Edulastic

LEAP 2025 Grade 8 Science Practice Test

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Created by Louisiana Educational Assessment Program

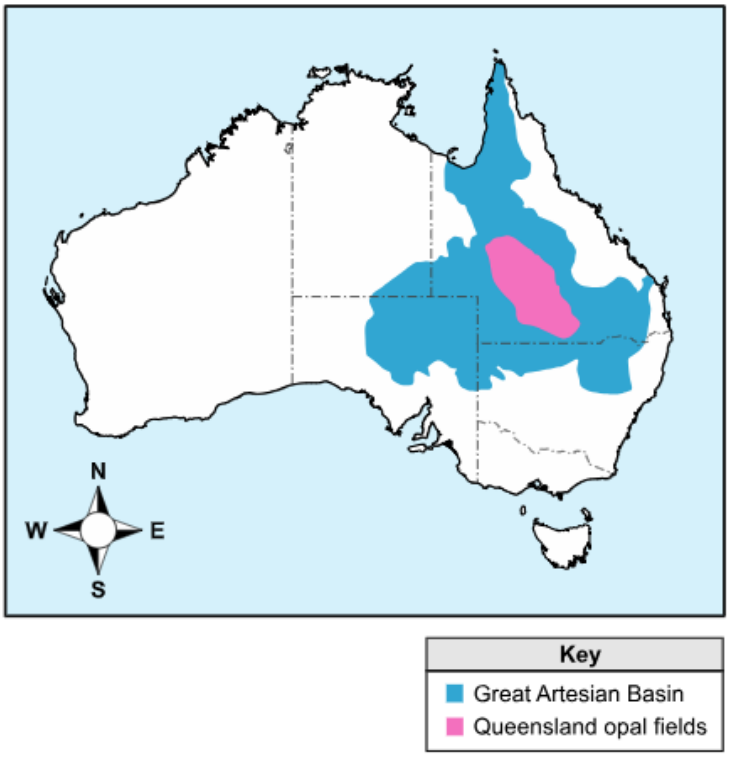
Use the information about opal and your knowledge of science to answer the questions.

Opal

Opal

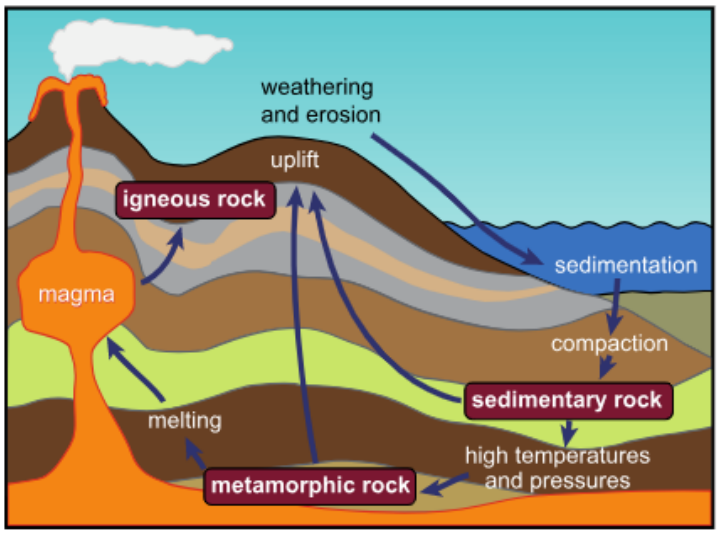
Earth processes form many different types of minerals and gems. One example is a mineral-like substance known as opal. Opal can be found in different areas across the Earth, such as Louisiana, Nevada, and Mexico. Australia is estimated to produce as much as 90 percent of the world's opal supply. Map 1 shows some of the major opal deposits in Australia.

Map 1. Major Opal Deposits in Australia



The process of mineral and gem formation, shown in Figure 1, can help explain how opal is distributed. When sandstone is weathered, it releases grains of sand. Water can then move the sand and other minerals into the cracks formed in other types of rock along the way. When the water evaporates, sand and other materials are left behind. This mixture of sand and other minerals hardens over time, eventually forming opal.

Figure 1. Conditions for Mineral and Gem Formation

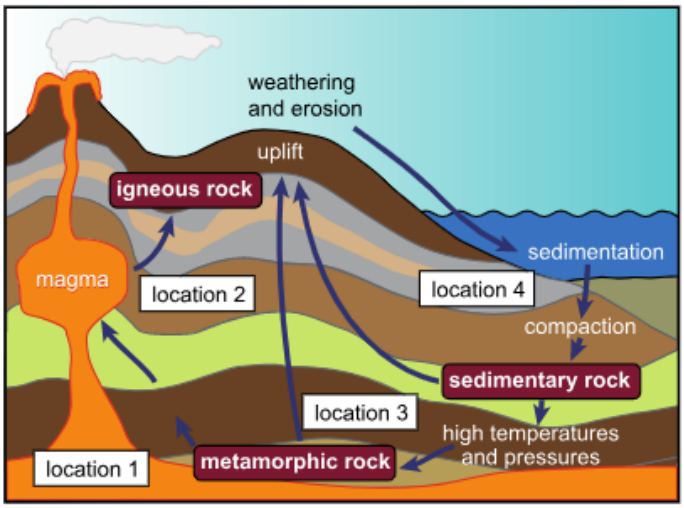


Source: Allen Institute.

There are several environmental concerns to consider when mining opal. Some opal mines use equipment that releases harmful substances into the soil, air, and water. These machines can also heavily compact the soil in these mining areas, which can affect how the soil absorbs water. In some places, large amounts of material are excavated from an open pit in order to recover minerals available in small concentrations. The small concentration increases the amount of material that must be excavated, damaging the landscape for many years, even after a mine has shut down.

Q1: The locations of mineral and gem formation depend on different Earth processes. Some gems need heat, extreme pressure, or even a certain type of rock layer to form.

Which location in the figure shows where opal is **most likely** to form?



Source: Allen Institute.

Select the correct location.

A Location 1

B Location 2

C Location 3

D Location 4

Q2: Certain steps in the mineral extraction process can often have a lasting impact on Earth.

Drag the correct labels into the table to show a primary environmental impact and a secondary environmental impact of a step in the opal extraction process.

Not all labels will be used.

DRAG DROP VALUES

- Local vegetation is damaged or removed.
- Animals move to new locations in search of food sources.
- Risk of flooding in the area decreases.
- Concentration of minerals in the ground is small.

Step in Mining Process	Primary Environmental Impact	Secondary Environmental Impact
Land is cleared for mining and drilling of minerals.		

Q3: **Part A**

Based on the information in the stimulus and Map 1, which statements **best** explain why opal is found in places such as Australia?

Select the **two** correct answers.

- **A** Australia has large amounts of sandstone and silica.
- **B** Opal can only be formed where an ocean comes in contact with land.
- **C** An inland sea once covered central to eastern Australia.
- **D** Australia has a very hot, desertlike climate in most areas.
- **E** Australia has very few active volcanoes across the continent.

Part B

Which statement **best** explains how the conditions identified in Part A affect the availability of opal?

- **A** Weathering processes no longer occur in Australia, so no new opal is formed.
- **B** Gems do not need an exact combination of elements or minerals to form, so opal forms more easily.
- **C** Opal formation occurs over large periods of time, so the number of opal deposits is limited.
- **D** Volcanoes in Australia no longer provide high temperatures and pressures, so no new opal is formed.

Q4: Identify **two** potential improvements to the opal extraction process and explain how these improvements could minimize harm to the environment.

Graded Rubric

Criteria	Rating		
Criteria Name 1	**Rating 1** Student's response correctly identifies two potential improvements to the opal extraction process and explains how both improvements could minimize harm to the environment.	**Rating 2** Student's response correctly identifies one potential improvement to the opal extraction process and explains how this improvement could minimize harm to the environment, but does not identify or explain a second improvement.	**Rating 3** Student's response does **not** correctly identify or explain an improvement to the opal extraction process. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Use the information about glowing jellyfish and your knowledge of science to answer the questions.

Passage

Glowing Jellyfish

Jellyfish and comb jellies have existed in both cold and warm ocean water for more than 500 million years. These two types of organisms have many similar features even though jellyfish and comb jellies are not closely related. Some jellyfish and comb jellies can even produce and emit light, as shown in Photograph 1.

Photograph 1. Jellyfish and Comb Jellies

Jellyfish

Source: NOAA.

Comb Jellies

Source: Wikimedia Commons.

These organisms glow because of a process known as bioluminescence. During this process, a chemical reaction produces light energy that the organism can then emit. A substance known as a luciferase helps a luciferin molecule release this light energy as it reacts with oxygen. In some comb jellies, this chemical reaction is activated when calcium is present. The bioluminescence chemical reaction is shown in Figure 1.

Figure 1. Simplified Bioluminescence Chemical Equation

$$\text{luciferin} + O_2 + \text{calcium} \xrightarrow{\text{luciferase}} \text{oxyluciferin} + CO_2 + \text{light}$$

Bioluminescence can occur in different ways, depending on the organism, but a few factors are common to all bioluminescent organisms. For example, oxygen is a reactant that is always needed. This element is absorbed through the thin cell membranes of the organism. Table 1 summarizes how bioluminescence can be used in different ways.

Table 1. Uses for Bioluminescence

Name of Adaptation	Type	Description
flash illumination	defensive	a quick burst of light confuses predators and allows for escape
counterillumination	defensive	camouflages the organism from predators swimming below
slow glow	offensive	lures prey to the organism
pattern flash	reproductive	used to attract a mate

Scientists are studying the genes needed for bioluminescence in comb jellies. In one experiment, a researcher injected

the DNA needed for bioluminescence into eight rabbit embryos. The embryos were then placed back inside the mother, where they developed normally. When the eight rabbits were born, it was found that two of them had the ability to bioluminesce. Scientists suggest that similar bioluminescent products will soon be possible for human use.

Q5: A population of comb jellies has members that show two distinct traits. One part of the population has male comb jellies that use a complex bioluminescence pattern to attract females. Another part of the population has male and female comb jellies that produce light in quick flashes. A new animal that preys on comb jellies enters the area.

Using Table 1, which statement describes the **most probable** change in the comb jelly population over time due to the introduction of the new predator?

A Only comb jellies whose genes mutate to no longer glow will survive and pass on this trait.

B The comb jellies that have the most complicated patterns will survive to pass on this trait.

C The comb jellies that are able to glow in quick flashes will survive and pass on this trait.

D The two types of comb jellies will have an equal chance to survive and pass on their traits.

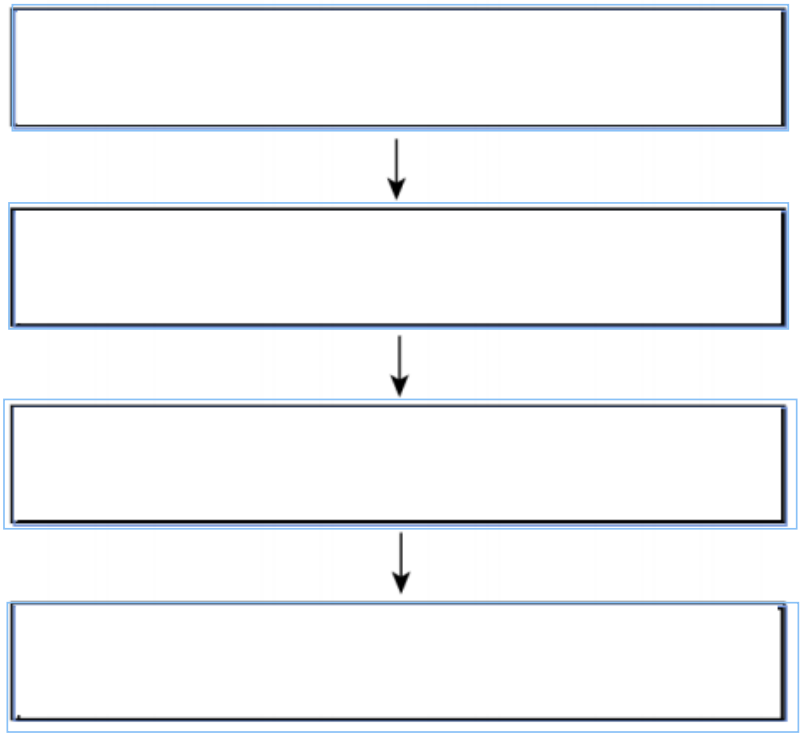
Q6: A large population of comb jellies was found living in an area with a large food source. After a long period of overfishing, the food source in the area significantly decreased. Scientists want to build a model to describe how the change in the availability of food may affect different types of comb jellies in the population.

Drag the statements into the correct order to complete the outline for the scientists' model.

Each statement will be used once.

DRAG DROP VALUES

- Comb jellies that slow glow will attract more prey than comb jellies that do not slow glow.
- The slow-glow genes will get passed on to future generations of comb jellies.
- Slow-glowing comb jellies will be more likely to survive and reproduce.
- Some comb jellies in the population carry genes for producing a slow glow of light.



Q7: Some of the members of a certain population of jellyfish carry genes that allow them to produce quick bursts of light over a short period of time. Which statement describes how this trait will **most likely** affect this population of jellyfish in future generations?

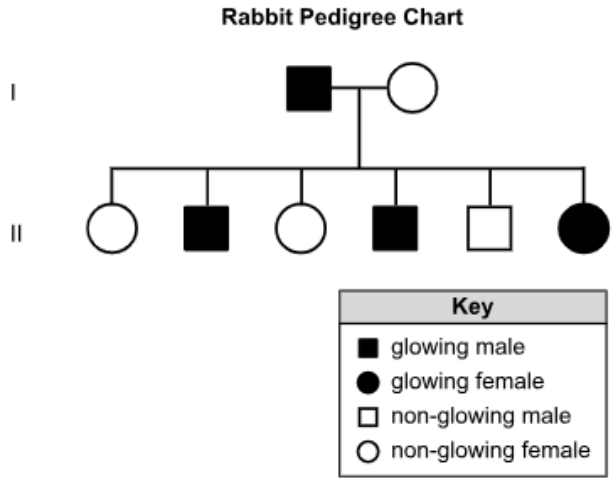
A The percentage of jellyfish with the genes for producing quick bursts of light should increase over time because jellyfish with these genes will be more likely to avoid predators.

B The percentages of jellyfish with and without the genes for producing quick bursts of light should not change because all jellyfish in this population will be better able to hunt prey.

C The percentage of jellyfish with the genes for producing quick bursts of light should decrease because these jellyfish will be more easily caught by predators.

D The genes for producing quick bursts of light should not give any advantage or cause any harm to the jellyfish with these genes.

Q8: The slow-glow gene for bioluminescence is inherited as a dominant trait. One of two rabbits that is born with the bioluminescence gene is a male. This male rabbit is mated with a female rabbit that does not have the bioluminescence gene. The offspring resulting from this mating experiment are shown in the pedigree chart.



Unlike some jellyfish and comb jellies, which are often helped by their ability to glow, rabbits with bioluminescence genes can be more easily spotted by predators.

Use the pedigree chart to describe how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild. Explain how natural selection would affect this probability.

Graded Rubric

Criteria	Rating		
Criteria Name 1	**Rating 1** Student's response correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild and correctly explains how natural selection would affect this probability.	**Rating 2** Student's response correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild OR correctly explains how natural selection would affect this probability.	**Rating 3** Student's response does **not** correctly describe how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild or correctly explain how natural selection would affect this probability. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

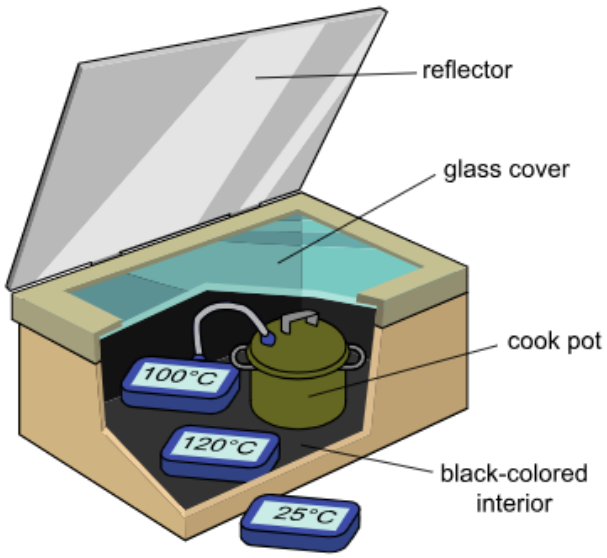
Use the information about a solar cooker and your knowledge of science to answer the questions.

Passage

Solar Cooker

A group of students has decided to design a solar cooker. These devices use energy from the Sun to help cook food. First, the students plan to measure the efficiency of the solar cooker, and then they will test different improvements to their design. The initial design of their solar cooker is shown in Figure 1.

Figure 1. Solar Cooker



The students will first add a measured amount of water to the cook pot. The solar cooker can then be placed in direct sunlight to begin cooking food.

As ultraviolet light from the Sun is transmitted through the glass, the light is absorbed by the black-colored interior of the solar cooker. The black-colored interior then emits thermal infrared radiation as heat waves. Most of this radiation cannot pass back through the glass, causing heat to build up inside the solar cooker and the cook pot. Only the thermal infrared wavelengths of radiation can cook the food. This process of trapping radiation is called the greenhouse effect.

The students note that all of the materials used in the solar cooker are able to conduct at least a small amount of heat. They also observe that more sunlight is transmitted through the glass when it strikes the surface more directly.

Q9: During the solar cooking process, energy is being transferred in several different ways.

Which statements **best** explain the flow of heat energy in the solar cooker design?

Select the **two** correct answers.

A Energy flows from the air outside the solar cooker to the air inside the solar cooker.

B Energy flows from the air inside the solar cooker, through the sides of the cook pot, and to the water.

C Energy flows from the water, through the sides of the cook pot, and to the air inside the solar cooker.

D Energy flows from the air inside the solar cooker, through the sides of the solar cooker, and to the air outside the solar cooker.

E Energy flows from the air outside the solar cooker, through the sides of the solar cooker, and to the air inside the solar cooker.

Q10: Which change to the design of the solar cooker would make the water in the cook pot boil **faster**?

A increasing the volume of water in the cook pot

B changing the interior walls to white instead of black

C using the solar cooker when the outside temperature is cooler

D adjusting the reflector as the Sun moves throughout the day

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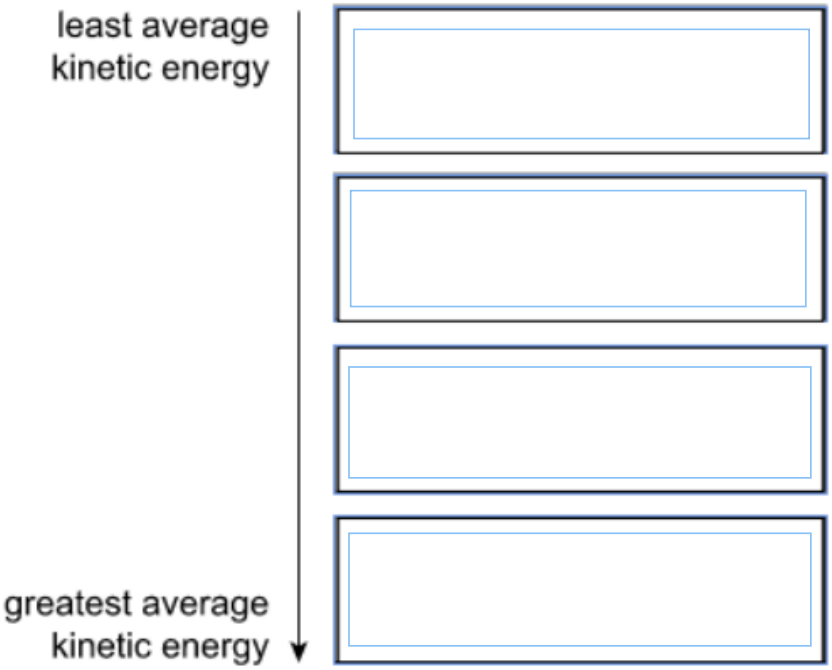
Q11: Drag the different parts of the solar cooker design into the correct order from **least** to **greatest** based on the average kinetic energy of the particles in each part.

Each part will be used once.

DRAG DROP VALUES

- the gas particles inside the cook pot
- the gas particles outside the solar cooker
- the gas particles inside the solar cooker
- the solid particles of the solar cooker walls



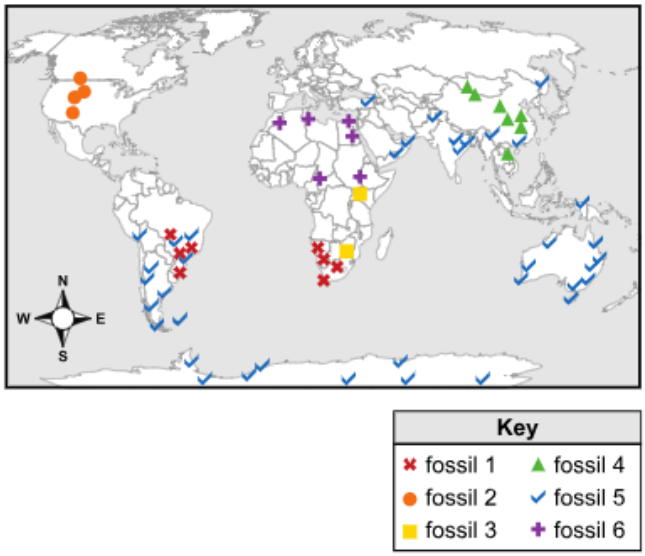
Q12: The students have decided to test how removing the reflective lid will affect the efficiency of the solar cooker. Explain how this change will impact the transfer of thermal energy in the solar cooker design and describe **one** possible design improvement the students can make to compensate for this change.

Graded Rubric

Criteria	Rating		
Criteria Name 1	**Rating 1** Student's response correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design and describes a possible design improvement to the solar cooker to compensate for the change.	**Rating 2** Student's response correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design OR describes a possible design improvement to the solar cooker to compensate for the change.	**Rating 3** Student's response does **not** correctly explain how removing the lid will affect the transfer of thermal energy **or** describe a possible design improvement to the solar cooker. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Q13: Use the information and your knowledge of science to answer the question.

The world map shows the locations where fossils of six different types of organisms have been found.



Source: The Paleobiology Database.

Based on the information in the map, which fossils provide the **best** evidence for past tectonic plate arrangement?

Select the **two** correct answers.

A fossil 1

B fossil 2

C fossil 3

D fossil 4

E fossil 5

F fossil 6

Q14: Use your knowledge of science to answer the questions.

Part A

Based on the organism skulls, which organisms share the **most recent** common ancestor?

Select the **two** correct answers.

A

B

C

D

E

F

Part B

Which fossil shows a skull for an organism that is **most likely** the ancestor for the organisms selected in Part A?

A

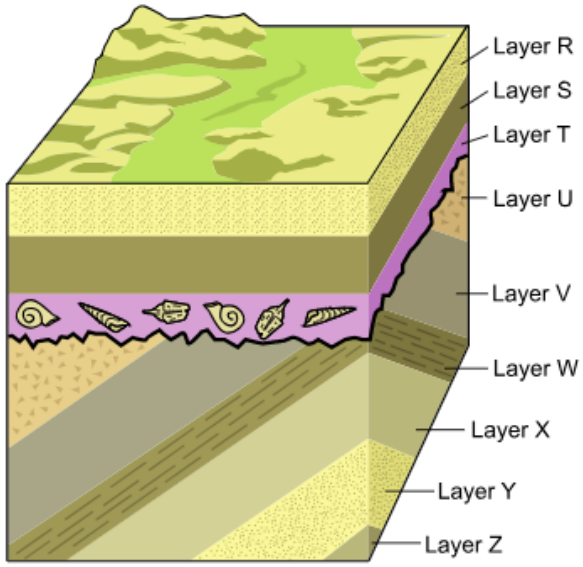
B

C

D

Q15: Use the information and your knowledge of science to answer the questions.

Rock layers can often help scientists compare and date fossils across a geological timeline. These layers can be affected by different Earth processes. The diagram shows a section of rock layers affected by both erosion and tectonic date movement.



Part A

Which timeline of events **best** explains the formation of the rock layers in the diagram?

A Layers R—T formed → Layer T eroded → tectonic pressure pushed layers at an angle → Layers U—Z formed

B Layer Z formed → tectonic pressure pushed layer at an angle → Layers Y—U formed Layers W—U eroded → Layers T—R formed

C tectonic pressure pushed layers at an angle → Layers Z—U formed → Layer T formed → Layer T eroded → Layers S—R formed

D Layers Z—U formed → Layers Z—U eroded → tectonic pressure pushed layers at an angle→ Layers T—R formed

Part B

Which statement explaining the age of the rock layers **best** supports the answer to Part A?

A Rock layers that contain fossils are always the oldest rock layers and can be used to determine the ages of rock layers above them.

B Geologic events like earthquakes can erase rock layers from the geologic timescale and make it difficult to know the ages of different rock layers.

C Older rock layers will always be directly below younger rock layers unless they have been disturbed by geologic activity.

D Rock layers that are the thickest are the oldest because they represent a longer span of time in which the rock layer was formed

Use the information about tsunamis and the Louisiana coast and your knowledge of science to answer the questions.

Passage

Tsunamis and the Louisiana Coast

Scientists recently discovered evidence for an underwater landslide that occurred in the Mississippi Canyon about 7,000 years ago. The undersea canyon is located on the seafloor of the Gulf of Mexico just south of Louisiana. A scar in the canyon suggests that the landslide happened about 50 miles southwest of the Mississippi River outlet. The Mississippi Canyon landslide zone is shown in Map 1.

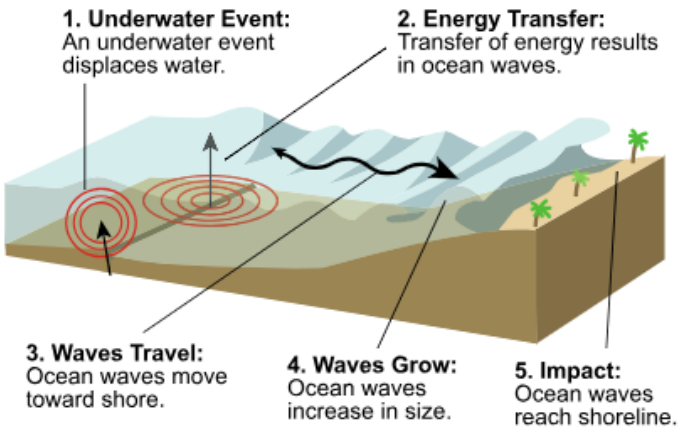
Map 1. Mississippi Canyon Landslide Zone

Source: USGS.

During the landslide, Earth materials from the canyon's upper slope likely broke free and slid down the slope of the canyon until the Earth materials spread out and slowed down. The movement of this material on the bottom of the Gulf of Mexico resulted in a tsunami that eventually reached the Louisiana coast.

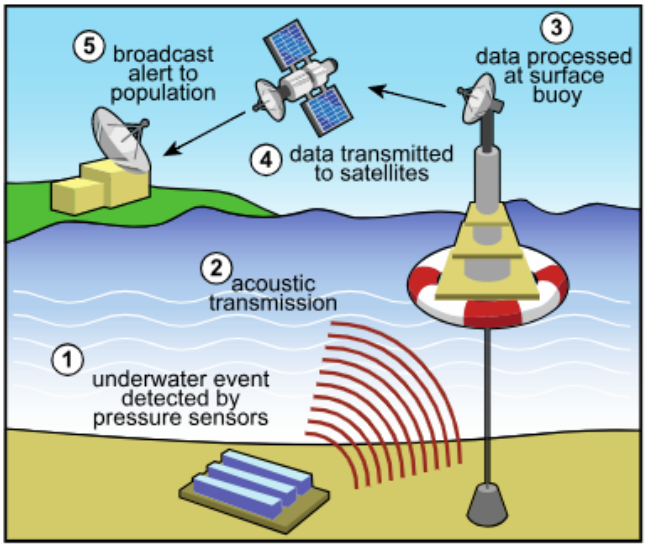
A tsunami usually forms when an event such as a sudden shift in the seafloor, a landslide, or volcanic activity releases a large amount of energy underwater. This causes a large wave to form on the surface. The wave is pulled back down by Earth's gravity and then splits into smaller waves that move outward in all directions. These waves can build to heights of 20 meters before reaching the shoreline. Figure 1 shows how a typical tsunami forms.

Figure 1. Tsunami Wave Formation



The National Tsunami Warning System has a network of sensors to detect underwater events such as landslides and earthquakes. More recently, the Deep-ocean Assessment and Reporting of Tsunamis (DART®) system was developed, as shown in Figure 2. In this system, each sensor has a sensitive pressure recorder on the ocean floor to monitor small changes in water pressure. Any changes in pressure are sent to an anchored flotation device known as a buoy. The data is then sent to a satellite.

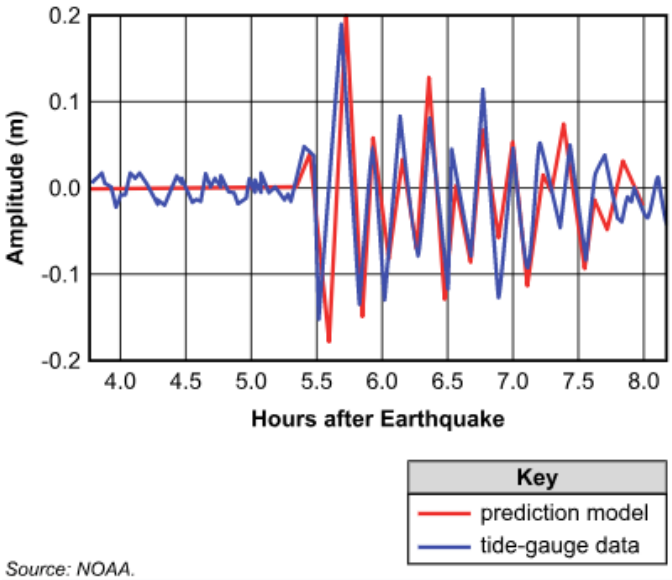
Figure 2. DART® Tsunami Warning System



Source: NOAA.

Data from these events is used to make predictions about tsunamis and provide warnings in coastal areas. Tsunami warning maps can be generated within minutes of an underwater event using the DART system and computer modeling. Graph 1 shows how scientists can use DART data in models to better predict tsunami-related events.

Graph 1. Tsunami Prediction Models



Source: NOAA.

Q16: Based on the data in Graph 1, which factors in the process of tsunami formation are **most** predictable?

Select the **three** correct answers.

A timing of when an earthquake will occur

B changes in the tsunami wave amplitude

C timing of when a tsunami wave reaches the shoreline

D intensity of the earthquake causing the tsunami

E length of time tsunami waves are present after an earthquake

Q17: Use Map 1 to answer the questions.

Scientists monitor tsunamis using detection sensors in the Gulf of Mexico. Several sensor locations are shown on the map.

Tsunami Detection Sensor Locations in Mississippi Canyon Landslide Zone

Source: USGS.

Part A

Based on the map of sensor locations, if a landslide in the Mississippi Canyon were to occur, which tsunami detection sensor location would likely provide the **earliest** warning of a tsunami for point X on the Louisiana coastline?

- **A** sensor P
- **B** sensor Q
- **C** sensor R
- **D** sensor S

Part B

Which statements describe evidence from the stimulus that **best** supports the answer to Part A?

Select **all** that apply.

- **A** Detectors closest to the coastline and detecting the largest waves will provide the earliest warning.
- **B** Detectors closest to the underwater energy event will provide the earliest warning.

C Detectors closest to the entrance of the Gulf of Mexico and detecting changes in water levels will provide the earliest warning.

D Detectors closest to the initial waves formed by an underwater event will provide the earliest warning.

E Detectors closest to the waves with the shortest wavelengths will provide the earliest warning.

Q18: Based on the information in Map 1 and Figure 1, which statement **best** describes why the flow of water out of the Mississippi River should be monitored over time to predict tsunamis in the Gulf of Mexico?

A Changes in the water temperature at the outlet of the Mississippi River could trigger a tsunami once water enters the Gulf of Mexico.

B Sediment in the Mississippi River water could build up near the Mississippi Canyon ledge and trigger a landslide that causes a tsunami.

C A reduction in the quality of the Mississippi 0 River water could trigger an earthquake that causes a tsunami.

D Large amounts of water flowing out of the 0 Mississippi River could trigger a tsunami once water enters the Gulf of Mexico.

Q19: Part A

Based on the information in Figure 1, which statement **best** describes the differences in wave height and wavelength between tsunami waves in shallow water and tsunami waves in deep water?

- **A** Tsunami waves in deep water have very large wave heights and long wavelengths, while tsunami waves in shallow water have very large wave heights and short wavelengths.
- **B** Tsunami waves in deep water have very small wave heights and short wavelengths, while tsunami waves in shallow water have very large wave heights and long wavelengths.
- **C** Tsunami waves in deep water have very small wave heights and long wavelengths, while tsunami waves in shallow water have very large wave heights and short wavelengths.
- **D** Tsunami waves in deep water have very large wave heights and short wavelengths, while tsunami waves in shallow water have very small wave heights and long wavelengths.

Part B

Which statements **best** explain the causes of the differences selected in Part A?

Select **all** that apply.

- [ ] **A** In deep water, there is a larger volume of water, resulting in waves with larger heights.
- [ ] **B** In shallow water, the rising seafloor drags on the bottom of the wave, resulting in a decreasing wavelength.
- [ ] **C** In deep water, there is more space for the energy of the wave to spread out under the water.
- [ ] **D** In shallow water, there is a smaller volume of water, resulting in waves with longer wavelengths.
- [ ] **E** In shallow water, there is less space for the energy of the wave under the water, so the height of the wave increases.
- [ ] **F** In deep water, the energy of the wave that forms decreases dramatically as the wave approaches the shoreline.

Q20: In the past, tsunami predictions depended on readings from individual seismometers and coastal tide gauges. The seismometer data only described the force of the earthquake, but not the resulting tsunami waves. Coastal tide gauges provided data on changes in wave height at different locations. These gauges were often placed near shorelines and were more easily affected by changes in water depth, wave movement, and shape of the harbor.

As you respond to Part A and Part B, follow the directions below.

- Address all of the instructions in each prompt.
- Use evidence from the information provided and your own knowledge of science to support your responses.

Part A

Use evidence from Graph 1 to describe the effectiveness of the forecast models used to predict tsunamis, and explain **two** ways in which the forecast models were less accurate in modeling the actual tsunami data.

Part B

Identify **three** advantages to using the newer DART system and sensors in Figure 2 compared to the seismometers and coastal tide gauges previously used to measure tsunami-related events Explain how **each** of these advantages can improve predictions in accuracy and timing for future tsunami-related events.

Q21: Use the information and your knowledge of science to answer the question.

Before the 1700s, the white-footed mouse, *Permyscus leucopus*, lived in the rural woodlands that once covered the area now known as New York City. As the city expanded, mouse populations have remained in these urban areas. Other mouse populations have also continued to live in the rural areas around New York City. Recent studies show that mice from rural populations have longer teeth than mice from urban populations.

Which statement **best** explains the observation that rural mouse populations have longer teeth than urban mouse populations?

A Food in rural areas requires less chewing, so mice with longer teeth are better suited for rural areas.

B Food in rural areas requires more chewing, so mice with longer teeth are better suited for rural areas.

C Urban mouse populations need much less food than rural mouse populations.

D Urban mouse populations need much more food than rural mouse populations.

Q22: Use the information and your knowledge of science to answer the questions.

A class of students is designing a carrier to help keep foods warmer during long-distance trips. The students plan to use a chemical reaction to help keep the carrier and the food warm. The students have collected temperature data over time using four different chemical reactions, as shown in the table.

Temperature Measurement	Reaction 1	Reaction 2	Reaction 3	Reaction 4
start of reaction	23°C	23°C	23°C	23°C
2 minutes	26°C	90°C	20°C	8°C
10 minutes	36°C	84°C	18°C	17°C
60 minutes	68°C	62°C	14°C	19°C
180 minutes	75°C	29°C	11°C	22°C

Part A

Based on the temperature data in the table, which chemical reaction should the students use for their food carrier design?

- **A** Reaction 1
- **B** Reaction 2
- **C** Reaction 3
- **D** Reaction 4

Part B

Select the correct answer from the drop-down menus to complete the paragraph and explain the answer to Part A.

The chemical reaction that is best suited for the food carrier will [a] energy as the reaction occurs over time. This chemical reaction should also have the [b] temperature over time.

a.
- absord
- release
- have no change in

b.
- most stable
- greatest change in
- highest
- largest decrease in

Q23: Use your knowledge of science to answer the questions.

Part A

Drag the images of embryological development into the correct boxes to complete the diagram of a developing organism.

Not all images will be used.


A


B


C


D

a

b

early development

late development

Part B

Based on the embryological development of four different species of organisms, which organism **most likely** shares the closest evolutionary relationship to the organism in Part A?

A

B

C

D

a.

- A
- B
- C
- D

b.

- A
- B
- C
- D

Use the information about nitinol and your knowledge of science to answer the questions.

Information

Nitinol: The Miracle Metal

Nitinol is an alloy made from nickel and titanium. Alloys contain mixtures of a metal and other elements, often other metals. One advantage to making alloys such as nitinol is that the properties of the alloy can more easily be adjusted. Table 1 shows some properties of nickel, titanium, and nitinol.

Table 1. Properties of Nickel, Titanium, and Nitinol

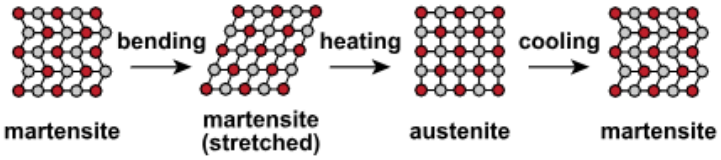
Metal or Alloy	Hardness at 20°C	Shape Memory	Density (g/cm^3)
nickel	hard	no	8.91
titanium	hard	no	4.51
nitinol	soft	yes	6.45

Source: Royal Society of Chemistry.

One very interesting property of alloys such as nitinol is shape memory. Shape memory alloys can be bent or twisted into different shapes. The alloys can then be returned to their original shape by heating them. This property can be explained by looking at the different crystal structures for nitinol.

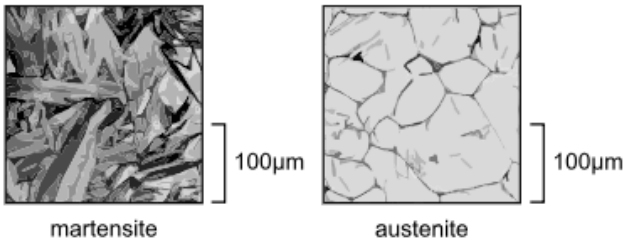
A piece of nitinol starts as a soft, bendable crystal structure form called martensite. Bending or twisting the nitinol into a new shape results in a slightly different "stretched" martensite crystal structure. If the nitinol is then heated, the nitinol crystal structure changes to the austenite form and starts to return to its original shape. The piece of nitinol returns to the original martensite crystal structure after completely cooling. The different nitinol crystal structures are shown in Figure 1.

Figure 1. Crystal Structure Changes in Nitinol



Differences in the crystal structures of martensite and austenite are visible under a microscope, as shown in Figure 2.

Figure 2. Microscopic Crystal Structures of Martensite and Austenite



Source: Hawkins.

The shape memory properties of nitinol allow it to be used in many unique ways. Since nitinol can change shape when heated, nitinol wire is often used as a switch in thermostats and temperature control devices. Nitinol tubing is also commonly used in the field of medicine to help open arteries and veins.

Q24: Based on the properties in Table 1, which example describes the **best** use of nitinol in a manufactured product?

- **A** making lightweight aircraft parts
- **B** making jewelry that is resistant to scratching
- **C** making heavy bicycle frames
- **D** making flexible eyeglass frames

Q25: Using Figure 1, select the correct answers from the drop-down menus to complete the paragraph.

All forms of nitinol have [a] types of atoms, but the different forms of nitinol have different properties because the [b] change. The atoms in the martensite molecules can [c] than the atoms in the austenite molecules.

a.
- the same
- different

b.
- types of atoms
- sizes of atoms
- positions of atoms
- number of atoms

c.
- become bigger
- become smaller
- move more easily
- move less easily

Q26: Like nitinol, steel is an alloy. Steel is mainly a mixture of iron and other elements, and is commonly used in frames for large buildings.

Which statements **best** explain why steel alloys are more often used than iron metal in large building frames?

Select the **two** correct answers.

- **A** Iron can be easily shaped and bent.
- **B** Adding other elements to iron increases its strength.
- **C** The physical properties of steel and iron are nearly identical.
- **D** Steel contains more than one element.
- **E** The properties of steel can be changed.

Q27: Using Table 1 and Figure 1, describe **two** differences in the atomic structure of nitinol and the atomic structure of either nickel or titanium that result in different physical properties of the elements used to make nitinol.

Graded Rubric

Criteria	Rating		
Criteria Name 1	**Rating 1** Student's response correctly describes **two** differences in the atomic structure of nitinol and the atomic structure of either nickel or titanium that result in different physical properties of the elements used to make nitinol.	**Rating 2** Student's response correctly describes **one** difference in the atomic structure of nitinol and the atomic structure of either nickel or titanium that results in different physical properties of the elements used to make nitinol, but does not correctly describe a second difference.	**Rating 3** Student's response does **not** correctly describe a difference in the atomic structure between nitinol and either nickel or titanium that results in different physical properties. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

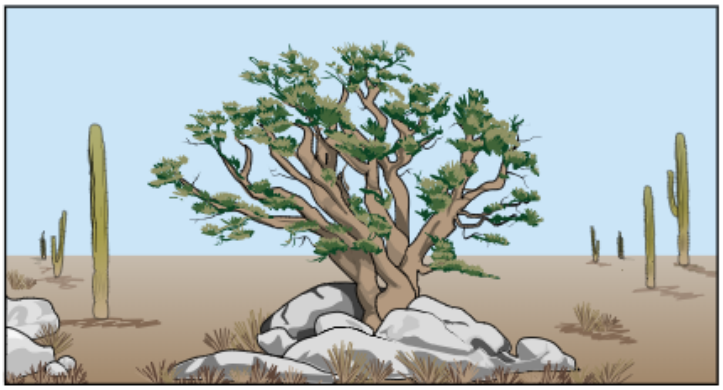
Use the information about surviving in desert landscapes and your knowledge of science to answer the questions.

Passage

Surviving in Desert Landscapes

An elephant tree is a type of tree that thrives in a desert climate. This tree has adapted over several years to survive in areas with little water, intense sunlight, and temperature extremes. Figure 1 shows an elephant tree in its natural desert habitat.

Figure 1. Elephant Tree in an Arid Desert



When it rains in the desert, the water quickly evaporates. Many desert plants have specialized structures that allow the plants to take in as much water as possible from the ground before the water is lost to evaporation. Their roots spread out near the surface of the soil to more efficiently collect water. On the rare occasions when it rains, plants like the elephant tree are also able to store water in their trunks and branches.

Another characteristic of some desert plants like the elephant tree is that they only open their leaf pores, or stomata, at night to allow an exchange of gases with the atmosphere. The plants store the gases absorbed at night until the next day's sunlight makes it possible for photosynthesis to occur In seasons when the elephant tree has lost its leaves, the tree can still photosynthesize in the outer layer of its bark.

Q28: Which adaptation to a dry climate **most** helps the elephant tree continue to grow by reducing the loss of moisture?

A a deep root system

B loss of leaves during a drought

C photosynthesis in the bark

D closing of stomata in daylight

Q29: Some desert plants produce groups of seeds where only a small portion of the group germinates each year. Which statement **best** explains how this type of seed germination affects the probability that these desert plants will reproduce?

A The plants are more likely to reproduce because fewer total seeds germinate.

B The plants are more likely to reproduce because the germinated seeds that die during drought periods are only a small portion of the total seeds.

C The plants are less likely to reproduce because all of the seeds do not germinate at the same time.

D The plants are less likely to reproduce because only a small portion of the total seeds will germinate and grow into plants during wet periods.

Q30: Select the correct answers from **each** drop-down menu to complete the description of desert plant adaptations.

Desert plants become dormant or stop growing temporarily during the [a] season. These rants begin their growth cycles again during the [b] season. By absorbing and storing [c] at night, many desert plants can minimize evaporation during growth periods.

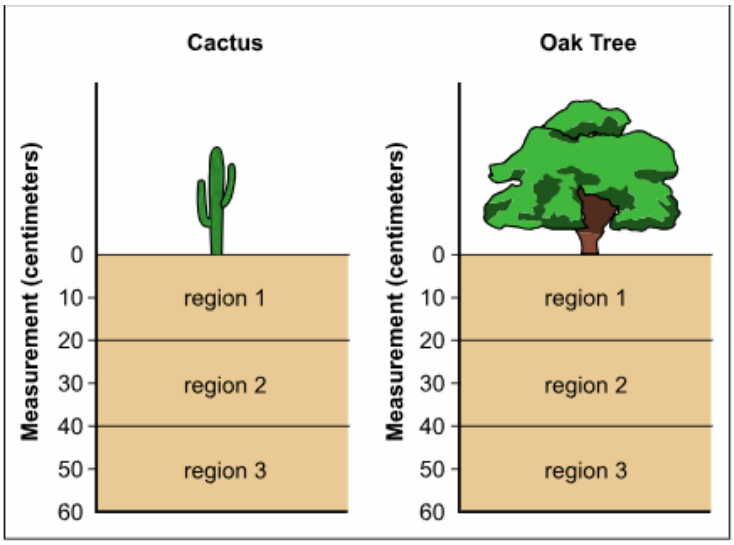
a.
- wet
- dry
- cold
- temperate

b.
- wet
- dry
- warm
- temperate

c.
- oxygen
- nitrogen
- sugar
- carbon dioxide

Q31: Part A

Select the correct region in each graph to show the **most likely** root length for each plant from the drop down below.



Cactus a

Oak Tree b

Part B

Which information can **best** be used as evidence to support the answer to Part A?

Select **all** that apply.

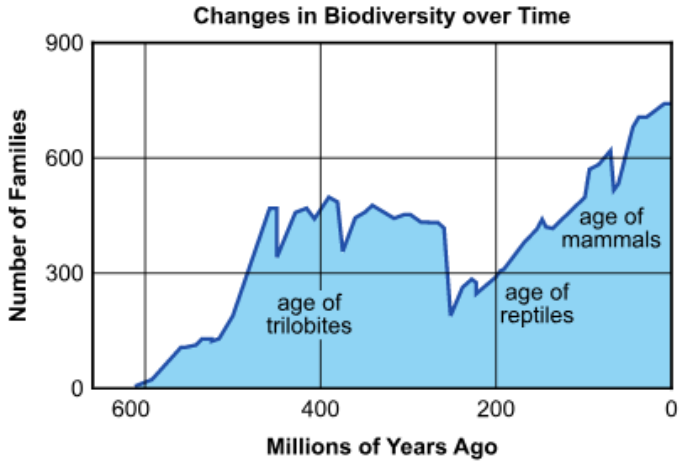
- **A** Desert areas have less precipitation than non-desert areas.
- **B** Both desert and non-desert plants absorb light from the Sun.
- **C** Plants in both desert and non-desert areas can grow leaves.
- **D** Lower temperatures in non-desert areas reduce the rate of evaporation.
- **E** Desert areas are most often found at low latitudes.

a.
- region 1
- region 2
- region 3

b.
- region 1
- region 2
- region 3

Q32: Use the information and your knowledge of science to answer the question.

The graph shows how the numbers of different types of organisms have changed throughout different periods in the geologic timescale.



Source: The Washington Post.

Which statement about the numbers of different types of organisms is **not** supported by the data in the graph?

A Mass extinction events are followed by periods of an increase in organism diversity.

B Smaller extinction events occur between periods of mass extinctions.

C Organism diversity has been greatest in the last 100 million years.

D The overall amount of organism diversity has decreased over time.

Q33: Use the information and your knowledge of science to answer the question.

A group of students was hiking along a riverbank in Louisiana and found a fossil of a shell in the gravel. One student identified the shelled organism as an organism that once lived on the seafloor.

Which student **best** explains how the shelled organism fossil formed over time?

A Student A states that the organism must have traveled to the river from the ocean and that the fossil formed over the last few years.

B Student B states that the organism must have traveled to the river from the ocean and that the fossil formed over the last few thousand years.

C Student C states that the Louisiana area must have once been covered by the sea and that the fossil formed over hundreds of years.

D Student D states that the Louisiana area must have once been covered by the sea and that the fossil formed over millions of years.

Q34: Use the information and your knowledge of science to answer the question.

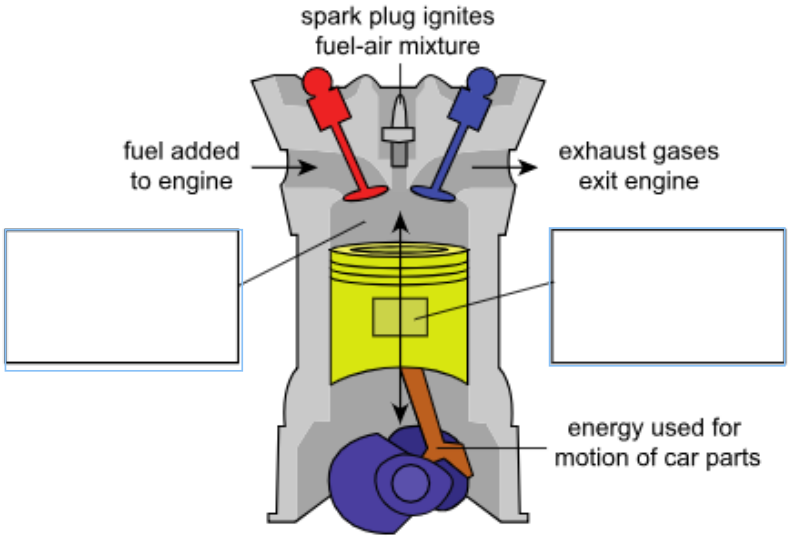
Engines help vehicles move by burning different types of fuels. Gasoline is a common fuel that is made of molecules containing hydrogen and carbon atoms. A spark plug is used to burn a mixture of fuel and air in the engine. This process causes the fuel-air mixture to expand and move a piston up and down, eventually resulting in the motion of different parts of the car.

Drag the descriptions into the correct boxes to complete the diagram showing the flow of energy in an engine.

Not all descriptions will be used.

DRAG DROP VALUES

- Chemical energy is released and then transformed into thermal energy.
- Chemical energy is absorbed and then transformed into thermal energy.
- Thermal energy is transformed into chemical energy.
- Thermal energy is transformed into mechanical energy.

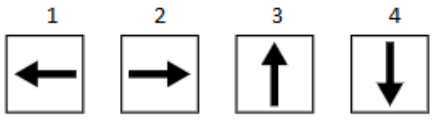


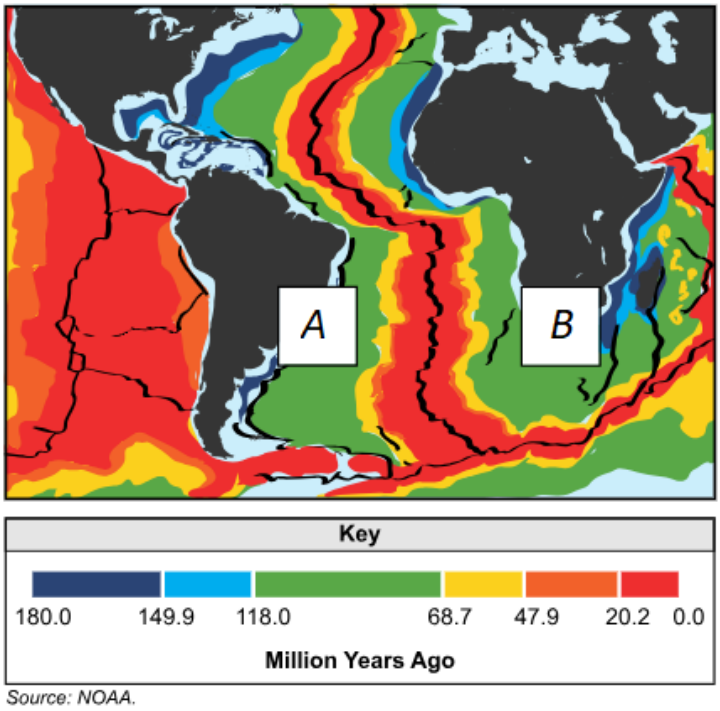
Q35: Part A

Use the information and your knowledge of science to answer the questions.

The map shows how tectonic plate movement can affect the age of the ocean floor over time.
Select the arrows that should go in box A and box B from the drop-down below to complete the map to show the most likely directions of plate movement.

Not all arrows will be used.





Source: NOAA.

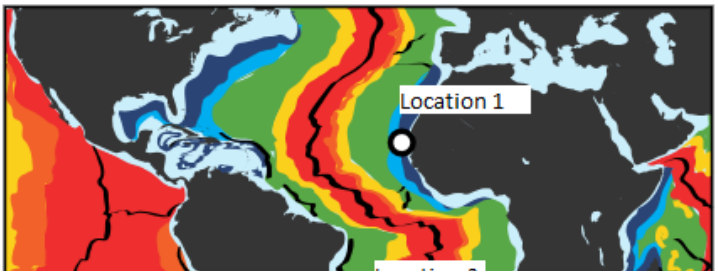
Box A = Arrow b

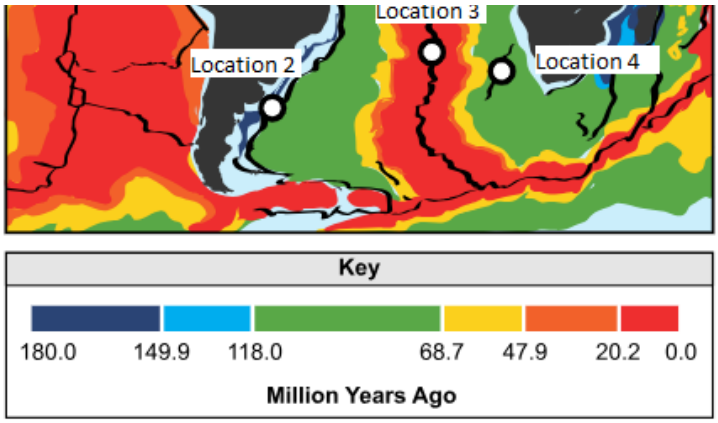
Box B = Arrow a

Part B

Which location on the map is a ridge most likely to be found at?

Select the correct location.





Source: NOAA.

Location C

a.
- 1
- 2
- 3
- 4

b.
- 1
- 2
- 3
- 4

c.
- 1
- 2
- 3
- 4

Q36: Use the information and your knowledge of science to answer the question.

The Natural Bridge Caverns in Texas contain several kinds of cave formations, such as stalagmites and stalactites. These caves are usually formed when water passes through different types of rock, such as limestone, and then dissolves the rock. The water then transports and deposits some of the rock in different cave formations. These cave formations can be formed in many different ways, such as when water flows over the walls and floors of the cave, drips or evaporates from the roof of the cave, or drops onto the cave floor. The history of each cave can be better understood by studying the ages of the cave formations found within the cave.

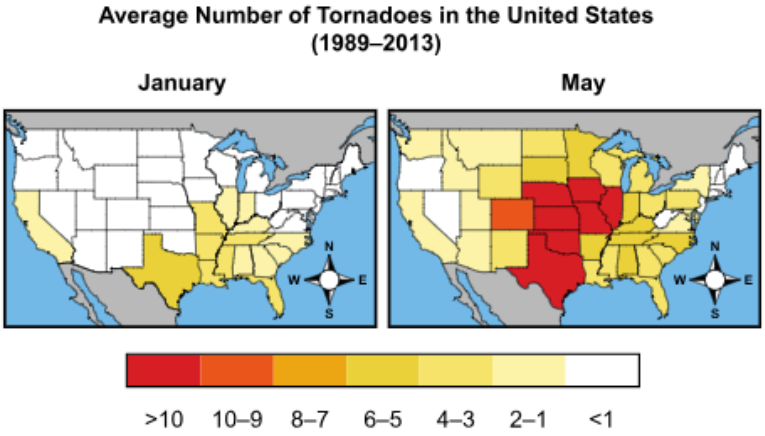
Which data would be **most useful** in determining the ages of the cave formations in the Natural Bridge Caverns?

Select the **three** correct answers.

- **A** the number of cave formations in the caves
- **B** the amount of water moving through the caves
- **C** the average amount of precipitation in the Texas area
- **D** the types of rocks in the caves
- **E** the rate at which cave formations occur over a period of time
- **F** the amount of light in the caves

Q37: Use the information and your knowledge of science to answer the question.

A number of researchers have been collecting data on where tornadoes most often occur throughout the United States. The maps of these data show the average number of tornadoes that occur in each state for the months of January and May.



Source: NOAA.

Which statements **best** identify tornado forecasting patterns that are supported by the data?
Select the **three** correct answers.

A Homes in the western section of the United States are at the greatest risk of being damaged by a tornado.

B Populations along the East Coast of the United States are at a greater risk from tornadoes during the winter months.

C Tornadoes are more likely to occur in the United States in the spring and summer months.

D Northern states have less risk of being affected by tornadoes than southern states.

E The greatest number of tornadoes occur in the Southeast during winter months.

F Areas in the central United States need tornado shelters most during the summer months.

Q38: Use the information and your knowledge of science to answer the question.

Select the sentence from the information that **best** supports which insulation material should be used to minimize the loss of thermal energy from a home.

Open-Cell Spray Foam

he cheapest spray foam option is known as open-cell. so-called because the bubbles inside of the foam never completely close. As the foam expands, air gets trapped in between the broken bubbles. These bubbles allow water to pass through them. which can be good or bad depending on the application. Although open-cell spray foam works well for filling in and around wires, pipes, and other obstacles, its insulating power is not very high.

Source: *"What is the Best Insulation?" by Corey Binford.*

Closed-Cell Spray Foam

The bubbles or cells in closed-cell spray foam are closed and tightly packed together. This makes closed-cell spray foam much denser and stronger than open-cell spray foam.It will not absorb water or allow air to pass through it. This is because the bubbles in closed-cell foam are filled with a gas, making them much smaller and a better insulator.

Source: "What is the Best Insulation?" by Corey binford.

Vegetable Spray Foams

A new, greener generation of vegetable-based spray foams uses small amounts of oils from soy, sugarcane, corn fructose, and other botanical sources, plus a minimum of 5 percent recycled content. Vegetable-based foams are blown with water. carbon dioxide. or hydrofluorocarbons (HFCs), Which do not damage the ozone layer.
The more environmentally sound versions are low density meaning , they also have a lower insulating power than the denser. more toxic varieties.

Source: "The Best Insulation Types for Your Home" from Mother Earth Living by Susan Lahey.

Q39: Use the information and your knowledge of science to answer the questions.

A geologist recorded fossil data for three different organisms found in a rock layer:

- **Fossil X:** existed 510 to 250 million years ago, is found in very few locations, and has unique fossil features.
- **Fossil Y:** existed 100 to 65 million years ago, is found in many different locations, and has unique fossil features.
- **Fossil Z:** existed 400 million years ago to present day, is found in many different locations, and has similar features to other fossils.

Part A

Which statement **best** explains which fossil the geologist should use to compare the rock layer to other layers and estimate when the layers were deposited?

A Fossil X, because the fossil has unique features and is only found in a few locations.

B Fossil Z, because the fossil has features similar to other fossils and is found in many different locations.

C Fossil Y, because the organism existed over the shortest time range and the fossil is found in many different locations.

D Fossil Z, because the organism existed over the largest time range and the fossil is found in many different locations.

Part B

Which statement explains what the geologist will **most likely** see when comparing fossils for different species of the organism selected in Part A?

A Organisms in both younger and older fossils should be about the same complexity.

B Organisms in older fossils should be more complex than organisms in younger fossils.

C Organisms in younger fossils should be more complex than organisms in older fossils.

D Organisms in the fossils show a random pattern of complexity based on the age of the fossil.

Q40: Use the information and your knowledge of science to answer the question.

Thousands of minerals can be found on Earth's surface. Some minerals are very common and can be found at locations all around the world. Other minerals are extremely rare and can only be found in one or two locations on Earth.

Select the mineral that is **most likely** to be found in many locations around the world, and select the text that best supports the mineral selection.

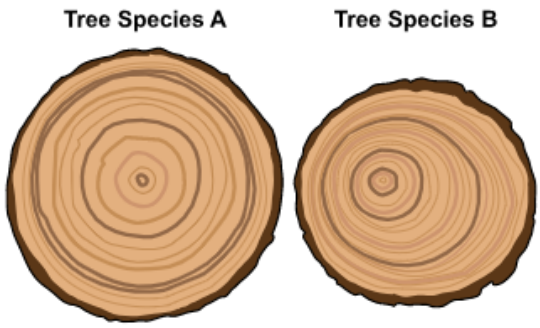
Mineral A forms where vanadium and copper exist together at fumaroles, or openings, on the sides of volcanic mountains. As gases pass through the openings, the mineral forms along the surface of the fumaroles and then washes away when it rains.

Mineral B forms under high temperature and pressure around 100 miles below Earth's surface. After forming, it is then brought to the surface through violent volcanic eruptions and is one of the hardest minerals on the Mohs hardness scale.

Mineral C is found where silica and oxygen naturally occur and is formed when the silica and oxygen combine. The mineral does not require a specific temperature or pressure to form and is resistant to weathering.

Q41: Use the information and your knowledge of science to answer the question.

As trees grow over time, the trees form new cells in circles called annual growth rings. These rings show the amount of wood produced during one growing season or year, as well as the effects of different environmental conditions on the tree. The figure shows the growth rings for two different types of trees growing in the same forest area.



Which statements **best** explain the similarities and differences seen in the growth rings of these two trees?

Select the **three** correct answers.

A Years with drought or very little precipitation most likely resulted in smaller tree rings.

B Environmental conditions in this forest area were the same each year and resulted in consistent growth for both trees.

C Different species of trees grow at the same rates when exposed to the same conditions.

D Tree species A grew at a slower rate than tree species B.

E Tree species A most likely received more water than tree species B.

F Larger tree rings on one side of tree species B most likely resulted from more room to grow on that side of the tree.