8.ESS.2.A.2	B	1	
2	21	CR	6-8.ESS.3.B.1		3	Please see the Grade 8 Science Scoring Rubric Guide – Page 14

Missouri Science Scoring Rubric

Item ID: 904194

Session: 1 Item: 4

Grade: 8

Scoring Guide: 6-8.PS4.A.2

Score	Description
3	<p>This response demonstrates a thorough understanding of developing and using a model to describe that waves are reflected, absorbed, or transmitted through various materials by</p> <ul style="list-style-type: none">• describing the path of light as it travels from the flashlight to the air;• describing the path of light as it travels from the air to the pane of clear glass; and• explaining why the student would not see the light travel through the black iron backing. <p><i>*The response is clear, complete, and correct.</i></p>
2	<p>This response demonstrates a thorough understanding of two of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- The light will travel in a straight line through the air.

Part B (1 point)

- The light will bend (or be refracted) when traveling into the glass.

Part C (1 point)

- The light will stop at the black iron backing.
- The light will be absorbed by the black iron backing.
 - (Note: Some reflection may occur due to luster of iron metal)

Missouri Science Scoring Rubric

Session: 1 Item: 5

Grade: 8

MLS Expectation: 6-8.ESS1.C.1

Item ID: 903810

Score	Description
3	<p>This response demonstrates a thorough understanding of constructing a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's history by</p> <ul style="list-style-type: none">• identifying the oldest layer of rock and explaining the reasoning for the identified oldest rock layer;• explaining how the environment has changed over time and including evidence for the explanation; and• identifying whether the scientist's claim is accurate or inaccurate. <p><i>*The response is clear, complete, and correct.</i></p>
2	<p>This response demonstrates a thorough understanding of two of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- Layer 7 is the oldest rock layer because it is at the bottom of the cliff (or it is the layer farthest from the surface).

Part B (1 point)

- Any response indicating that the area was once covered by water as evidence by the presence of fish, ammonite, and/or trilobite fossils (and is now covered by land).
- Any response indicating that the area changed to a land habitat as evidence by presence of dinosaur, bird, plant, and/or mammal fossils (from originally being covered by water).

Part C (1 point)

- Any response indicating disagreement based on dinosaur fossils being found in the layers above the lava.

Missouri Science Scoring Rubric

Session: 1 Item: 6

Grade: 8

MLS Expectation: 6-8.ESS1.B.1

Item ID: 903807

Score	Description
2	<p>This response demonstrates a thorough understanding of analyzing and interpreting data to determine scale properties of objects in the solar system by</p> <ul style="list-style-type: none">explaining one error in the size of materials in the model; andexplaining one error in the distance between the materials in the model. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- Any response indicating that the sizes of the circles are not to scale.
- Any response indicating that the circles are too close in size as compared to the other planets.

Part B (1 point)

- Any response indicating that the distances between the planets are not to scale.
- Any response indicating that the distances between the planets are too close together.

Missouri Science Scoring Rubric

Session: 1 Item: 7

Grade: 8

MLS Expectation 6-8.ESS3.D.1

Item ID: 903814

Score	Description
4	This response demonstrates a thorough understanding of analyzing evidence of the factors that have caused the change in global temperatures over the past century by <ul style="list-style-type: none">describing the overall pattern of change in average global temperatures;explaining whether the student's claim is plausible based on the data;describing a possible change to the environment likely caused by the pattern of average global air temperatures; anddescribing an additional possible change to the environment as mentioned above. <i>*The response is clear, complete, and correct.</i>
3	This response demonstrates a thorough understanding of three of the four key elements. <i>*The response may contain some work that is incomplete or unclear.</i>
2	This response demonstrates a thorough understanding of two of the four key elements. <i>*The response may contain some work that is incomplete or unclear.</i>
1	This response demonstrates a thorough understanding of one of the four key elements. <i>*The response may contain some work that is incomplete or unclear.</i>
0	The response provides insufficient evidence to demonstrate any understanding of the concept being tested.

Exemplar Responses:

Part A (1 point)

- Any response indicating that the average global temperature has increased.

Part B (1 point)

- Any response indicating that the student's claim is plausible due to the increased use of natural gas, coal, and/or oil.

Part C (2 points)

- Any response indicating **two** plausible negative environmental changes due to increased global temperatures.
 - melting glaciers
 - melting polar ice caps
 - increases in sea levels
 - changes in flooding occurrences
 - droughts
 - other weather/climate patterns, etc.

Missouri Science Scoring Rubric

Session: 1 Item: 13

Grade: 8

MLS Expectation: 6-8.PS3.A.1

Item ID: 912451

Score	Description
2	<p>This response demonstrates a thorough understanding of constructing and interpreting graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object by</p> <ul style="list-style-type: none">identifying whether the student's conclusion is correct or incorrect; andusing evidence to support the evaluation of the conclusion. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

(1 point)

- Any response indicating that the student's conclusion is incorrect (1 point)

(1 point)

- Any response indicating that the object with more mass will have more kinetic energy than the object with less mass.
- Any response indicating that the object with more mass will have a greater speed than an object with less mass.
- NOTE: Students will receive credit if the terms "heavier" and "lighter" are used in place of "more mass" and "less mass")*

Missouri Science Scoring Rubric

Session: 1 Item: 20

Grade: 8

MLS Expectation: 6-8.LS2.C.1

Item ID: 912136

Score	Description
3	<p>This response demonstrates a thorough understanding of constructing an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations by</p> <ul style="list-style-type: none">describing how a winter with less snowfall might affect populations of willow, aspen, and cottonwood trees;describing how a winter with less snowfall might affect the elk population; andusing evidence to predict a long-term effect of the reduced snow cover in the ecosystem on the beaver population. <p><i>*The response is clear, complete, and correct.</i></p>
2	<p>This response demonstrates a thorough understanding of two of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- More young willow, aspen, and cottonwood trees would survive.
- Since shorter plants and shrubs would be more available for the elk to eat, more young willow, aspen, and cottonwood trees would survive.

Part B (1 point)

- The elk population would increase.
- The elk would have a greater access to food sources.

Part C (1 point)

- The beaver population would increase if more young willow, aspen, and cottonwood trees would survive because more material would be available for food and/or shelter.
- Any response indicating that the beaver population would increase due to additional resources provided by the willow, aspen, and cottonwood trees.

Missouri Science Scoring Rubric

Item ID: 929707

Session: 2 Item: 4

Grade: 8

Scoring Guide: 6-8.LS1.A.2

Score	Description
2	<p>This response demonstrates a thorough understanding of developing and using a model to describe the function of a cell as a whole and ways parts of the cells contribute to that function by</p> <ul style="list-style-type: none">identifying two organelles that are present in plant cells but absent in animal cells; andexplaining why one of the organelles identified in part A is not necessary for animal cells to survive. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- chloroplast and cell wall
- NOTE: central vacuole is a less common option but should be accepted with one of the two organelles listed above.*

Part B (1 point)

- Any response indicating that the chloroplast is not necessary for an animal cell to survive because animals get their energy (food/nutrients) from other organisms.

Missouri Science Scoring Rubric

Session: 2 Item: 5

Grade: 8

MLS Expectation: 6-8.PS3.A.2

Item ID: 904190

Score	Description
2	<p>This response demonstrates a thorough understanding of developing a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system by</p> <ul style="list-style-type: none">• identifying two spheres that have the same potential energy and explaining how this can be determined from the diagram; and• identifying two spheres that have unequal potential energy and identifying the sphere with the greater potential energy. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- Spheres 1 and 2 have the same potential energy because they are the same distance from the ground.

Part B (1 point)

- Sphere 1 and sphere 3 have unequal potential energy. Sphere 1 has more potential energy than sphere 3.
- Sphere 2 and sphere 3 have unequal potential energy. Sphere 2 has more potential energy than sphere 3.

Missouri Science Scoring Rubric

Session: 2 Item: 6

Grade: 8

MLS Expectation: 6-8.ESS3.A.1

Item ID: 903811

Score	Description
3	<p>This response demonstrates a thorough understanding of constructing a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes and human activity by</p> <ul style="list-style-type: none">identifying the main areas people would expect to find 100-million-year-old sedimentary rocks that contain the given fossils;evaluating the student’s claim that based on the map, the oil and gas deposits in Missouri are about 100-million years old; andexplaining the decision made when evaluating the student’s claim. <p><i>*The response is clear, complete, and correct.</i></p>
2	<p>This response demonstrates a thorough understanding of two of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- Any response indicating that locations covered by the Western Interior Seaway, the Labrador Seaway, and the Hudson Seaway would contain fossils of ocean organisms that are about 100-million years old.
- Any response indicating that areas of North America that were covered by ocean water 100-million years ago would contain fossils of approximately the same age.

Part B (2 points)

- Any response indicating that the student’s claim is incorrect.
- AND
- Missouri was not covered by water 100-million years ago.
 - The oil and gas deposits in Missouri are likely from more ancient organisms.

Missouri Science Scoring Rubric

Session: 2 Item: 7

Grade: 8

MLS Expectation: 6-8.PS2.A.2

Item ID: 904188

Score	Description
2	<p>This response demonstrates a thorough understanding of planning and conducting an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object by</p> <ul style="list-style-type: none">describing the motion of a stone sphere based on forces shown acting on it in a diagram; anddescribing how the motion of the same sphere will most likely change when placed on a rougher surface. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- The sphere is moving, or will move, to the left.
- The sphere is moving, or will move, in the direction of the greater force being applied to it.

Part B (1 point)

- Any response indicating that the motion of the sphere will be slower or decreased.
- Any response indicating that the motion of the sphere will be influenced by a greater force of friction.

Missouri Science Scoring Rubric

Session: 2 Item: 9

Grade: 8

MLS Expectation: 6-8.LS4.A.1

Item ID: 913235

Score	Description
2	<p>This response demonstrates a thorough understanding of analyzing and interpreting evidence from the fossil record to infer patterns of environmental change resulting in extinction and changes to life forms throughout the history of Earth by</p> <ul style="list-style-type: none">• using data from the chart to identify the species of horse fossil that would be found in the uppermost layer of rock; and• using data from the chart to identify the species of horse fossil that would be found in the bottommost layer of rock. <p><i>*The response is clear, complete, and correct.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the two key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Species of fossil found in uppermost layer or rock (1 point)

- Any response indicating *Miohippus*.

Species of fossil found in bottommost layer or rock (1 point)

- Any response indicating *Orohippus*.

Missouri Science Scoring Rubric

Session: 2 Item: 18

Grade: 8

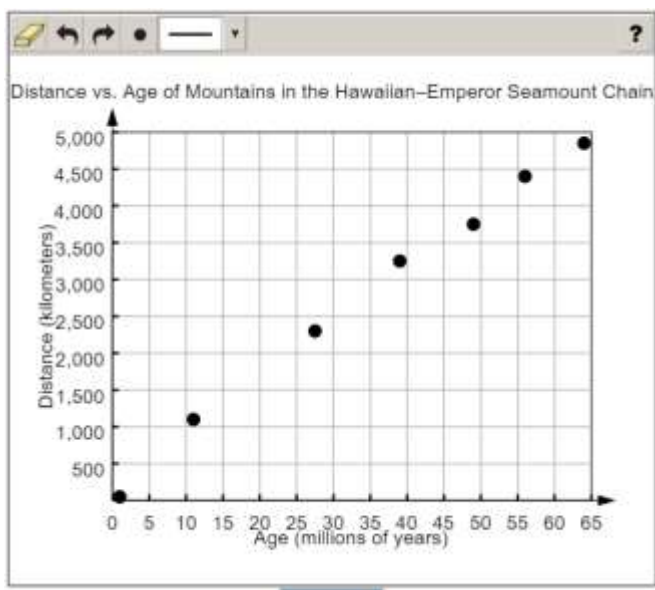
MLS Expectation: 6-8.ESS.2.A.2

Item ID: 903995

Score	Description
4	All 7 plots are correct in the graph and all 3 drop-down selections are correct.
3	6 or 7 plots are correct in the graph and all 3 drop-down selections are correct. OR All 7 plots are correct in the graph and any 2 of the 3 drop-down selections are correct.
2	6 of 7 plots are correct in the graph and any 2 of the 3 drop-down selections are correct.
1	6 of the 7 plots are correct in the graph and less than 2 of the 3 drop-down selections are selected. OR 6 of the 7 plots are correct in the graph and any 2 of the 3 drop-down selections are selected.
0	5 or less plots are correct in the graph

Screenshot or List of Correct Response(s)

Part A:



Part B: Use the drop-down menus to make a conclusion based on the data in the graph.

As the Pacific Plate moves , the age of each mountain as the distance from the hotspot .

NOTE: The plots can be anywhere inside the current square they are shown in above.

Missouri Science Scoring Rubric

Item ID: 903989

Session: 2 Item: 21

Grade: 8

Scoring Guide: 6-8.ESS3.B.1

Score	Description
3	<p>This response demonstrates a thorough understanding of analyzing and interpreting data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects by</p> <ul style="list-style-type: none">describing a recommendation that the researchers should make to people in the area about the risk for eruption events in April after the most recent activity in March;describing a difference, based on the data, in the warning time given to people preceding volcanic events compared to the warning time preceding a tornado; andexplaining how the warning time can have a positive effect on mitigating the hazards of a volcanic eruption. <p><i>*The response is clear, complete, and correct.</i></p>
2	<p>This response demonstrates a thorough understanding of two of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
1	<p>This response demonstrates a thorough understanding of one of the three key elements.</p> <p><i>*The response may contain some work that is incomplete or unclear.</i></p>
0	<p>The response provides insufficient evidence to demonstrate any understanding of the concept being tested.</p>

Exemplar Responses:

Part A (1 point)

- Any response indicating that the researchers should communicate that eruptions tend to follow an increase in tectonic earthquakes.

Part B (2 points)

First Point:

- The warning time for volcanic events can be days while the warning time for tornadoes can be only minutes.
- Any response indicating that the warning time for possible volcanic events is much longer than that of tornadoes.

Second Point:

- Any response indicating that more time allows people to evacuate areas that may be impacted by the eruption.
- Any response indicating that more time allows people to prepare more effectively.

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