

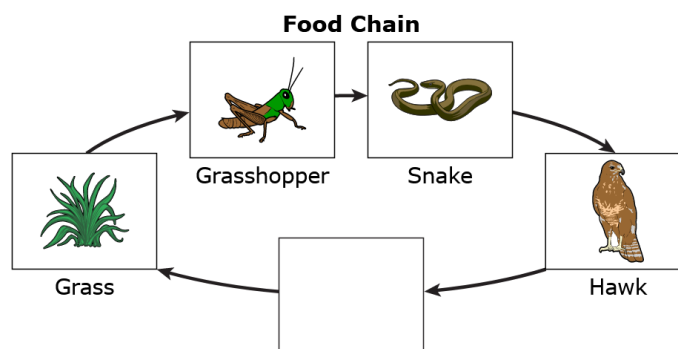
Sample CAST Assessments

Write new questions for these scenarios that assess students' knowledge of 3D science. Highlight the aspects that assess CCCs.

5th grade:

Food Webs

Students are studying ecosystems. Their teacher assigned groups to make posters that show how matter and energy flow through a food chain. One group drew this model.

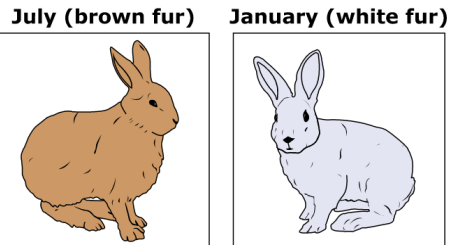


Which would be the **best** choice to fill the empty box and complete the model?

- Ⓐ a mouse that eats matter in the form of seeds produced by grass
- Ⓑ a tree that makes its own matter using sunlight, carbon dioxide, and water
- Ⓒ microbes that break down dead organisms, releasing their matter to be reused in the food chain
- Ⓓ a chicken farmer that scares away a hawk to keep it from eating matter in the form of his chickens

Arctic Hare

Arctic hares live in the northernmost parts of North America where the ground is covered in snow during the coldest months. Arctic hares change fur color by molting and growing new fur twice a year. The diagram shows a hare in July and a hare in January.



Explain how the change from a brown fur coat to a white fur coat helps arctic hares to survive in the winter.

Enter your answer in the box provided.



Cause & Effect? 🔍

- Explain what factor(s) affect the survival rate of the arctic hare ?

Race Car Energy

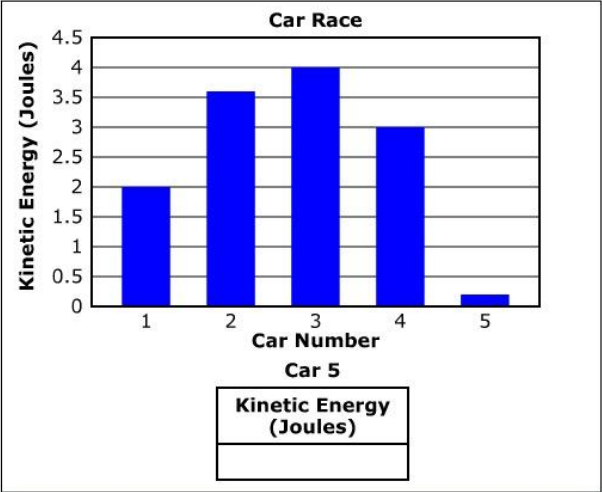
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Students are studying how mass and velocity affect the kinetic energy of an object. The students race five cars. The winning car has the most kinetic energy. The graph shows the results for the race.

Click the bar location for Car 5 to show Car 5 finished with the third-highest kinetic energy.

Car 5 raced with a velocity of 2.0 meters per second (m/s). Based on the kinetic energy shown in the graph for Car 5, complete the table by determining the mass to two decimal places for Car 5.



Car 5
Kinetic Energy (Joules)

Mass (grams)	Velocity (m/s)
	2.0

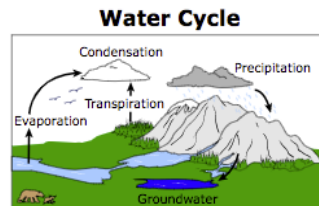
- ## Stability & Change

Water Cycle

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GUEST

A student creates the model shown of the water cycle for a class presentation. The student's main goal is to help the class understand how living organisms assist in the movement of water through the system.



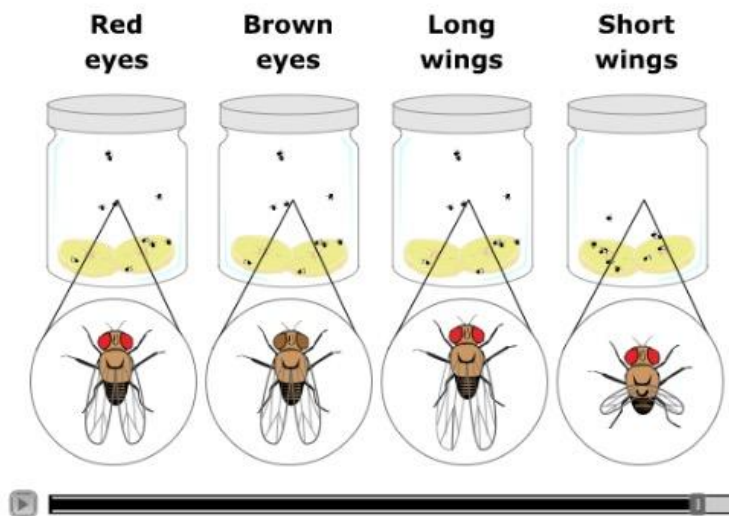
Based on the model, what should the student say about the role of living organisms in the water cycle?

- Ⓐ Plants help move water from the soil to the atmosphere.
- Ⓑ Animals generate heat that helps evaporate water from the land.
- Ⓒ Plant movements create wind that helps draw water into the atmosphere.
- Ⓓ Animals create pathways in the mountains that allow water to flow downhill.

High School:

Drosophila

You will be using fruit flies, *Drosophila melanogaster*, to study genetics. Fruit flies are studied because they have a short life cycle and have only 4 pairs of chromosomes. The flies will be crossed to observe the inheritance patterns of eye color and wing shape. The fruit flies are kept in jars with pieces of banana to serve as a nutrient source. The fruit flies were ordered from a supply company, and each jar contains its own phenotype. You will use the jars containing different fruit flies to answer questions. Click the play button to watch the animation.



A long-winged fly is crossed with a short-winged fly and allowed to mate. The phenotype of the offspring is observed and recorded in the table below.

Fly Phenotype	Number Observed
	146
	0

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Based on the results in the data table, explain why there are no flies with short wings. Type your answer in the box below.

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Using the Punnett square provided, drag the correct parents that would be expected to produce approximately 50% homozygous brown-eyed offspring and 50% heterozygous offspring.


 rr


 RR


 Rr

 Rr	 rr
 Rr	 rr

To allow the students to observe an additional trait, the teacher gives them a fly with a darker body color than the other flies, which have a lighter body color. The students crossed the dark-body-colored fly with the light-body-colored fly. The cross is represented in the Punnett square below.

Parent Cross




Light body color

 rr	 rr
 Rr	 Rr

Dark body color

F1 generation

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The students then crossed two flies from the F1 generation and recorded the following results:

162 light-body-colored fruit flies
52 dark-body-colored fruit flies

Explain how the dark body color of the fruit flies remained in the gene pool.

Leaf Beetle

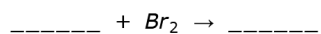
The leaf beetle, *Chrysomela aeneicollis*, lives in the Sierra Nevada Mountains of California. Scientists studying the beetles found that exposure to high temperatures during the summer, when the eggs are laid and the larvae are developing, causes physiological stress. The impact is on metabolic enzymes and heat shock protein expression. One allele, *Pgi-4*, increased in frequency in the beetle population that was exposed to hotter, drier summers in the Sierra Nevada Mountains.

Complete the sentence about this change by selecting the correct words from the menus.

If the temperatures in the Sierra Nevada Mountains continue to increase, the frequency of the *Pgi-4* allele is expected to as a result of .

Elemental Bromine

Students use the periodic table to predict reactions between different elements and elemental bromine (Br_2). An incomplete equation for the reaction between an element and Br_2 is shown. Bromine atoms have seven valence electrons.

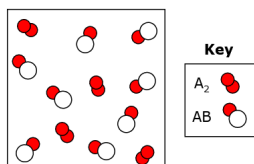


Based on the number of valence electrons of elements in a compound, which is an ionic compound that can form in a reaction between an element and Br_2 ?

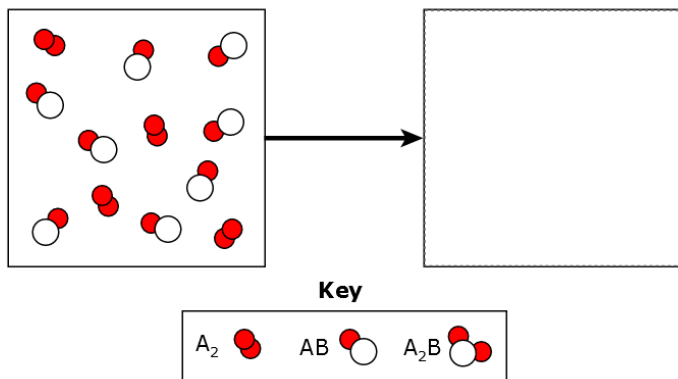
- Ⓐ SBr_2 , composed of S^{2+} ions and Br^- ions
- Ⓑ $CaBr_2$, composed of Ca^{2+} ions and Br^- ions
- Ⓒ CB_4 , composed of C^{4+} ions and Br^- ions
- Ⓓ KBr_2 , composed of K^+ ions and Br^- ions

Reaction

The reaction $A_2(g) + 2AB(g) \rightarrow 2A_2B(g)$ is carried out in a closed, 1.0 L container. The diagram shows the relative amounts of A_2 and AB used for the reaction.

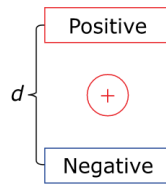


Assuming the reaction is complete, drag the correct number of molecules of A_2B that will be produced to the empty box.



Charged Plates

Students are discussing a model of a system that consists of two parallel conducting plates (called a capacitor) separated by a distance of d and a positively charged sphere directly in the middle of the two plates. The upper plate has a positive charge, and the lower plate has a negative charge.

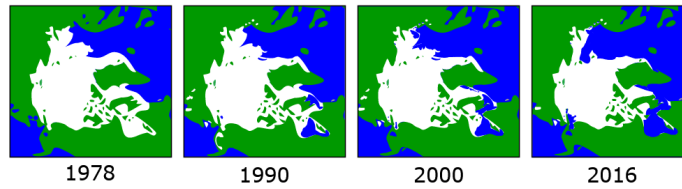


In which direction should the charged sphere move to increase the energy stored in the system?

- ☐ Ⓐ to the left with an external force
- ☐ Ⓑ to the right with an external force
- ☐ Ⓒ toward the positive plate with an external force
- ☐ Ⓓ toward the negative plate with an external force

Arctic Ice

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.



Part A

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

- ☐ Ⓐ Arctic sea ice will move to other parts of the ocean.
- ☐ Ⓑ Arctic sea ice will freeze and melt at the same rate.
- ☐ Ⓒ Arctic sea ice will continue to melt at an increasing rate.
- ☐ Ⓓ Arctic sea ice will continue to expand until it exceeds its 1978 extent.

Part B

Use the menus to complete the statement.

Melting Arctic sea ice contributes to a positive feedback loop in the Arctic. As Arctic sea ice melts, sunlight is reflected and the temperature of the Arctic Ocean .

more/less

increases/decreases