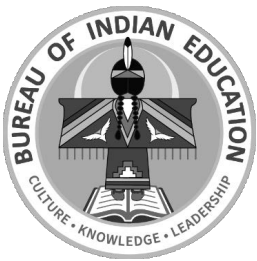




BIE Science
Practice Test
Grade 5



cognia[™]

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Science Session 1

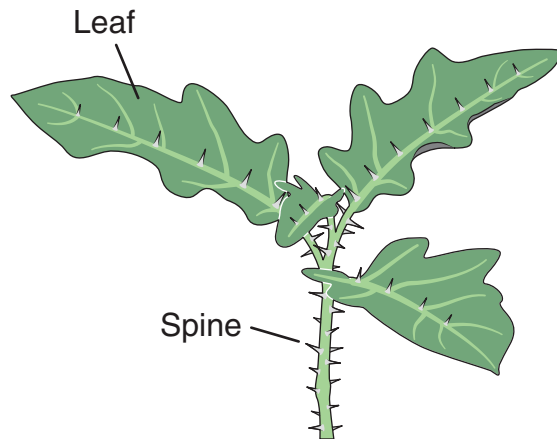
DIRECTIONS

Read each question carefully. For each multiple-choice question, decide which is the best answer and be sure to mark your answer in your answer document. For each open-ended item, be sure to write your answer in the lined box provided in your answer document. Only answers and work written inside the answer boxes will be scored.

This question has two parts. Be sure to answer both parts of the question.

1. Horse nettle plants have long spines on the stem and underneath the leaves as shown in the diagram. Caterpillars eat the leaves of horse nettle plants. After leaves have been eaten, new stems and leaves grow that have more spines than before.

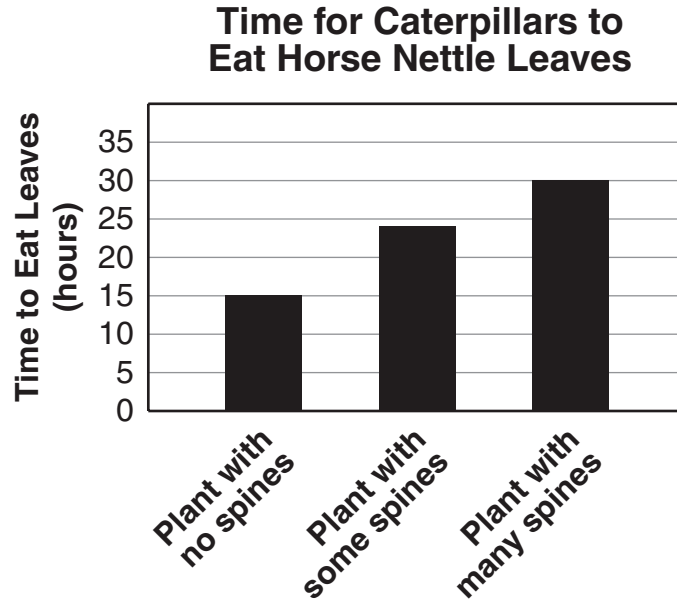
Horse Nettle Plant



SESSION
1

To understand why this happens, Kim takes three horse nettle plants that each have three leaves. She removes all the spines from one plant and half the spines from the second plant. She leaves all the spines on the third plant. Then Kim puts one caterpillar on each plant and measures the time for the caterpillar to eat all three leaves on the plant.

The graph shows the results of Kim's investigation.



Part a

Which claim is supported by the results of Kim's investigation?

- A** Spines increase the survival of horse nettle plants because caterpillars eat leaves very slowly on horse nettle plants with no spines.
- B** Spines increase the survival of horse nettle plants because caterpillars eat leaves very slowly on horse nettle plants with many spines.
- C** Spines decrease the survival of horse nettle plants because caterpillars eat leaves very slowly on horse nettle plants with no spines.
- D** Spines decrease the survival of horse nettle plants because caterpillars eat leaves very slowly on horse nettle plants with many spines.

Part b

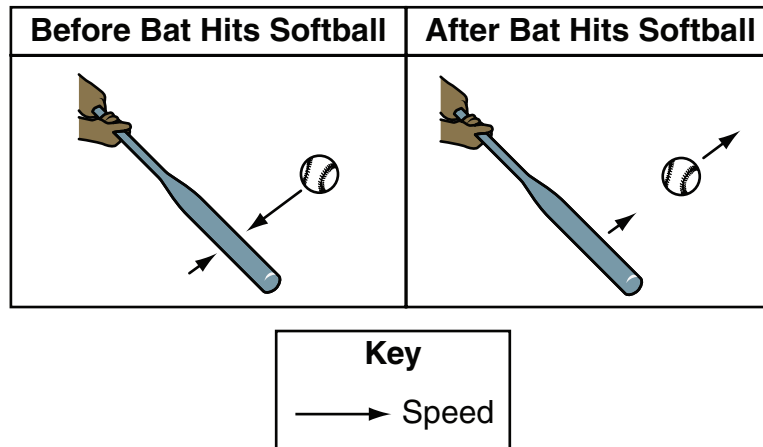
Which evidence supports the claim in Part (a)?

- A** Horse nettle plants without spines survive the best because caterpillars eat leaves without spines very quickly.
- B** Horse nettle plants with some spines survive the best because caterpillars prefer to eat leaves with many spines.
- C** Horse nettle plants survive with and without spines because caterpillars eat all the leaves in the same amount of time.
- D** Horse nettle plants with many spines survive the best because caterpillars eat fewer leaves in a day on plants with more spines.

This question has two parts. Be sure to answer both parts of the question.

2. Mandy is on the softball team. She wants to learn about changes in energy that occur when the bat hits the softball. Mandy observes as her teammates hit the softball with the bat. She draws a diagram to show the motions of the ball and bat.

Motions of Bat and Softball



Part a

Based on her observations and diagram, which question could Mandy investigate?

- A How much energy does the bat transfer to the softball?
- B Does using a heavier bat increase the speed of the softball?
- C How does the speed of the softball affect the distance the ball travels?
- D How much force is needed to make the bat move with twice the speed?

Part b

Mandy predicts that some energy is transferred to the air when the bat hits the softball.

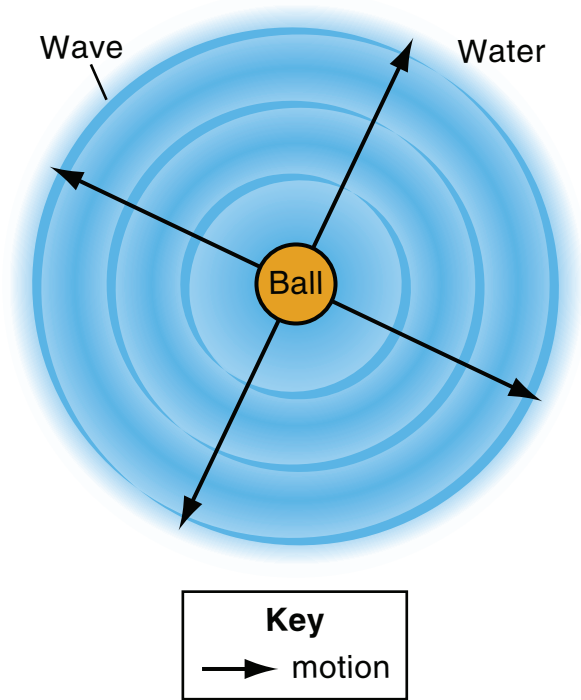
Which **two** types of energy are produced when the bat hits the softball?

- A light energy
- B sound energy
- C thermal energy
- D chemical energy
- E electrical energy

This question has two parts. Be sure to answer both parts of the question.

3. Kyria stands on a bridge and looks down at people throwing a ball into a lake. She observes that the ball hitting the water causes waves that move across the surface of the water. The diagram shows the waves that Kyria observes as she looks down on the lake.

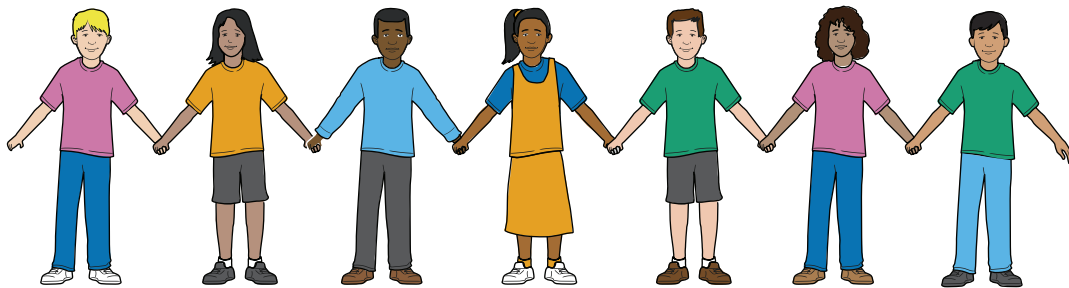
Wave Observations



SESSION
1

The next day at school, Kyria tells her friends about the ball and waves. Her friends decide to act like the waves in water. They hold hands and stand in a line, as shown in the diagram.

Wave Model



Part a

How could the friends move so that their motion models the motion of the water waves that Kyria observed?

- A** The friends could all sit down at the same time.
- B** The friends could jump up and down in any order.
- C** The friends could all move one step to the right at the same time.
- D** The friends could move their arms up and down in order from left to right.

Part b

Which evidence from the Wave Observations diagram supports the answer to Part (a)?

- A** The waves move water away from the ball.
- B** The waves move the ball through the water.
- C** The waves move toward the ball and into the water.
- D** The waves move through the water away from the ball.

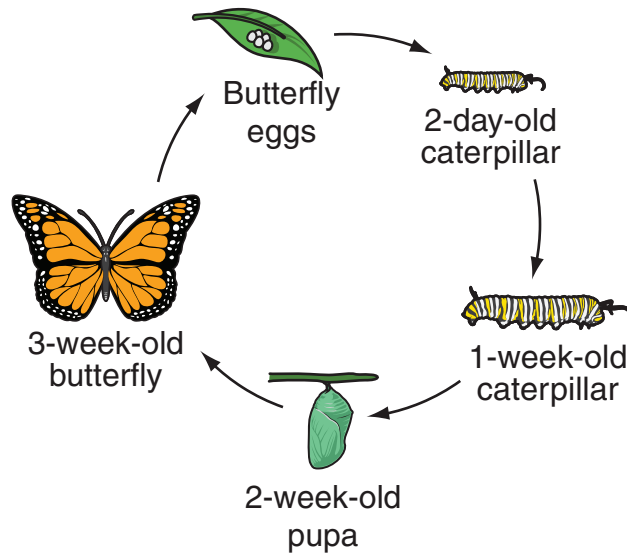


This question has two parts. Be sure to answer both parts of the question.

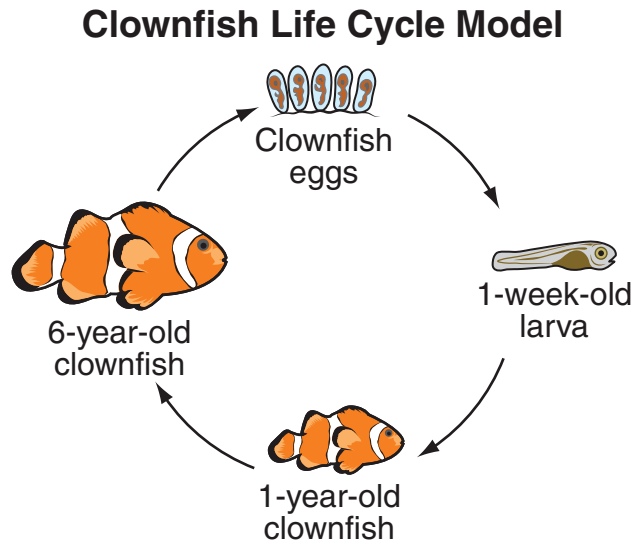
4. Hazel and Julian go to the zoo to see their favorite animals.

Hazel's favorite animals are insects like butterflies. She learns about the butterfly's life cycle and finds out that butterflies can live up to four weeks in a zoo. Hazel draws a model of the butterfly's life cycle using the information she learned.

Butterfly Life Cycle Model



Julian's favorite animals at the zoo are fish like clownfish. Julian learns that clownfish can live up to 10 years in a zoo. Julian draws a model of the clownfish's life cycle using the information he learned.



Hazel and Julian compare their models.

- a. Based on the models, describe one way the butterfly and clownfish life cycles are alike and one way they are different.

Their friend Ruby's favorite animal is her pet parrot. Ruby's parrot is a bird that can live up to 30 years as a pet.

- b. Identify which of the two life cycle models is most similar to the parrot's life cycle. Describe one way that animal's life cycle and the parrot's life cycle are alike and one way that animal's life cycle and the parrot's life cycle are different.



Read the information. Then answer the questions that follow.

Investigating Gas Production

In class, a teacher demonstrates a chemical reaction by mixing vinegar and baking soda to produce bubbles of gas. Eliana wonders whether mixing other substances could also produce a gas. She decides to test different combinations of sugar, water, vinegar, and baking soda.

Some properties of these substances are shown in the table.

Properties of Substances

Substance	Color	Solid or Liquid	Attracted to a Magnet	Conducts Electricity
Sugar	White	Solid	No	No
Water	Clear	Liquid	No	Yes
Vinegar	Clear	Liquid	No	Yes
Baking soda	White	Solid	No	No



Investigation 1

Eliana mixes a small amount of each liquid and solid in a bowl and observes whether bubbles of gas are produced. Her observations are shown in the table.

Investigation 1 Observations

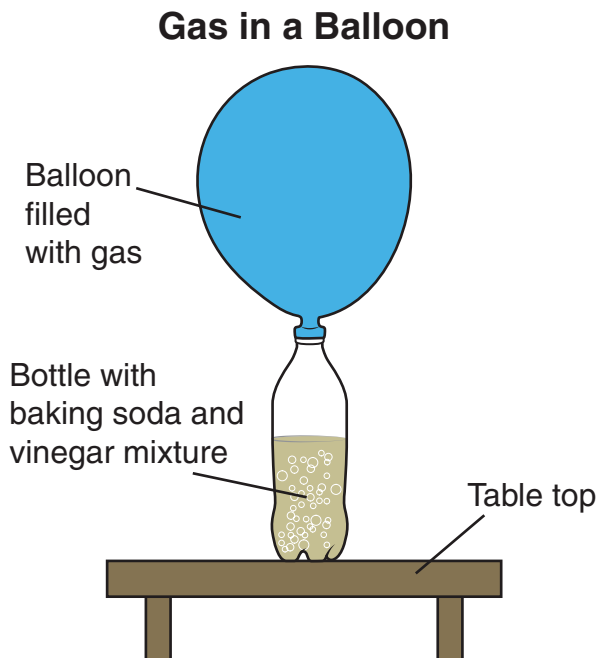
Liquid Used	Solid Used	Gas Produced
Water	Sugar	No
Water	Baking soda	No
Vinegar	Sugar	No
Vinegar	Baking soda	Yes

Investigation 2

Next, Eliana wonders whether changing the amount of baking soda would change the amount of gas produced. To investigate, she follows these steps:

1. Record the mass of a balloon.
2. Pour 50 milliliters of vinegar into a bottle.
3. Put 5 milliliters of baking soda inside the balloon. Hold the balloon so that the baking soda stays inside the balloon and attach the open end of the balloon to the top of the bottle.
4. Lift the balloon so that the baking soda falls into the bottle with vinegar.
5. Wait one minute.
6. Carefully remove the balloon from the bottle without allowing any gas to escape.
7. Measure the mass of the balloon filled with gas.
8. Calculate the mass of gas produced by subtracting the mass of the balloon from the mass of the balloon filled with gas.
9. Repeat steps 1–8 until three trials have been completed.
10. Repeat steps 1–9 with 10 milliliters and 15 milliliters of baking soda.

The results of one trial are shown in the diagram.



Eliana's data are shown in the table.

Investigation 2 Data

Amount of Baking Soda (milliliters)	Mass of Gas Produced (grams)			Average Mass of Gas Produced (grams)
	Trial 1	Trial 2	Trial 3	
5	1.0	0.8	1.2	1.0
10	1.5	1.9	1.4	1.6
15	2.4	1.9	2.6	2.3

5. Eliana claims she does not need to use any measuring tools during investigation 1. Which sentence describes her claim?
- A Her claim is correct because she does not measure the amount of gas produced.
 - B Her claim is correct because she mixes four different combinations of liquid and solid.
 - C Her claim is incorrect because she uses a beaker to measure the amount of liquid used.
 - D Her claim is incorrect because she uses a balance to measure the amount of solid used.



This question has two parts. Be sure to answer both parts of the question.

6. Part a

Based on the properties in the table, how can Eliana tell whether a substance is water or sugar?

- A** The substance is sugar if the substance is a solid and conducts electricity.
- B** The substance is sugar if the substance is clear and is not attracted to a magnet.
- C** The substance is water if the substance is white and does not conduct electricity.
- D** The substance is water if the substance is liquid and is not attracted to a magnet.

Part b

Based on the observations from investigation 1, how can Eliana tell whether a substance is water or vinegar?

- A** The substance is water if gas is produced after sugar is added.
- B** The substance is vinegar if gas is produced after sugar is added.
- C** The substance is water if gas is produced after baking soda is added.
- D** The substance is vinegar if gas is produced after baking soda is added.

- 7.** Which evidence from the investigations supports the claim that mixing vinegar and baking soda produces a new substance?
- A** A gas is produced when a liquid and a solid are mixed.
 - B** When a liquid and solid are mixed, the mass does not change.
 - C** The properties of substances stay the same when the substances are mixed.
 - D** Different amounts of baking soda can be mixed with the same amount of vinegar.

This question has two parts. Be sure to answer both parts of the question.

8. Part a

Eliana claims that when baking soda and vinegar are mixed, a new substance forms.

Which statement describes an observation from investigation 2 that supports her claim?

- A** After baking soda and vinegar are mixed, bubbles form.
- B** After baking soda and vinegar are mixed, the mass increases.
- C** After baking soda and vinegar are mixed, vinegar stays a liquid.
- D** After baking soda and vinegar are mixed, baking soda disappears.

Part b

Which observation is evidence that the new substance inside the balloon is a gas?

- A** The new substance filled the balloon.
- B** The new substance has more mass than the baking soda.
- C** The new substance takes up less space than the vinegar.
- D** The new substance increases as the baking soda increases.

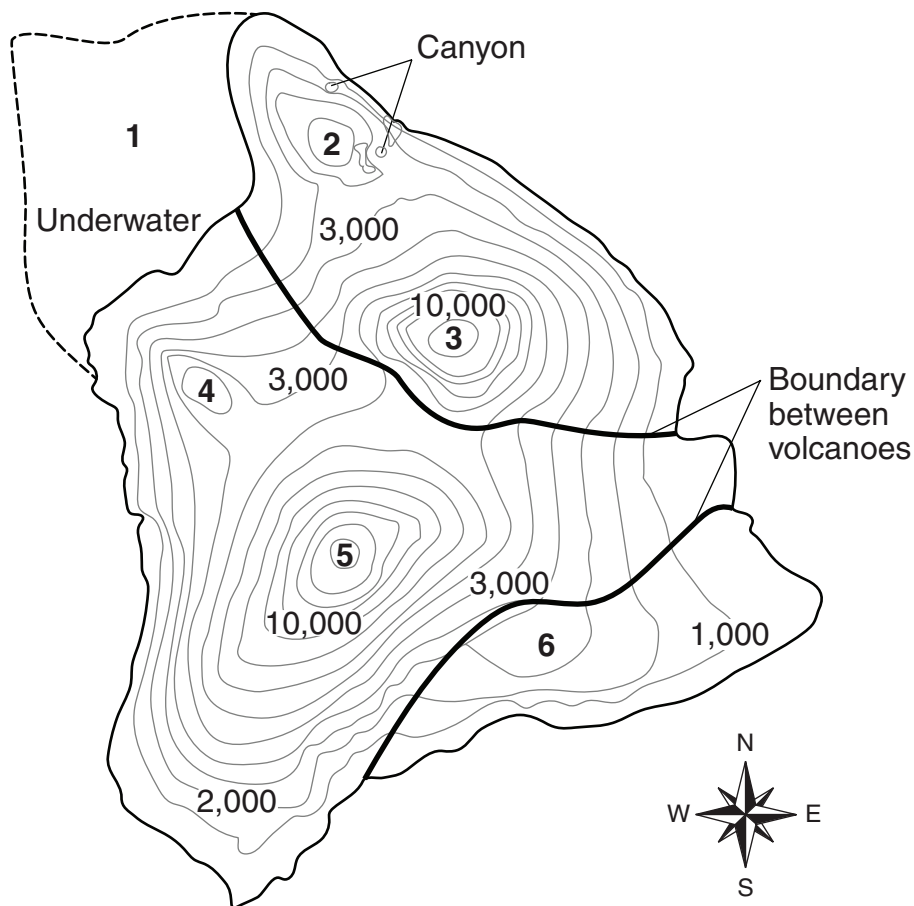
Read the information. Then answer the questions that follow.

Volcanic Slopes

During a summer trip, Aiden visits a volcanic island. He learns that the island was formed by six volcanoes over millions of years. Aiden finds a topographic map that shows the location, elevation, and boundaries of each volcano. A topographic map shows differences in elevation. Each elevation line on the map shows locations that are the same height above sea level. The numbers represent kilometers above sea level. The volcanoes on the map are labeled by numbers 1–6 in the order of age. The oldest volcano, volcano 1, is underwater. The youngest volcano, volcano 6, is still forming new parts of the island.

The volcanoes on the map are labeled by numbers 1–6 in the order of age. The oldest volcano, volcano 1, is underwater. The youngest volcano, volcano 6, is still forming new parts of the island.

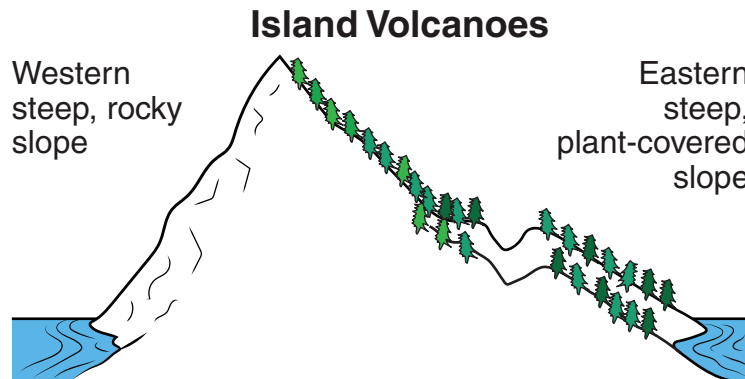
Island Volcanoes



The map shows canyons on two of the slopes of volcano 2. During his trip, Aiden goes for a walk on volcano 2. As he stands facing the volcano from the south, Aiden observes that the western slope of the volcano is steep and rocky with no canyon. The eastern slope of the volcano is not as steep, has a deep canyon, and is covered with plants.

SESSION
1

Aiden draws a diagram that shows his observations. He plans an investigation to find out what caused the differences in the two slopes of the volcano.



This question has two parts. Be sure to answer both parts of the question.

9. Aiden wants to investigate how the motion of rainwater affects the slopes of a volcano. He wonders whether differences in erosion caused the differences he observed on the eastern and western slopes of volcano 2.

SESSION
1

Part a

Which type of data would be **most** useful for Aiden to collect during his investigation?

- A the amount of rain that falls on each slope of volcano 2
- B the time of day when rain falls on each slope of volcano 2
- C the time of year when rain falls on each slope of volcano 2
- D the number of days that rain falls on each slope of volcano 2

Part b

Which measurement would be **most** helpful to Aiden during his investigation?

- A Measure the number of days with rain on each slope of volcano 2 every year.
- B Measure the time of day that rain begins and ends on the eastern slope of volcano 2.
- C Measure the total number of rainstorms on the western slope of volcano 2 every year.
- D Measure the amount of rainfall per hour on each slope of volcano 2 during a rainstorm.

10. Which additional evidence would **best** support Aiden’s hypothesis that differences in erosion caused the observed differences on the eastern and western slopes of volcano 2?
- A data showing that the western slope has less rainfall and less erosion than the eastern slope
 - B data showing that the western slope has less rainfall and more erosion than the eastern slope
 - C data showing that the western slope has more rainfall and less erosion than the eastern slope
 - D data showing that the western slope has more rainfall and more erosion than the eastern slope
11. Which comparison is supported by the map?
- A Volcano 2 is shorter than volcano 3.
 - B Volcano 2 is farther east than volcano 6.
 - C Volcano 2 has a larger area than volcano 5.
 - D Volcano 2 is farther from the ocean than volcano 4.



This question has two parts. Be sure to answer both parts of the question.

- 12.** After studying the map, Aiden concludes that other volcanoes have steeper slopes than volcano 2.

Part a

Which volcano on the map has the steepest slopes?

- A** 3
- B** 4
- C** 5
- D** 6

Part b

Which pattern from the map describes the volcano in Part (a)?

- A** This volcano has the most elevation lines.
- B** This volcano has the longest elevation lines.
- C** This volcano has elevation lines that are closest together.
- D** This volcano has elevation lines that cover the largest area.



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Science Session 2

DIRECTIONS

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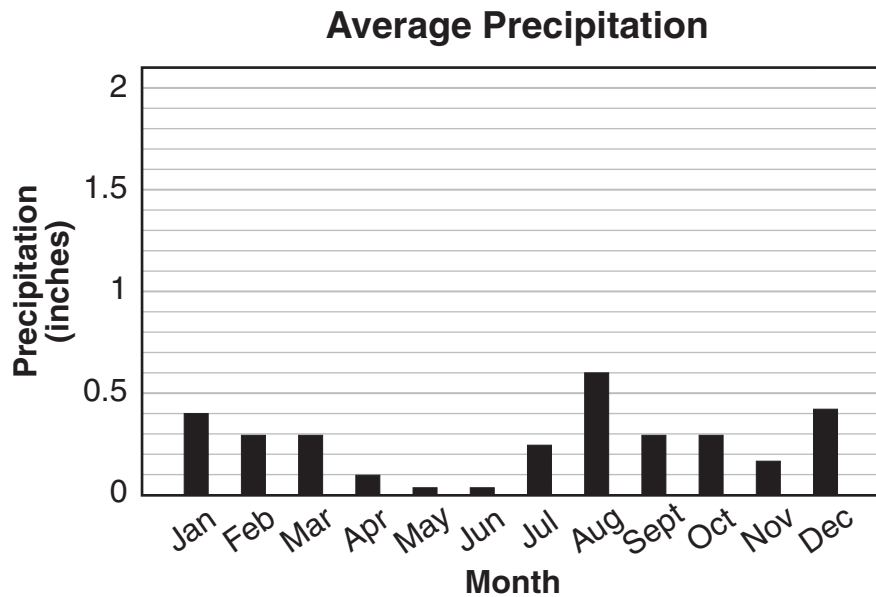
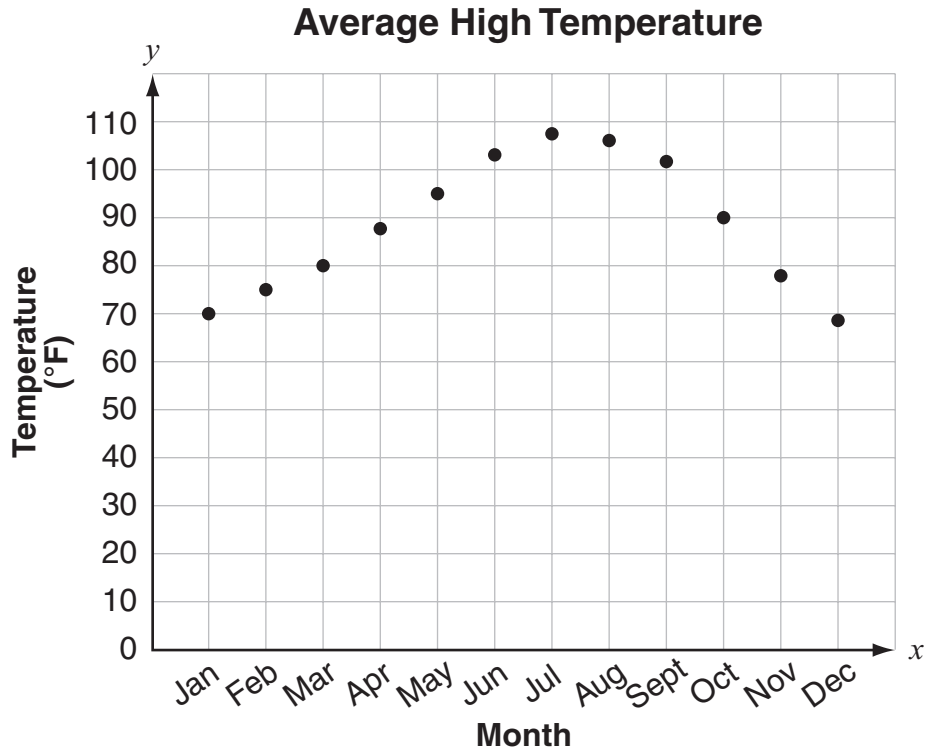
This question has two parts. Be sure to answer both parts of the question.

- 13.** Sonia has a friend, Marisa, who lives in a country that has different weather conditions during the summer and winter than where Sonia lives. Sonia learns that different locations on Earth have different types of climate. She makes the table to show the typical weather conditions in different types of climates during the summer and winter months.

Weather and Climate

Type of Climate	Typical Summer Weather	Typical Winter Weather
Desert	Hot, dry	Warm, dry
Tropical	Hot, wet	Hot, wet
Temperate	Cool, dry	Cold, wet
Polar	Cool, dry	Cold, wet
Mediterranean	Hot, dry	Cool, wet
Mountain	Cold, wet	Cold, wet

Marisa sends Sonia information about temperatures and precipitation where she lives. The graphs show the average temperature and precipitation throughout the year in Marisa’s country.



Part a

Based on the table and graphs, which statement describes typical weather patterns in Marisa's country?

- A Marisa's country has hot, dry summers.
- B Marisa's country has cold, wet summers.
- C Marisa's country has hot, wet weather all year.
- D Marisa's country has cool, dry weather all year.

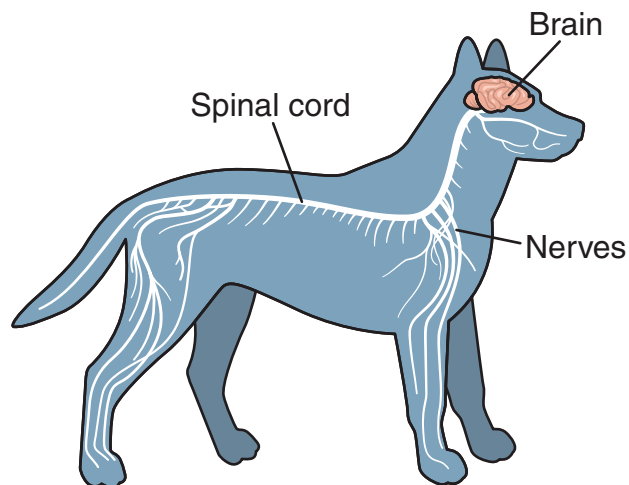
Part b

Based on the table and graphs, which type of climate does Marisa's country have?

- A polar
- B desert
- C tropical
- D mountain

This question has two parts. Be sure to answer both parts of the question.

- 14.** Sam gets a puppy for his birthday. The puppy is interested in everything he sees. Sam learns that dogs use their nervous system to react to their environment. He draws a model of his puppy's nervous system.

Nervous System Model

SESSION
2

Part a

Based on the model, which **two** statements describe how the puppy's nervous system allows the puppy to react to the environment?

- A** The brain pumps blood to the dog's legs.
- B** Nerves help the dog's body stay in shape.
- C** Nerves carry information from the eyes to the brain.
- D** The spinal cord removes waste from the dog's body.
- E** The brain sends information to the tail to make the tail wag.

Part b

Sam's puppy sees a cat. Based on the model, which statement describes the path of information that results in the puppy chasing the cat?


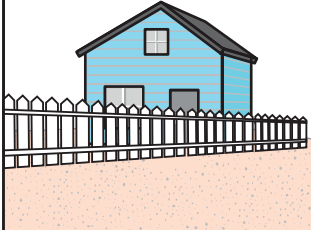
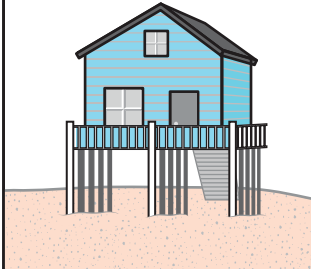
- A** Information about the cat is sent to the brain. The brain sends signals to the legs so that the puppy can chase the cat.
- B** Information about the cat is sent to the nerves. The nerves send signals to the spinal cord to move the legs to chase the cat.
- C** Information about the cat is sent to the spinal cord. As the spinal cord removes waste, the puppy moves forward and chases the cat.
- D** Information about the cat is sent to the brain. The brain pumps blood through the spinal cord to the legs so that the puppy can chase the cat.

This question has three parts. Be sure to answer all three parts of the question.

15. Sid lives in a new house by the ocean. He knows that hurricanes can cause strong ocean waves known as surges. Surges can break simple structures and cause flooding. Sid wants to protect his new house from flood damage due to surges. Sid wants to finish construction of the flood protection in three months.

Sid studies three designs for protecting his house from flood damage. He gives each design a score based on how well it reduces flood damage. The scores range from 1 to 100. A score of 100 means the design completely stops flood damage. Sid organizes the data in the table shown.

Designs for Reducing Flood Damage

Name	Design	Score	How Long to Build?
Concrete pods		85	1 week
Wood fence		25	1 week
Concrete pillar		95	3 to 4 months

- The concrete pod design has a score of 85. Explain what this score means.
- Describe what will likely happen if a strong wave hits the wood fence design.
- Identify the design that **best** meets Sid's criteria. Explain your reasoning.

Read the information. Then answer the questions that follow.





Surviving the Drought

Miguel's family has enjoyed his grandfather's garden for years. They enjoy the flowers and also the birds, butterflies, rabbits, and other animals that live in the garden.

This year, a drought is predicted for Miguel's area. There will be much less rainfall than normal. Miguel's grandfather grows many different types of plants in his garden and is worried that he will not be able to give all the plants enough extra water during the drought. He asks Miguel to investigate how much water the types of plants in his garden need to survive.

In his investigation, Miguel uses four different types of plants from his grandfather's garden. He plants 10 identical plants of each type in the same soil. He puts them in a location where they receive the same amount of sunshine. Once a week, Miguel gives each plant a very small amount of water. The table shows how many plants of each type are alive after three months.

Plant Survival Data

Type of Plant	Diagram of Plant	Number of Plants That Survived
Aloe vera		9
Fern		2
Coneflower		4
Rose		0

Based on the results of Miguel's investigation, Miguel's grandfather adds new types of plants to his garden that can survive with very little water. A year later, Miguel and his family are still enjoying the garden.

- 16.** Which claim is supported by the data from Miguel's investigation?
- A** Some types of plants can survive in environments with no water.
 - B** Some types of plants can survive in environments with only rainwater.
 - C** Some types of plants can survive in environments with very little water.
 - D** Some types of plants can survive in environments with large amounts of water.
- 17.** Miguel claims that adding new types of plants to his grandfather's garden has solved the problem caused by the drought.

Which data would support his claim?

- A** The garden has more water than before the drought.
- B** The garden has fewer animals than before the drought.
- C** The garden has the same types of flowers as before the drought.
- D** The garden has the same number of plants as before the drought.

This question has two parts. Be sure to answer both parts of the question.

18. Part a

Based on the data from Miguel's investigation, which plants can Miguel claim are the **best** choices for his grandfather's garden during the drought?

- A fern and rose
- B aloe vera and fern
- C coneflower and rose
- D aloe vera and coneflower

Part b

Which data support the claim in Part (a)?

- A These types of plants grew the fastest.
- B These types of plants had the most flowers.
- C These types of plants survived with very little water.
- D These types of plants made the most food for animals.

This question has two parts. Be sure to answer both parts of the question.

- 19.** Miguel's grandfather observes that fewer animals live in the garden after he adds the new types of plants.

Part a

Which claim is supported by the grandfather's observation?

- A** Animals found more places in the garden to hide.
- B** Animals moved away from the garden to find food.
- C** Animals began to use the new types of plants for homes.
- D** Animals had more water because of the new types of plants.

Part b

Which evidence would support the claim in Part (a)?

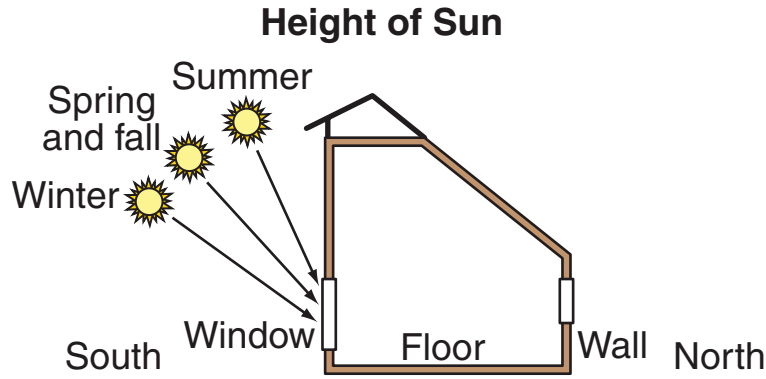
- A** The new types of plants use more water than the other plants.
- B** The new types of plants have a different taste than the other plants.
- C** The new types of plants are easier to build nests in than the other plants.
- D** The new types of plants are taller and have larger leaves than the other plants.

Read the information. Then answer the questions that follow.

Model House

Jaylinn wants to design a house. She wants the design to interact with sunlight in ways that make the inside of the house warm during winter and keep the inside of the house cool during summer.

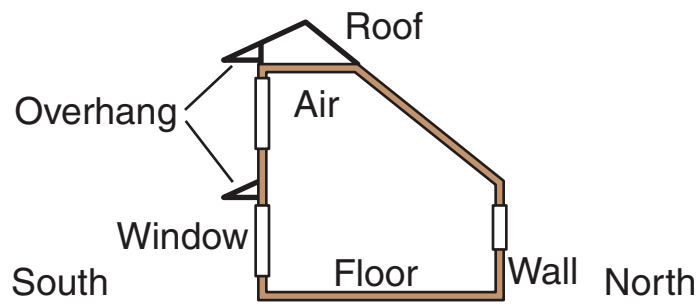
Jaylinn learns that the Sun rises higher in the sky during summer days than winter days, as shown in the diagram.



She also observes that some houses have structures above windows on the south side of the house. The structures are called overhangs and keep some sunlight from entering the windows.

Jaylinn builds the model house shown in the diagram. The south side of the house has two glass windows with a wooden overhang above each window.

Model House



This question has two parts. Be sure to answer both parts of the question.

- 20.** Jaylinn wants her design to use sunlight to warm the inside of the model house during winter.

Part a

Based on the Height of Sun diagram, how is the model house described in the Model House diagram designed to use sunlight to make the house warm during winter?

- A** The house has more windows on the south side than on the north side.
- B** There are overhangs above the windows on the south side of the house.
- C** Windows let sunlight into the south side and out of the north side of the house.
- D** Overhangs keep sunlight from entering the windows on the north side of the house.

Part b

Which statement describes how the model could be improved to make the inside of the model house warmer during winter?

- A** Increase the size of the windows so that more sunlight enters the house during winter.
- B** Decrease the size of the windows so that less sunlight enters the house during winter.
- C** Increase the size of the overhangs so that less sunlight enters the house during winter.
- D** Decrease the size of the overhangs so that more sunlight enters the house during winter.

- 21.** Jaylinn wonders whether other energy transformations have happened while the model house is in the sunlight.

Which observation would be evidence of another energy transformation happening while the model house is in the sunlight?

- A** The walls inside the house become darker.
- B** The air inside the house becomes warmer.
- C** The windows let more sunlight enter the house.
- D** The shadows made by the overhangs become shorter.

This question has two parts. Be sure to answer both parts of the question.

- 22.** Jaylinn also wants the design to keep the inside of the model house cool during the summer.

Part a

Based on the Height of Sun diagram, how is the model house described in the Model House diagram designed to keep the inside of the house cool during the summer?

- A** The house has overhangs above the windows on the south side.
- B** The house has more windows on the south side than on the north side.
- C** Windows let sunlight into the south side and out of the north side of the house.
- D** Overhangs keep sunlight from entering the windows on the north side of the house.

Part b

Which statement describes how the model could be improved to keep the inside of the model house cooler during summer?

- A** Make the windows larger so that less sunlight enters the house during summer.
- B** Make the overhangs larger so that less sunlight enters the house during summer.
- C** Make the windows smaller so that more sunlight enters the house during summer.
- D** Make the overhangs smaller so that more sunlight enters the house during summer.

- 23.** Jaylinn observes that, in addition to overhangs above windows, some houses have windows with tinted¹ glass that is dark gray. Windows with tinted glass let less sunlight enter the house. Jaylinn wonders whether she should add tinted glass in the windows of her model house.

¹**tinted:** darkened

Which statement describes the effect of tinted glass on the inside of Jaylinn's house?

- A** The inside of the model house would be cooler during winter and warmer during summer.
- B** The inside of the model house would be cooler during winter and cooler during summer.
- C** The inside of the model house would be warmer during winter and cooler during summer.
- D** The inside of the model house would be warmer during winter and warmer during summer.



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Science Session 3

DIRECTIONS

Read each question carefully. For each multiple-choice question, decide which is the best answer and be sure to mark your answer in your answer document. For each open-ended item, be sure to write your answer in the lined box provided in your answer document. Only answers and work written inside the answer boxes will be scored.

This question has two parts. Be sure to answer both parts of the question.

24. Ava observes that when she pushes a heavy box, she cannot push hard enough to make the box move. She also observes that when she and a friend push the box together, they can push hard enough to make the box move.

Part a

Which statement describes the reason for Ava's observation?

- A When Ava pushes, the forces on the box are balanced, and when Ava and her friend push, the forces on the box are balanced.
- B When Ava pushes, the forces on the box are unbalanced, and when Ava and her friend push, the forces on the box are balanced.
- C When Ava pushes, the forces on the box are unbalanced, and when Ava and her friend push, the forces on the box are unbalanced.
- D When Ava pushes, the forces on the box are balanced, and when Ava and her friend push, the forces on the box are unbalanced.

Part b

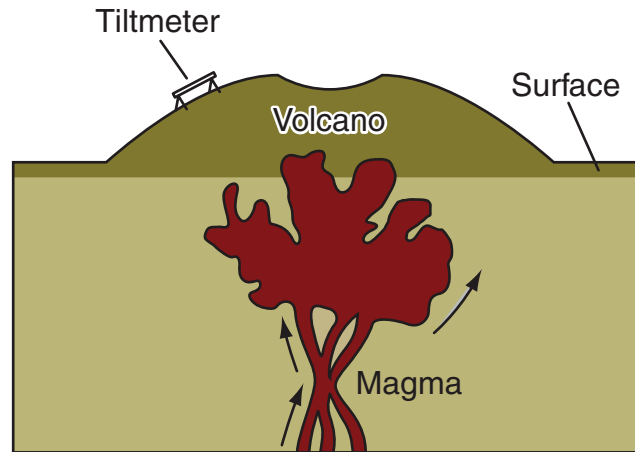
Which plan **best** describes how Ava could investigate the effect of balanced forces on the box?

- A Use two forces that are the same size to push the box from both sides, and then observe that the motion of the box changes.
- B Use two forces that are different sizes to push the box from both sides, and then observe that the motion of the box changes.
- C Use two forces that are the same size to push the box from both sides, and then observe that the motion of the box does not change.
- D Use two forces that are different sizes to push the box from both sides, and then observe that the motion of the box does not change.

This question has two parts. Be sure to answer both parts of the question.

- 25.** Mario learns that scientists put a tool called a tiltmeter on a volcano to predict when the volcano will erupt. The tiltmeter measures changes in the shape of the volcano and sends that data to a computer. The diagram shows that a tiltmeter works because the shape of a volcano changes as magma moves up and causes the surface of the volcano to tilt.

Measuring the Shape of a Volcano



Part a

Which statement describes how using a tiltmeter could help save the lives of people who live near a volcano?

- A** Using a tiltmeter can warn people which direction magma will flow during an eruption.
- B** Using a tiltmeter can warn people to move away from the volcano during an eruption.
- C** Using a tiltmeter can decrease the number of people who need to be warned before an eruption.
- D** Using a tiltmeter can increase the time people have to move away from the volcano before an eruption.

Part b

Which statement **best** describes how the data from a tiltmeter on one volcano could save the lives of people who live near another volcano?

- A** The data could show the shape of the volcano before the eruption.
- B** The data could show the direction magma moves during an eruption.
- C** The data could show the amount of magma released during an eruption.
- D** The data could show the time between a change in shape and an eruption.

This question has two parts. Be sure to answer both parts of the question.

- 26.** Raquel hears that some of the homes in her neighborhood have hard water. Hard water is water that contains dissolved calcium. Hard water can cause problems when calcium builds up in pipes and water cannot flow.

Raquel learns that lime is a mineral that usually dissolves in water but produces a solid when added to hard water. She wants to use lime to test whether her home has hard water.

Part a

Which measurement could Raquel use to test whether the water in her home is hard water?

- A** the amount of lime that she adds to her water
- B** the amount of calcium that dissolves in her water
- C** the amount of hard water in her neighbor's house
- D** the amount of solid in her water when she adds lime

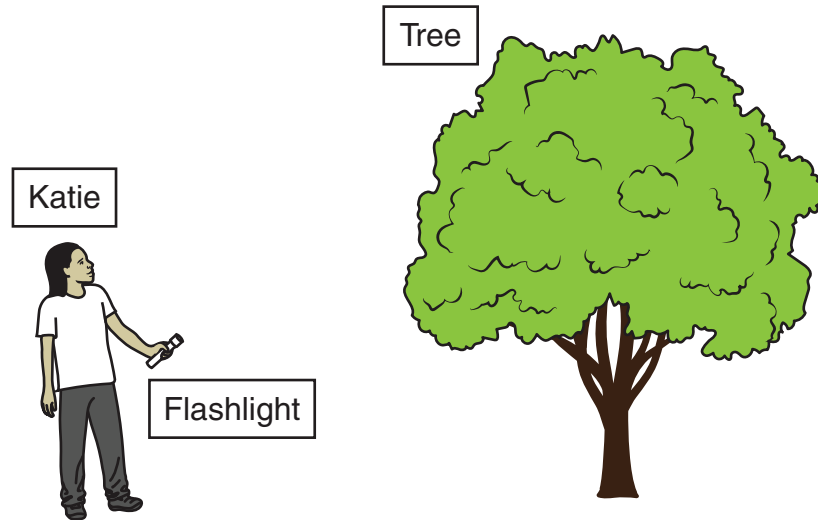
Part b

Raquel wants to compare the water in her home to water in other buildings. Which **two** variables should Raquel keep the same during her investigation?

- A** the amount of water in each test
- B** the amount of calcium in the water
- C** the number of hours between tests
- D** the amount of lime added to the water
- E** the number of containers used during testing

This question has three parts. Be sure to answer all three parts of the question.

27. Katie and her friend are walking on a path in the woods at night. They use a flashlight to help them see the path and the trees next to the path. Katie wants to make a model that shows how she is able to see the tree. The diagram shows the objects to include in the model.



- Use the objects in the diagram to draw a model that shows how Katie is able to see the tree. Draw arrows to show the path of light.
- Based on the path of light shown in your model, describe how Katie is able to see the tree.
- Predict how well Katie will be able to see the tree if there is thick fog in the woods. Use your model in part (a) to explain your reasoning.

Read the information. Then answer the questions that follow.

Changing Shadows

One summer day, Amelia walks past a tall tree in a park several times. She observes that the shadow of the tree changes during the day. She records her observations in the diagram.

Observed Tree Shadows

Early Morning	Noon	Late Afternoon

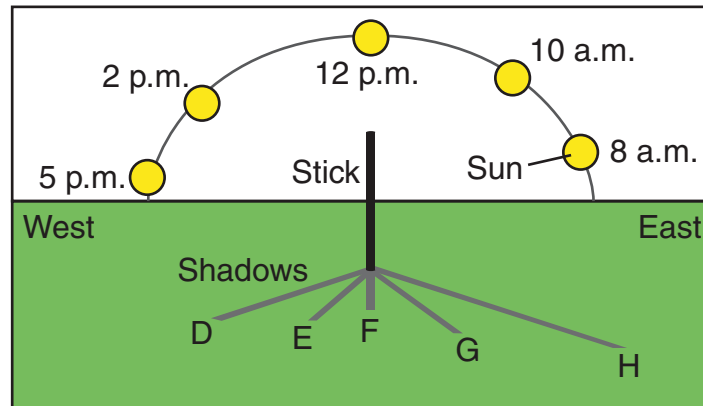
Amelia studies a diagram that shows the path of the Sun across the sky during summer and winter.

Path of the Sun

Summer	Winter

Amelia decides to collect her own data on how shadow direction and shadow length change during the day. She puts a stick into the ground in a park near her home and observes the direction and length of the stick's shadow at different times on a summer day. The diagram shows the directions and lengths of five shadows Amelia observed.

Observed Stick Shadows



Finally, Amelia records the lengths of five shadows in a table.

Shadow Lengths

Shadow	Time	Shadow Length (centimeters)
D	8 a.m.	60
E	10 a.m.	20
F	12 p.m.	10
G	2 p.m.	30
H	5 p.m.	110

This question has two parts. Be sure to answer both parts of the question.

28. Part a

Based on the five shadows that Amelia observed, which statement describes how the direction of the stick's shadow changes?

- A** The direction of the shadow of the stick moves from east to west as the Sun appears to move from east to west.
- B** The direction of the shadow of the stick moves from east to west as the Sun appears to move from west to east.
- C** The direction of the shadow of the stick moves from west to east as the Sun appears to move from east to west.
- D** The direction of the shadow of the stick moves from west to east as the Sun appears to move from west to east.

Part b

Which Earth motion causes the direction of the stick's shadow to change?

- A** Earth orbits the Sun once every day.
- B** Earth orbits the Sun once every year.
- C** Earth rotates on its axis once every day.
- D** Earth rotates on its axis once every year.

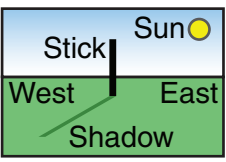
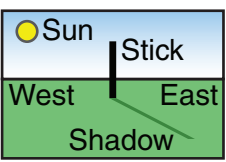
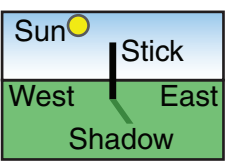
29. Which sequence represents the stick's shadows ordered from shortest to longest?

- A** 5 p.m. → 2 p.m. → 12 p.m. → 10 a.m. → 8 a.m.
- B** 10 a.m. → 12 p.m. → 2 p.m. → 8 a.m. → 5 p.m.
- C** 12 p.m. → 10 a.m. → 2 p.m. → 8 a.m. → 5 p.m.
- D** 5 p.m. → 8 a.m. → 2 p.m. → 10 a.m. → 12 p.m.

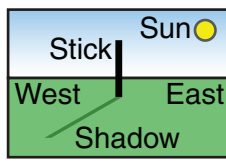
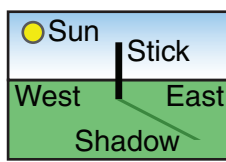
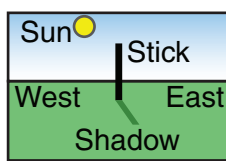
30. Although Amelia did not record the lengths in the table, she also observed the length of the stick's shadow at three other times that day.

Based on the pattern in Amelia's observations of the stick's shadow, which table shows the time of the day Amelia observed each shadow?

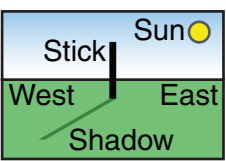
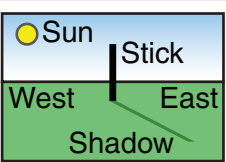
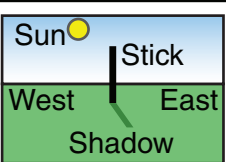
A

Shadow of the Stick	Time of the Day
	3 p.m.
	1 p.m.
	9 a.m.

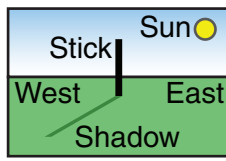
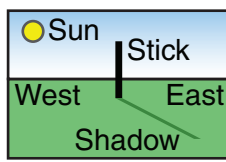
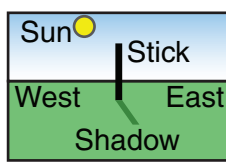
B

Shadow of the Stick	Time of the Day
	1 p.m.
	3 p.m.
	9 a.m.

C

Shadow of the Stick	Time of the Day
	9 a.m.
	3 p.m.
	1 p.m.

D

Shadow of the Stick	Time of the Day
	1 p.m.
	9 a.m.
	3 p.m.

This question has two parts. Be sure to answer both parts of the question.

- 31.** Amelia makes a claim about how long the stick's shadow would be if she observed her stick on a winter day.

Part a

Which claim is supported by what Amelia learned about the path of the Sun?

- A** In winter, the shadows during the middle of the day will be longer than in summer.
- B** In winter, the shadows when the Sun is rising and setting will be longer than in summer.
- C** In winter, the shadows will be longer in the morning and shorter in the afternoon than in summer.
- D** In winter, the shadows will be shorter in the morning and longer in the afternoon than in summer.

Part b

Which statement **best** explains the difference between shadows in summer and winter?

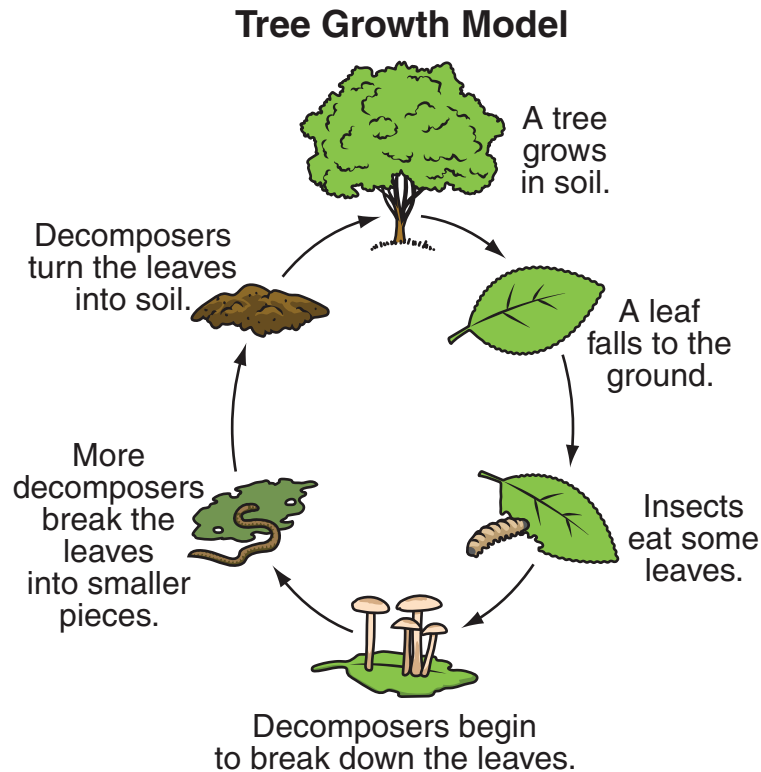
- A** Earth is closer to the Sun in winter than in summer.
- B** Earth is on opposite sides of the Sun in winter and in summer.
- C** The Sun's path across the sky is lower in winter than in summer.
- D** The Sun moves from east to west across the sky in winter and in summer.

Read the information. Then answer the questions that follow.

Trees

Mr. Garcia shows Natalie the decaying plants that are turning into soil inside the compost bin in his garden. He tells her that he plans to spread the soil around the trees in his garden to help them grow.

Natalie thinks about Mr. Garcia's compost bin and how trees grow. She draws a model that shows how matter from trees becomes part of the soil.



Natalie asks Mr. Garcia whether soil becomes part of trees as they grow. He tells her about a scientist who conducted an investigation long ago. The scientist measured the mass of a small tree. Then he measured the mass of dry soil that he put into a container and planted the small tree in the container. He took care of the tree as the tree grew larger. Five years later, the scientist took the tree out of the container and dried the soil. Then he measured the mass of the tree and the dry soil again. The table shows the results of the scientist's investigation.

Tree Growth Data

When Mass Was Measured	Mass of Tree (kg)	Mass of Dry Soil (kg)
When planted	2	91
Five years later	77	91

32. Which statement **best** describes how soil helps trees grow?
- A Trees take in food from the soil.
 - B Trees take in matter from the soil.
 - C Trees take in energy from the soil.
 - D Trees take in organisms from the soil.

This question has two parts. Be sure to answer both parts of the question.

33. Part a

Mr. Garcia tells Natalie that some of the matter that organisms need to live is not included in her model.

Which **two** types of matter does Natalie need to add to her model?

- A air
- B water
- C plants
- D animals
- E sunlight

Part b

Which statement supports the answer to Part (a)?

- A Organisms exchange matter with each other.
- B Organisms exchange matter with their environment.
- C Organisms grow when they take in matter from food.
- D Organisms transfer matter from one place to another as they move.

- 34.** Natalie has heard that trees that are planted in the ground and completely wrapped in clear plastic do not grow.

What is the **most likely** reason that trees wrapped in plastic do not grow?

- A** These trees do not have roots.
- B** These trees do not have leaves.
- C** These trees do not absorb sunlight.
- D** These trees do not absorb matter from air.

This question has two parts. Be sure to answer both parts of the question.

- 35.** Natalie decides to repeat the scientist's investigation using a smaller tree in a smaller container. She measures the mass of the tree and container and then plants the tree in the container. Natalie plans to put the tree near a window in the garage and leave the tree alone. After three months, she will come back and measure the mass of the tree and container again.

Natalie claims that her tree will grow taller and wider during the three months in the garage.

Part a

Which sentence describes Natalie's claim?

- A** The claim is correct because trees need light to grow.
- B** The claim is incorrect because trees need water to grow.
- C** The claim is correct because trees need to be in soil to grow.
- D** The claim is incorrect because trees need to be outside to grow.

Part b

Which change could Natalie make to her investigation to help her tree grow faster?

- A** giving the tree some water twice a week
- B** adding some soil to the container twice a week
- C** moving the tree closer to the window twice a week
- D** taking the container outside of the garage twice a week



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