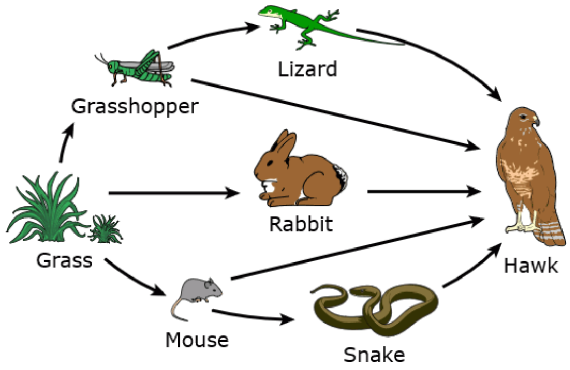
Multipart Examples - Science

These document shows new style labeling and splitting up of multipart problems. The labeling and spacing can be changed on the Format tab in Problem-Attic. All problems are scorable when delivered as an online test.

1. A food web for a forest ecosystem is shown. The arrows indicate the flow of energy.



Part A

What statement best describes the role of the grass plants in the food web?

A. The grass plants break down dead plants and animals.

B. The grass plants are producers that make their own food.

C. The grass plants are the main food for the snake and lizard.

D. The grass plants are the main source of energy for the hawk.

Part B

Complete the statement by selecting the correct word from the menu.

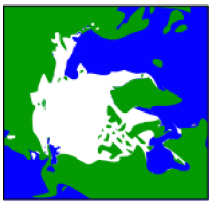
One of the limitations of this food web is that [producers / consumers / decomposers] are not included.

2. Scientists studied the extent of Arctic sea ice from 1978 to 2016. Observations from selected years are shown in the maps. The white areas show the extent of the sea ice in November of the indicated year. The dark blue areas are ice-free ocean and the green areas are continents in all of the maps.

1978

1990

2000



2016

Part A

Based on the Arctic sea ice images from 1978 to 2016, what is *most likely* going to occur from 2017 to 2027?

A. Arctic sea ice will move to other parts of the ocean.

B. Arctic sea ice will freeze and melt at the same rate.

C. Arctic sea ice will continue to melt at an increasing rate.

D. Arctic sea ice will continue to expand until it exceeds its 1978 extent.

Part B

Choose the best words to complete the statement.

Melting Arctic sea ice contributes to a positive feedback loop in the Arctic. As Arctic sea ice melts, [more / less] sunlight is reflected and the temperature of the Arctic Ocean [increases / decreases].

3. The following question has two parts.

You may use the Periodic Table Reference Sheet to answer this question.

Part A

Sodium chloride, commonly known as table salt, is made of sodium (Na) ions and chloride (Cl) ions. Which of the following is the simplest formula unit for sodium chloride?

A. NaCl
C. $NaCl_2$
B. Na_2Cl
D. Na_3Cl_2

Part B

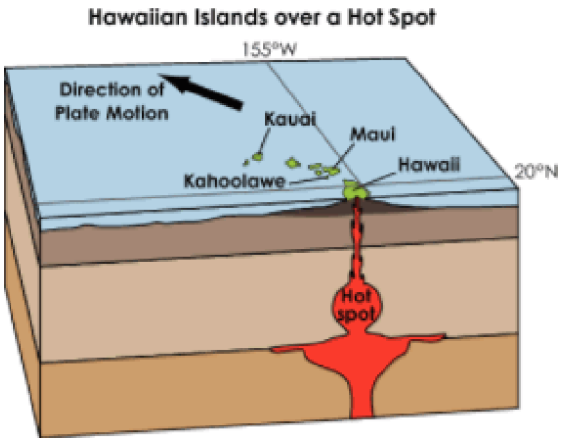
Enter the correct number into each box to complete the sentences.

This formula is best because a sodium atom has [ ] valence electron(s) and a chlorine atom has [ ] valence electron(s). Sodium forms an ion with a [ ] charge and chlorine forms an ion with a [ ] charge.

4. The following question has two parts. First, answer Part A. Then, answer Part B.

Part A

The Hawaiian islands were formed over a "hot spot" as shown in the diagram.



Which island was formed first?

A. Hawaii
C. Kauai
B. Kahoolawe
D. Maui

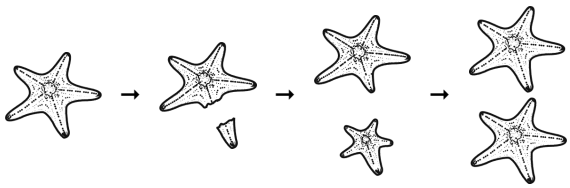
Part B

Select the *three* pieces of evidence from the diagram that support your choice for the first island formed.

- ❍ depth of the hot spot
- ❍ distance from the hot spot
- ❍ size and shape of the island
- ❍ direction of plate movement
- ❍ presence of an active volcano
- ❍ latitude and longitude of the island and hot spot

5. The model shows a starfish undergoing the process of regeneration.

Starfish Undergoing Regeneration



Part A

Select one word or phrase in each set to *best* describe the process of regeneration.

Regeneration is a form of [sexual / asexual] reproduction. Following regeneration, the DNA of the offspring is [identical to / different from] the DNA of the parent.

Part B

Which statement *best* describes a *negative* effect of regeneration on a starfish population?

A. The genetic variation within the starfish population decreases.

B. The number of genetic mutations in the starfish population increases.

C. Regenerated starfish reproduce less often than starfish that have not regenerated.

D. Regenerated starfish are eaten by predators more often than starfish that have not regenerated.

6. Lichens are made up of two tiny living things: fungi and algae. The fungi and the algae live close together, giving a lichen the appearance that it is a single organism. Algae produce food through photosynthesis, and the fungi gather water. In this way, lichens can survive harsh weather that would kill a fungus or an alga growing on its own. Lichens can grow on sand, trees, and even rocks, but they are very sensitive to pollution sources and are seldom observed near factories or roads.

Part A

Which type of relationship is *best* represented by fungi and algae in a lichen?

A. parasitic

B. symbiotic

C. predator-prey

D. competitive

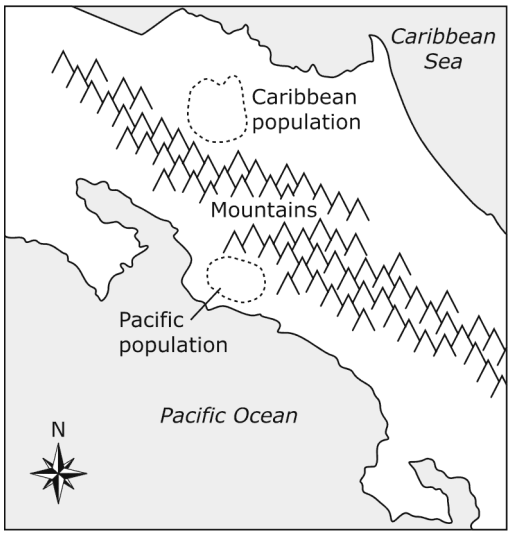
Part B

Which statements are evidence that supports the answer to Part A?

Select *all* that apply.

- ❍ Lichens are sensitive to pollution.
- ❍ Algae can live on their own, but fungi cannot.
- ❍ Fungi and algae are different types of organisms.
- ❍ Algae produce food, but fungi do not.
- ❍ Fungi and algae have different ways of using energy.
- ❍ Fungi gather water much better than algae do.

7. Two populations of venomous snakes live in Central America. These two snake populations are the same species, but they are separated by a mountain range, as shown on the map.



Part A

Which of the following provides the best evidence that these two snake populations are geographically isolated?

A. variation in the number of individuals in each population

B. a difference in the temperature ranges of each population's habitat

C. variation in the types of organisms sharing each population's habitat

D. a difference in the protein composition of the venom in each population

Part B

Which of the following could be compared to determine whether the evidence identified in Part a was the result of reproductive isolation in these two snake populations?

A. similar diets of individuals from each population

B. similar fossilized structures of individuals from each population

C. sequences of the same genes in individuals from each population

D. stages of embryonic development in individuals from each population

8. Humans use energy and fuels in their daily lives.

Part A

Which of the following best describes the energy and fuels humans use?

A. Energy and fuels always produce electricity.

B. Energy and fuels always are made from rocks.

C. Energy and fuels always come from natural resources.

Part B

Coal, wind, natural gas, and ocean tides are types of energy sources.

Which of the following tables correctly identifies the energy sources as renewable or nonrenewable energy sources?

A.

Renewable	Nonrenewable
coal	ocean tides
natural gas	wind

B.

Renewable	Nonrenewable
ocean tides	coal
wind	natural gas

C.

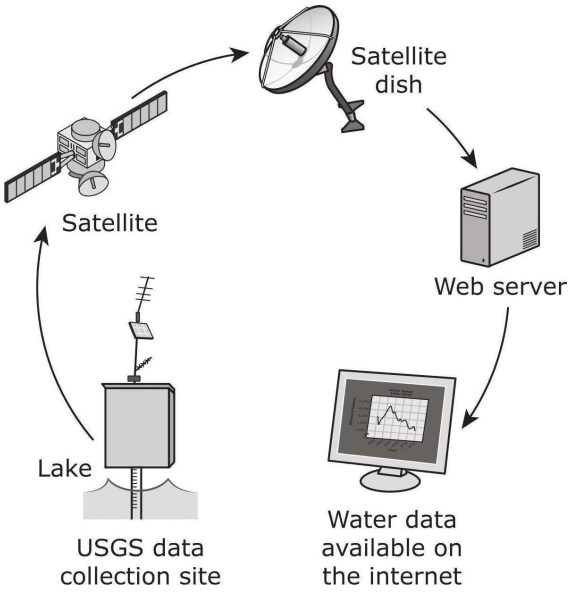
Renewable	Nonrenewable
coal	ocean tides
wind	natural gas

D.

Renewable	Nonrenewable
wind	coal
natural gas	ocean tides

9. This question has two parts.

The diagram shows an example of a communication system for a United States Geological Survey (USGS) data collection site that collects information about water in a lake.



Part A

What is the source of the message in this communication system?

A. the satellite

B. the satellite dish

C. the USGS data collection site

D. the water data available on the internet

Part B

Which of the following is the storage for this communication system?

A. the lake

B. the satellite

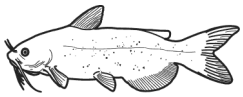
C. the satellite dish

D. the web server

10. **Part A**

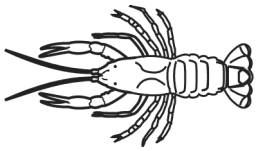
Place the letter below each organism in the boxes to complete the food chain.

A



channel catfish

B



crayfish

C

double-crested cormorant

D

aquatic plant

Channel Catfish Food Chain

□ → □ → □ → □

Part B

Complete the chart by classifying each organism as a producer or as a consumer.

	Producer	Consumer
channel catfish	❍	❍
crayfish	❍	❍
double-crested cormorant	❍	❍
aquatic plant	❍	❍

11. Some of the elements given bond ionically while others bond covalently. Given the name for each compound, determine the type and number of atoms needed to represent the composition of the compound.

Part A

Place the type and number of atoms into the chart to represent the composition of each ionic compound.

Ca C CI F

O Na S

Ionic Compounds

Compound Name	Composing Elements
Sodium oxide	
Calcium fluoride	

Part B

Place the type and number of atoms into the chart to represent the composition of each covalent compound.

Ca C CI F

O Na S

Covalent Compounds

Compound Name	Composing Elements
Carbon monoxide	
Sulfur dioxide	

- You may use each element more than once.
- You do *not* need to use all of the elements.

12. This question has two parts. First, answer Part A. Then, answer Part B.

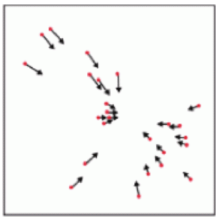
Part A

A student is trying to construct a model of the universe as it will appear several billion years from now. The student has determined everything except the distribution of galaxies. The current distribution of galaxies is shown in the diagram.

Current Distribution of Galaxies

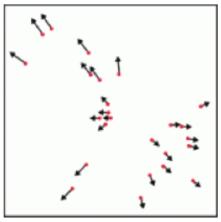
Which diagram represents how the current distribution of galaxies would need to change to represent the future distribution of galaxies several billion years from now?

A.



C.

B.



D.

Part B

Select all of the choices that give observations that support the future distribution of galaxies several billion years from now.

- ❍ Inertia
- ❍ Gravity
- ❍ Red Shift
- ❍ Hubble's law for galaxies
- ❍ Hertzprung-Russell Diagram

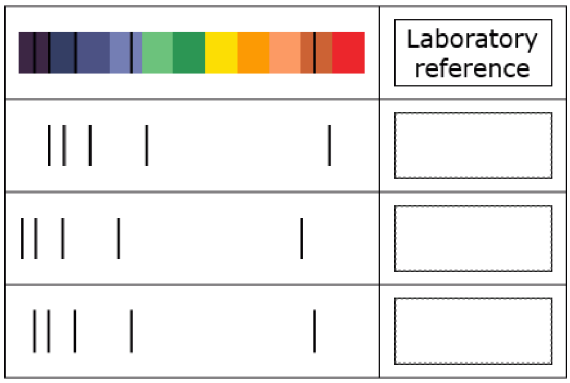
13. Scientists observe the light spectra from distant galaxies. The absorption lines in a spectrum from a galaxy moving away from Earth are observed to be shifted to longer wavelengths (redshift). The absorption lines from an approaching galaxy shift to shorter wavelengths (blueshift).

Part A

The diagram shows the spectra of three distant galaxies. Each spectrum shows the absorption lines from hydrogen. The pattern of absorption lines is the same for each galaxy, but the wavelengths of the lines are different. The laboratory reference shows the wavelengths of the hydrogen absorption lines as measured on Earth. Choose the correct label for each spectrum to identify whether the spectrum is redshifted, blueshifted, or not shifted.

Labels

No Shift | Blueshift | Redshift



14. A student competes in the long jump track event. She runs forward, jumps up into the air as she runs, reaches her highest point, and returns to the ground.

Part A

A student claims that gravity acts on the long jumper throughout her jump. Which statement best supports this claim?

A. Objects weigh less on the moon than on Earth.

B. Objects thrown up in the air return back to Earth.

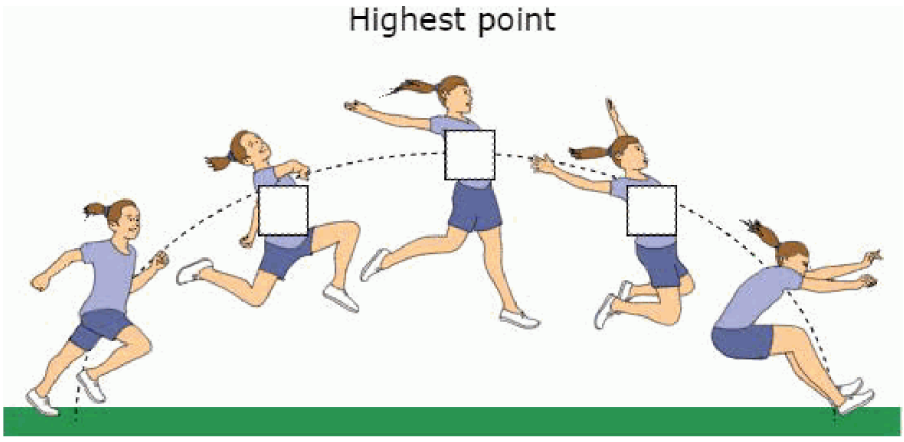
C. Heavy objects fall at the same speed as light ones.

D. The force of gravity decreases as the distance between objects increases.

Part B

For each location in the picture, drag the arrow that shows the direction of the force of gravity on the long jumper as she moves through the air. Each arrow can be used as many times as needed.

↓ ↑ ← →



15. A student uses wax crayons to model different parts of the rock cycle. The model has several steps as shown.

Part A

Match the process to the step that most closely models that part of the rock cycle. Each process is used only once.

Processes

Weathering and erosion of igneous rock	Formation of metamorphic rock	Formation of sedimentary rock
Magma or lava forming igneous rock	Metamorphic rock changing into magma	

Step	Process
Crayons are grated into small pieces.	
↓	
Grated pieces of crayons are squeezed together with hands.	
↓	
Squeezed crayon pieces are wrapped in foil and flattened with a warm iron.	
↓	
Flattened crayon pieces are placed in a beaker and heated until liquid.	
↓	
Liquid crayon is poured into a Petri dish to cool and solidify.	

Part B

The rock cycle is different from the student's model, because in the rock cycle

A. processes take a much longer time.

B. pressure is involved in some processes.

C. there are both liquid and solid materials.

D. thermal energy is needed for some processes.

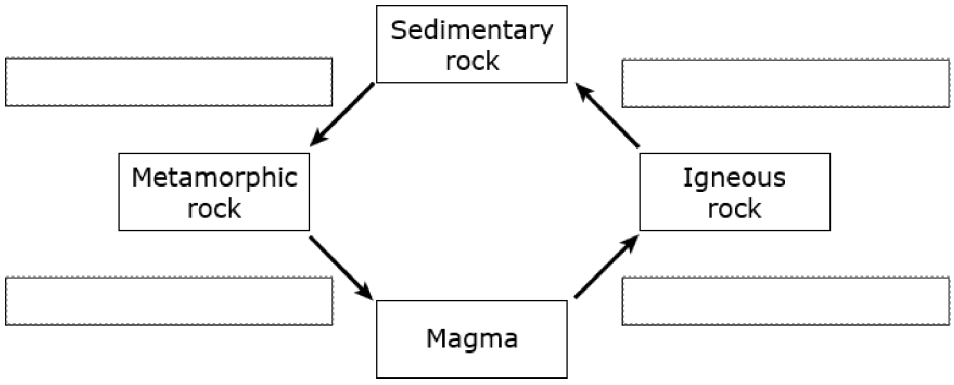
16. This model of the rock cycle shows magma (the molten rock found under the surface of Earth) and the major types of rocks. The arrows represent some processes that rocks go through as they are changed from one type to another.

Part A

Place the processes in the correct positions to complete the model. Each process is used only once.

Erosion and deposition | Melting

Heating under pressure | Solidification



Part B

Based on the model, which is a correct statement about the rock cycle?

A. Rocks and minerals are the same thing.

B. All processes in the rock cycle occur at the same rate.

C. Rocks are always found in the same locations as where they formed.

D. Rocks are changed into different types as a result of Earth processes.

17. In order to reduce air pollution, a particular community identifies three possible solutions. The community also proposes several criteria that the solutions must meet, including low cost and rapid impact. The three possible solutions are:

Solution 1: Begin phasing in renewable sources of electricity generation, which would involve building new types of power plants.

Solution 2: Encourage increased use of ride-sharing.

Solution 3: Encourage people to raise thermostat settings in the summer and lower them in the winter.

Part A

The community identified three constraints to help determine the best approach to reduce air pollution. For each of the three potential solutions, mark the box if the solution meets the constraint.

	Long time to implement change	**Requires change in people's behaviors**	**Provides benefits in a short time period**
Solution 1	❑	❑	❑
Solution 2	❑	❑	❑
Solution 3	❑	❑	❑

Part B

What additional information will be *most* helpful to the community to prioritize these approaches?

A. the projected reduction in air pollution

B. the projected cost savings of using renewable resources

C. the number of homes projected to be built in the next 10 years

D. the number of cars currently using electricity as an energy source

18. For a certain farming community in California, a water shortage is predicted if the average global temperature rises by 1°C. The residents of this community rely on private vehicles powered by fossil fuels for transportation because there is no public transportation system. Farm vehicles powered by diesel fuel are used to harvest the crops and get them to market.

Residents of the farming community want to reduce their impact on global temperature increases by reducing their carbon dioxide (CO_2) emissions. They asked the town planners to propose some possible solutions that will address their transportation concerns and reduce the amount of CO_2 released into the atmosphere. Two potential solutions have been proposed:

- Solution 1: Restrict the use of private vehicles powered by fossil fuels on public roads.
- Solution 2: Promote vehicles powered by renewable energy sources to harvest the crops and get them to market.

Part A

Choose *two* questions that residents of the farming community could ask to *quantitatively* evaluate the proposed solutions.

- ❍ Does this plan take into consideration damage to the crops caused by extreme weather events?
- ❍ Will this plan allow our community members to independently select oil suppliers?
- ❍ Will this plan increase our farming community's access to new varieties of seeds?
- ❍ Does this plan allow the farms in our community to continue to be profitable?
- ❍ Does this plan allow for a significant reduction in the use of diesel fuel?

Part B

Select the boxes to indicate whether each of the two potential solutions addresses the stated transportation concerns of the farming community, the global problem of increasing CO_2 emissions, or both.

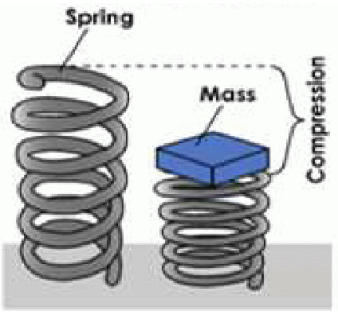
	Addresses transportation concerns of farming comm.	**Addresses global problem of increasing CO_2 emissions**
Solution 1: Restrict the use of private vehicles powered by fossil fuels on public roads.	❑	❑
Solution 2: Promote vehicles powered by renewable energy sources to harvest the crops and get them to market.	❑	❑

19. The following question has two parts. First, answer Part A. Then, answer Part B.

A student investigates the change in potential energy of a spring, using the experimental setup shown.

The student conducts three tests, using a different mass on top of the spring for each one. She records the mass on the spring and spring compression data in the partially completed table.

Experimental Setup



Part A

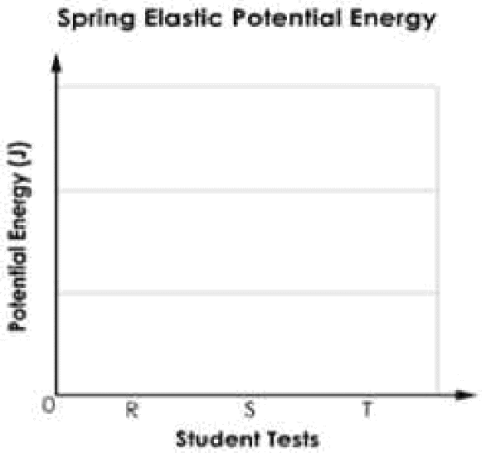
Select the correct spring's compression data for each test in the table, based on the experimental setup.

Compression Data

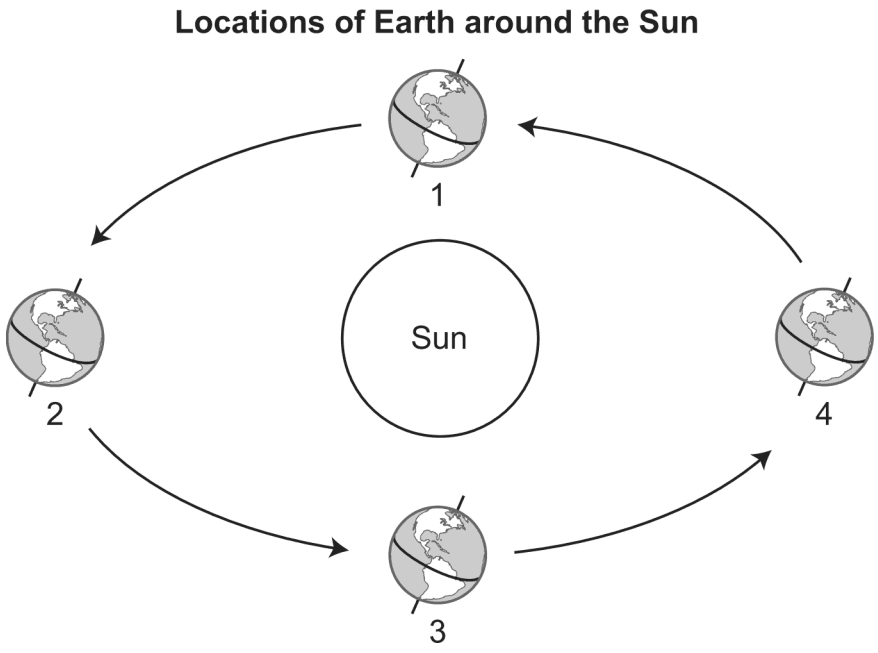
Student Test	Mass on Spring (grams)	Spring Compression (centimeters)
R	20	0.7 1.6
S	40	1.2 0.7
T	60	1.6 1.2

Part B

Complete the bar graph to show where the top of bars R, S, and T should be to compare the spring's elastic potential energy for each of the student's tests, based on the compression data in Part A.



20. The model shows Earth at four different times of year.



Part A

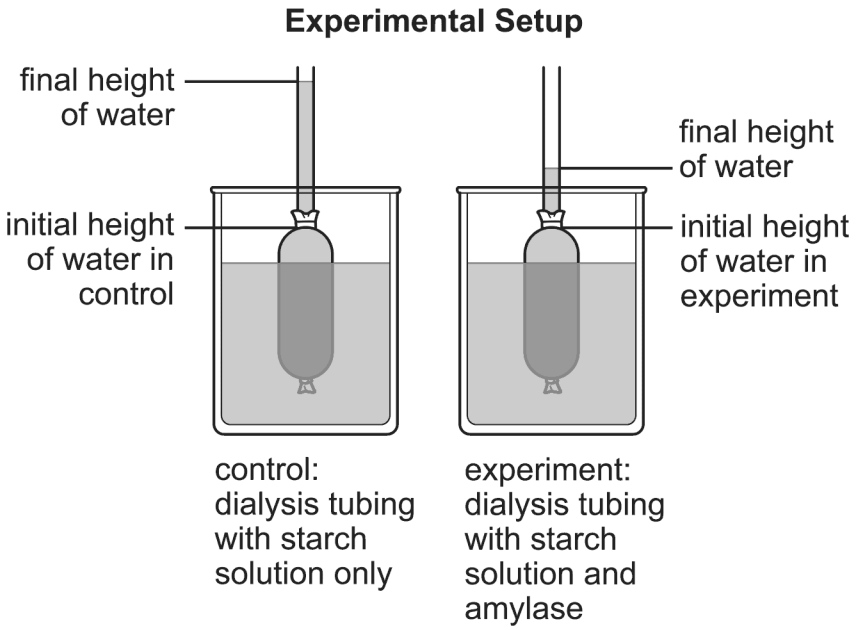
Record the number of the position that represents when the Southern Hemisphere experiences the shortest days and longest nights.

Part B

Select a word or phrase in each set to *best* explain why the Southern Hemisphere experiences the season identified in Part A.

The Southern Hemisphere is tilted [toward / away] from the Sun, and the Sun is [higher / lower] in the sky. This causes temperatures to be [cooler / warmer] than in the Northern Hemisphere.

The diagram describes an experimental setup to study cell membrane permeability.



Two beakers are filled with equal amounts of water. Each beaker contains dialysis tubing. One is filled with a starch solution, and the other is filled with the same starch solution and the enzyme amylase. Amylase breaks down starch into maltose.

Dialysis tubing is permeable to particles smaller than 5,000 daltons (Da). Daltons are a unit of mass. The table shows sizes of some of the particles in the solution.

Sizes of Particles

Name	Size (Da)
starch	1,000,000
maltose	342
salt ion	23

21. **Part A**

Predict whether each substance will move or will not move through the dialysis tubing. Record an "X" in each row.

	Will Move through Tubing	**Will Not Move through Tubing**
starch	❍	❍
maltose	❍	❍
salt ion	❍	❍

Part B

Select a word or phrase in each set of options to describe the movement of water during this investigation.

In the control, water moves [into / out of] the dialysis tube because [more / less] solvent is inside the tube than in the beaker.

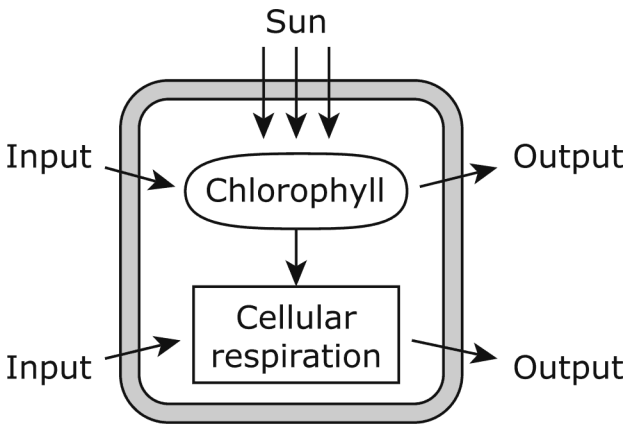
In the experiment, amylase breaks down starch into maltose. Maltose [stays in / moves out of] the dialysis tube, and [more / less] water movement is observed than in the control.

Read the information. Use the information to answer the questions.

Cyanobacteria

Cyanobacteria are single-celled organisms that contain chlorophyll. Scientists think that they were the first organisms to complete photosynthesis. They can exist in a wide range of aquatic habitats, including freshwater and saltwater environments. The model shows the processes that take place in the cyanobacteria.

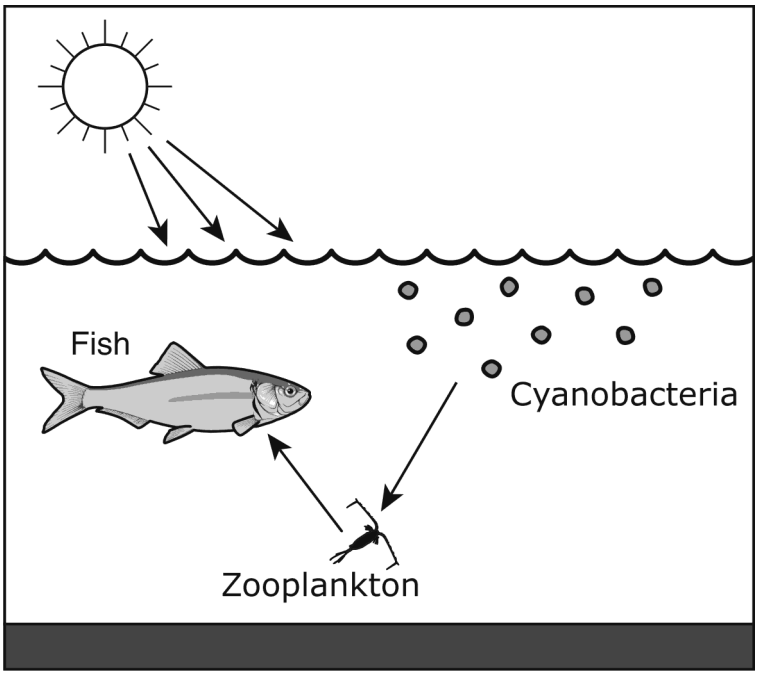
Cyanobacteria Processes



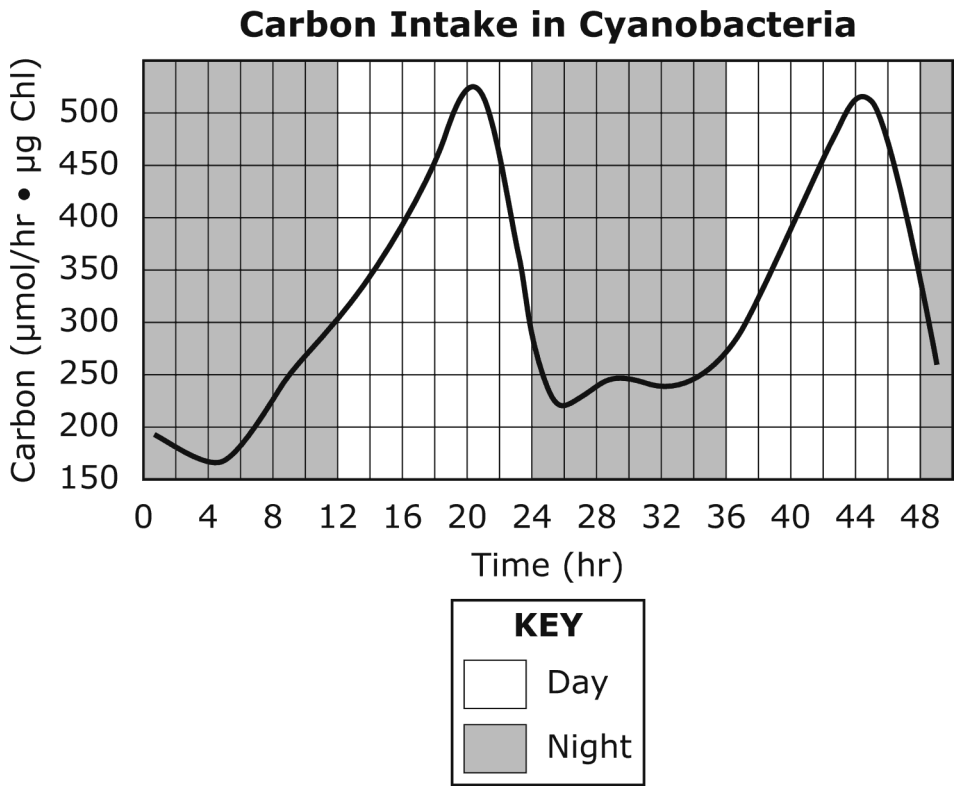
Carbon Cycling

In aquatic ecosystems the cyanobacteria are part of the plankton. Plankton include plant-like organisms and animals that float along at the mercy of the tides and currents. The plant-like plankton, or phytoplankton, are the base of most food webs. They are the producers of most aquatic ecosystems. The animal plankton, or zooplankton, feed on them. The model shows the flow of energy from the Sun through the organisms in an aquatic ecosystem.

Flow of Energy



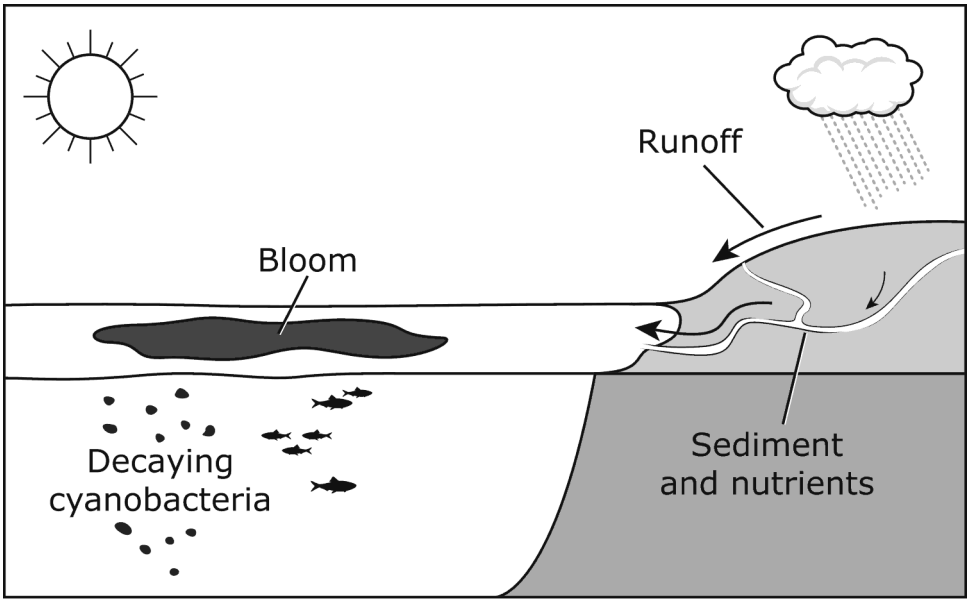
Another important role of cyanobacteria in the aquatic ecosystem is carbon cycling. Scientists measured the intake of carbon by cyanobacteria over a 48-hour period. The graph shows the data collected and the periods of day and night when light was or was not present. The scientists measured the carbon intake in micromoles per hour in a microgram of chlorophyll (μmol/hr · μg Chl).



Cyanobacteria Blooms

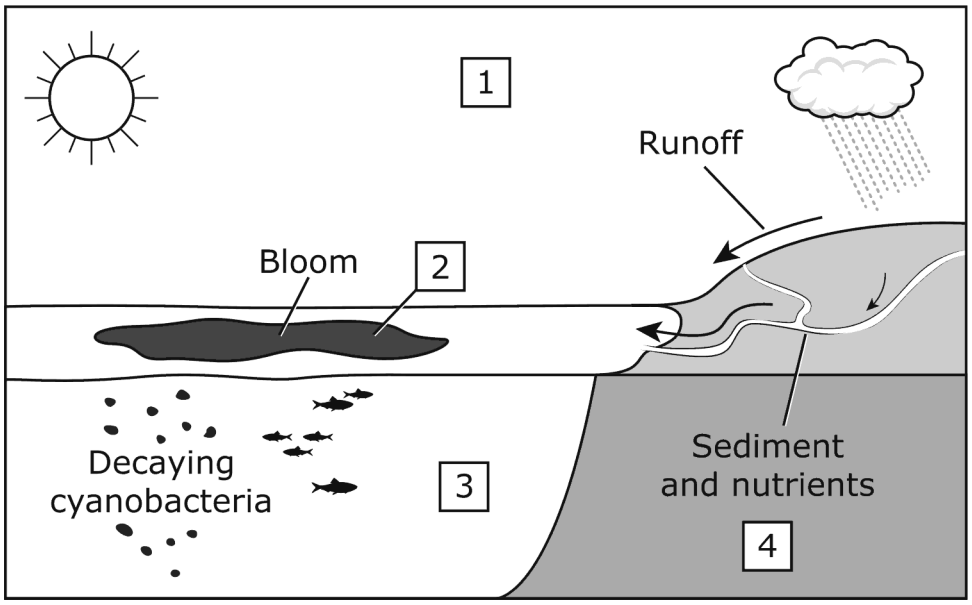
Cyanobacteria can also cause problems in some ecosystems. When they multiply quickly, they can form large groups called blooms. Blooms are caused when nutrients run off into the water from cities, industries, and agricultural fields. The excess nutrients provide additional resources to help in the process of creating food. Warmer water temperatures will also encourage blooms to form. Blooms cover the water's surface and block the sunlight that other organisms need. Some blooms are toxic and can harm or kill other organisms. When the bloom uses up the extra nutrients, the cyanobacteria die and decompose. The model shows a bloom.

Cyanobacteria Bloom



22. The Cyanobacteria Bloom model shows the cycling of carbon through the Earth spheres by the process of photosynthesis and cellular respiration. Use the model to answer the questions.

Cyanobacteria Bloom



Part A

Which box represents the sphere that is gaining carbon through the photosynthesis of the cyanobacteria?

A. Box 1 B. Box 2 C. Box 3 D. Box 4

Part B

Which box represents the sphere that is directly gaining carbon when cellular respiration occurs in the cyanobacteria?

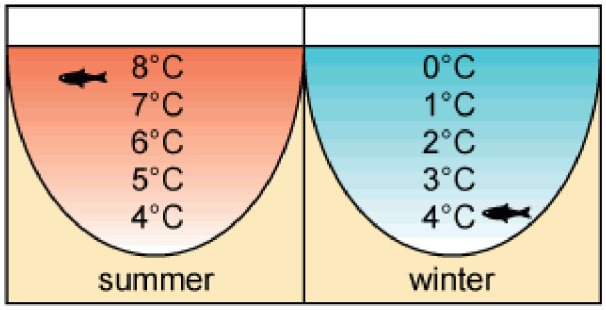
A. Box 1 B. Box 2 C. Box 3 D. Box 4

Use the information about properties of water and your knowledge of science to help answer the questions.

Properties of Water

A student examines Figure 1. It shows how the water temperatures at different depths compare in summer and in winter. The student wonders why, in summer, warmer water sits on top of cooler water, but in winter, water that is frozen (0°C) floats on top of warmer water.

Figure 1. Summer and Winter Water Temperatures at Different Depths in a Lake



The student learns that water has many unique properties that make it different from most other substances. Water is one of the few substances that exists on Earth's surface in all three phases of matter (solid, liquid, and gas).

Another unique property of water is that, unlike most other substances, it is less dense in the solid phase than in the liquid phase. This helps explain why ice cubes float near the top of a glass of water and why ice forms on the surface of a pond or a lake in winter. This also means that a mass of water in the solid phase takes up more volume than the same mass of liquid water.

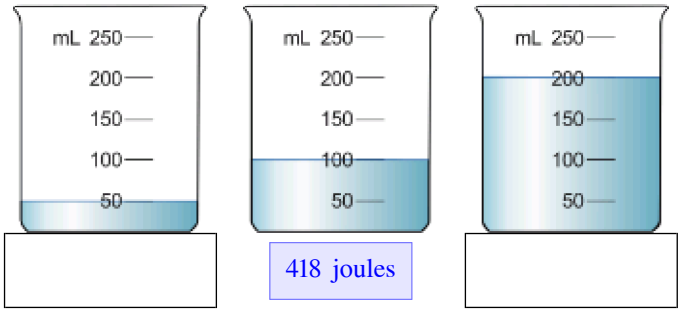
23. **Part A**

The amount of energy needed to heat 100 mL of water is shown. Predict the amount of heat energy needed to heat the water in the other two beakers.

Drag each heat energy value to the appropriate beaker.

Each value may be used more than once. Not all values will be used.

209 joules | 418 joules | 627 joules | 836 joules



418 joules

Part B

Which statements support the answer to Part A?

Select *all* that apply.

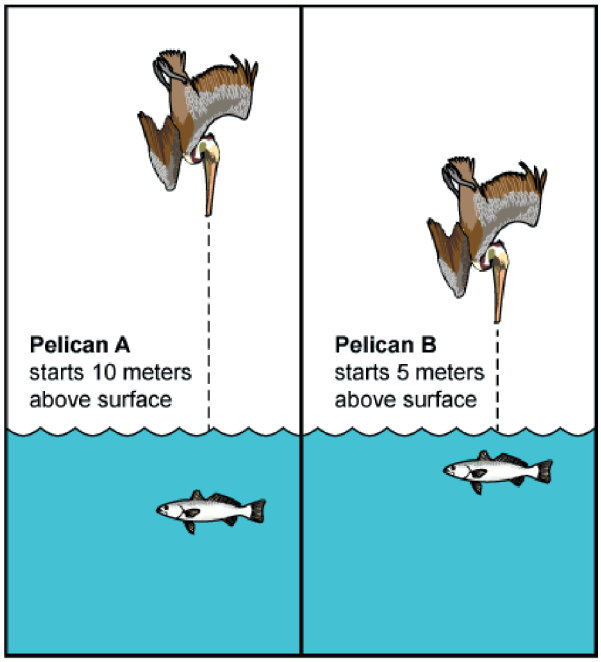
- ❍ Each beaker contains the same substance, so the total amount of energy needed to raise the temperature by 1 °C is the same for each beaker.
- ❍ As the amount of water in the beaker increases, the total amount of thermal energy required to raise the temperature by 1 °C increases.
- ❍ As the amount of water in the beaker increases, the total amount of thermal energy required to raise the temperature by 1 °C decreases.
- ❍ The relationship between the mass of a substance and the amount of thermal energy required for a given temperature increase is directly proportional.
- ❍ There is no relationship between the mass of a substance and the amount of thermal energy required for a given temperature increase.

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

Brown Pelicans

Brown pelicans are large seabirds that live along the coast of the Gulf of Mexico. Brown pelicans are often seen gliding in groups above the ocean surface, or flying up and "plunge-diving" into the water below. During a plunge-dive, pelicans fly as high as 60 feet (18.3 meters) into the air, tuck in their wings, and then dive, beak first, into the ocean. The force of the impact stuns fish in the water. The pelican picks up the stunned fish with its large bill, tilts its bill to drain the seawater, and then swallows the fish. Figure 1 shows two brown pelicans plunge-diving from different starting heights.

Figure 1. Brown Pelicans



Note: Not to scale

24. **Part A**

The success of a plunge-dive depends on the point at which the pelican has the greatest amount of potential energy and on the total amount of energy that is transferred to the water to stun the fish.

Based on figure 1, drag the correct statement into *each* box to show:

- the pelican and the position with the greatest potential energy, and
- the pelican and the position when the greatest amount of energy has been transferred to the water.

Not all statements will be used.

Pelican A, 10 meters above the surface of the water	Pelican A, 5 meters above the surface of the water	Pelican B, 5 meters above the surface of the water	Pelican A, at the surface of the water
Pelican B, at the surface of the water	Pelican A, 1 meter below the surface of the water	Pelican B, 0.5 meters below the surface of the water	

Position of Pelican with Greatest Potential Energy	Position of Pelican When Greatest Amount of Energy Has Been Transferred to the Water

Part B

Which statements support the answer to Part A?

Select *all* that apply.

- ❍ A pelican needs to start at a lower elevation to dive farther into the water.
- ❍ A pelican that starts at a higher elevation above the water transfers more energy to the air as it dives.
- ❍ A pelican that dives farther into the water transfers more energy to the water.
- ❍ A pelican that starts with more potential energy has more energy when it reaches the water.
- ❍ A pelican with greater speed creates more energy before it transfers the energy to the water.

Multipart Examples - Science 12/13/2024

1.
Answer: B; 3
Points: 1

2.
Answer: C; 2,1
Points: 1

3.
Answer: A; 1,7,+1,−1
Points: 1

4.
Answer: C; B,D,F
Points: 1

5.
Answer: 2,1; A
Points: 1

6.
Answer: B; D,F
Objective: LA 6-LS2-2
Points: 1

7.
Answer: D; C
Points: 1

8.
Answer: C; B
Points: 1

9.
Answer: C; D
Points: 1

10.
Answer: [D],[B],[A],[C]; [2],[2],[2],[1]
Points: 1

11.
Answer: [F,F,E][A,D,D]; [B,E][G,E,E]
Objective: OH PS.M.4
Points: 1

12.
Answer: B; C,D
Objective: OH PS.U.1
Points: 1

13.
Answer: [C],[B],[A]; A,E
Points: 1

14.
Answer: B; [A],[A],[A]
Points: 1

15.
Answer: [A],[C],[B],[E],[D]; A
Points: 1

16.
Answer: [C],[D],[B],[A]; D
Points: 1

17.
Answer: [1],[2,3],[2,3]; A
Points: 1

18.
Answer: D,E; [2],[1,2]
Points: 1

19.
Answer: 1,1,1; [no scoring answer]
Points: 1

20.
Answer: 2; 2,2,1
Points: 1

21.
Answer: [2],[1],[1]; 1,2,2,2
Points: 1

22.
Answer: B; C
Points: 1

23.
Answer: [A][D]; B,D
Objective: LA 7-PS3-4
Points: 1

24.
Answer: [A][F]; C,D
Objective: LA 8-PS3-5
Points: 1