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Multi-State Alternate Assessment

Teacher Guide

Sample Items

Science

High School

Science
High School
Sample Items

Items 1–6 | Cluster Stimulus

Sarah’s science class is experimenting with toy cars. There are two ramps set up to face each other. Toy cars are released at the top of each ramp. The cars move down the ramps and hit each other. Sarah observes that one car has more damage from the collision than the other car.

Experiment 1

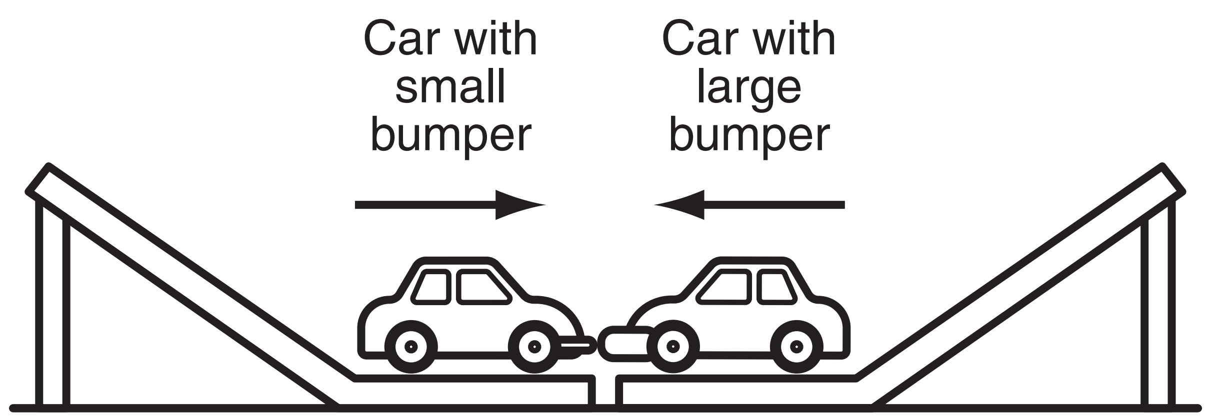
Sarah wants to know why one car had more damage after the collision than the other car. She experiments with two undamaged toy cars using two ramps of the same height set up to face each other. One car has a small bumper attached to the front of the car, and the other car has a large bumper attached to the front of the car.

She places one toy car at the top of each ramp and releases them at the same time so that they collide at the bottom of the ramps.

Items 1–6 | Cluster Stimulus

Sarah made this model to show the collision between the cars in her experiment.

Toy Car Collision



Sarah organizes the results of her experiment in a data table.

Experiment 1: Amount of Damage after Collision

Car	Damage after Collision
Car with small bumper	Major
Car with large bumper	Minor

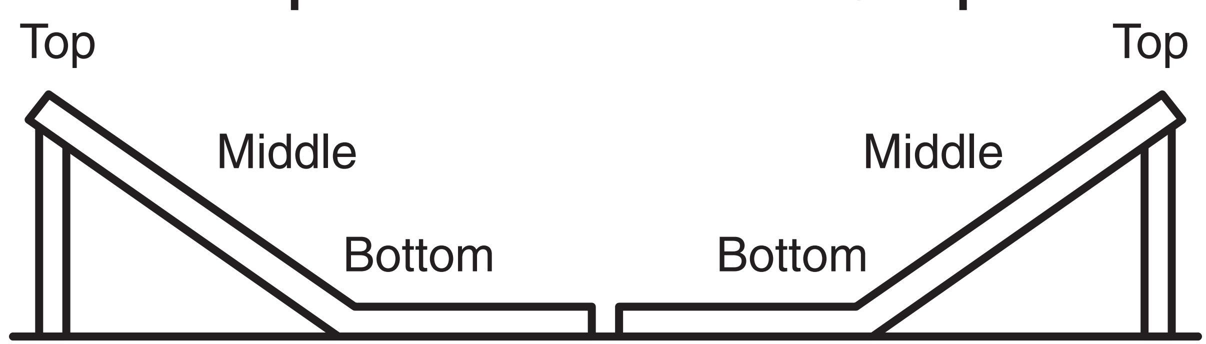
Items 1–6 | Cluster Stimulus

Experiment 2

Sarah wonders if the position of the cars when they are released on the ramps affects the amount of damage to the car with a small bumper.

She performs a second experiment with two undamaged cars, a car with a small bumper and a car with a large bumper. She releases each car at the same time at three different positions: top, middle, and bottom of the ramps. She makes a model that shows the three positions.

Experiment 2: Positions Setup



Items 1–6 | Cluster Stimulus

The data table shows the damage to the car with a small bumper after each collision in Sarah's second experiment.

Experiment 2: Damage versus Position on Ramps

Position of Cars on Ramps when Released	Damage to Car with Small Bumper after Collision
Top	Major
Middle	Moderate
Bottom	Minor

Items 1–6 | Cluster Stimulus

Experiment 3

Sarah then wonders if the size of the bumper affects the amount of damage to a car after a collision.

She builds two different bumper designs and attaches each bumper to a toy car.

Sarah then repeats the collision experiment two more times. This time she sees what happens when an undamaged car with a small bumper collides with a car that either has a small or medium bumper.

The results of Sarah's third experiment are listed in the data table.

**Experiment 3:
Damage versus Bumper Size**

Collision	Bumper Size	Damage after Collision
Car with small bumper collides with car with small bumper	Small	Major
	Small	Major
Car with small bumper collides with car with medium bumper	Small	Major
	Medium	Moderate

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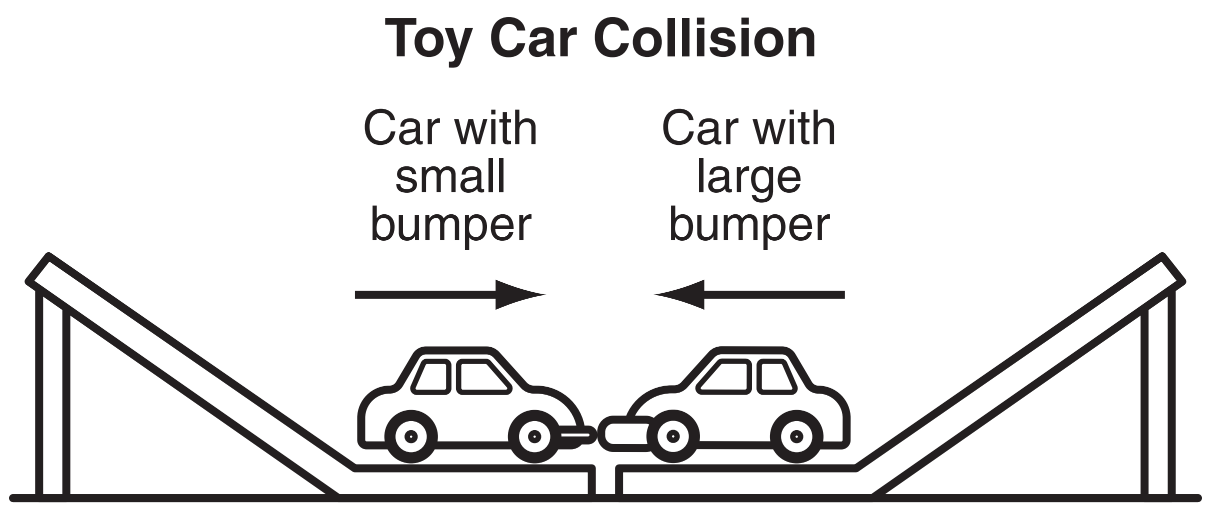
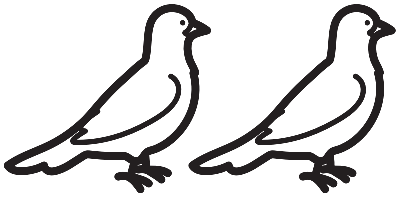
Item 1

Here is a model that Sarah made for Experiment 1.

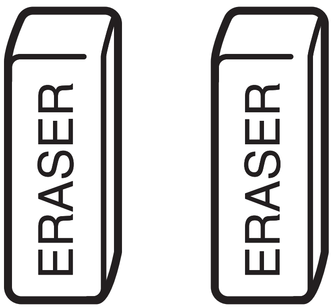


Item 1

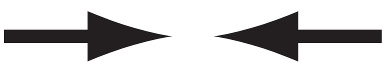
Which part of the model shows the forces acting on the cars?

○ 

birds

○ 

erasers

○ 

arrows

Item 2

Sarah reviews the results from Experiment 1.

**Experiment 1:
Amount of Damage after Collision**

Car	Damage after Collision
Car with small bumper	Major
Car with large bumper	Minor

Item 2

Which claim can be made about the effect of large bumpers?

- ◯ The large bumper caused the car to move faster.
- ◯ The large bumper protected the car from damage.
- ◯ The large bumper decreased the weight of the car.

Item 3

Sarah reviews the results from Experiment 1.

Experiment 1:
Amount of Damage after Collision

Car	Damage after Collision
Car with small bumper	Major
Car with large bumper	Minor

She then reviews the results from Experiment 3.

Experiment 3:
Damage versus Bumper Size

<table>
<tr><th>Collision</th><th>Bumper Size</th><th>Damage after Collision</th></tr>
<tr><td rowspan="2">Car with small bumper collides with car with small bumper</td><td>Small</td><td>Major</td></tr>
<tr><td>Small</td><td>Major</td></tr>
<tr><td rowspan="2">Car with small bumper collides with car with medium bumper</td><td>Small</td><td>Major</td></tr>
<tr><td>Medium</td><td>Moderate</td></tr>
</table>

Item 3

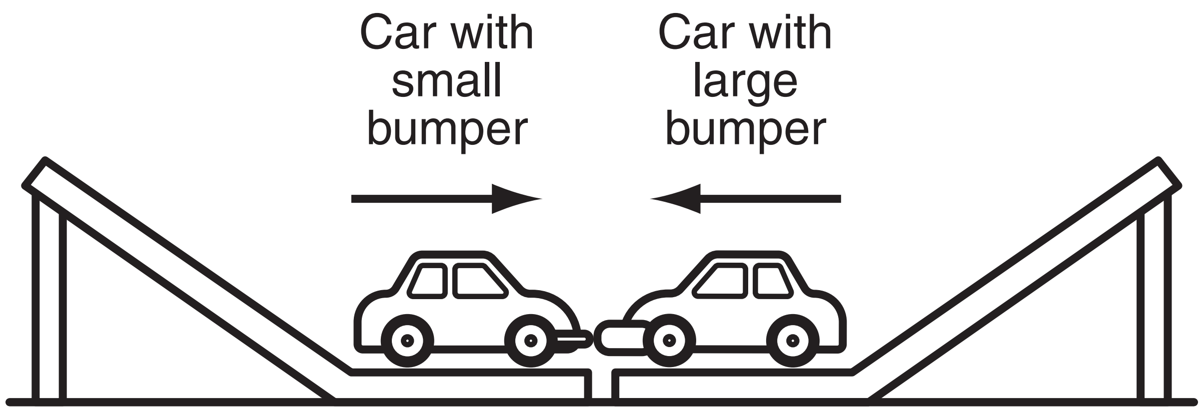
Which bumper design **most** reduces force during a collision?

- ○ large bumper
- ○ small bumper
- ○ medium bumper

Item 4

Sarah wants to know whether the potential energy of the cars changes as the cars move down the ramp. Here is her model from Experiment 1.

Toy Car Collision



Item 4

Which question will help Sarah find out how the potential energy of the cars changes?

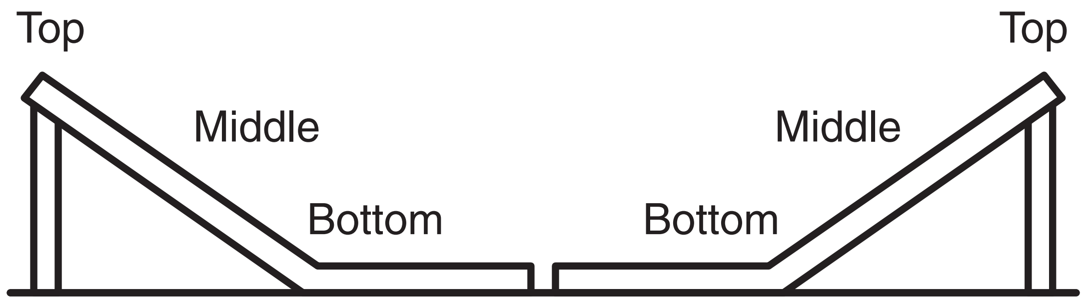
- ◯ What are the colors of the cars?
- ◯ Is the surface of the ramp hot or cold?
- ◯ How far do the cars move down the ramp?

Item 5

Sarah looks at her setup for Experiment 2. She wonders if the position of the cars on the ramps when they are released affects how much kinetic energy the cars have when they collide.

Her model shows three different positions on the ramps.

Experiment 2: Positions Setup



She also looks at how much damage occurred to the cars after the collision when the cars were released from different positions on the ramps.

**Experiment 2:
Damage versus Position on Ramps**

Position of Cars on Ramps when Released	Damage to Car with Small Bumper after Collision
Top	Major
Middle	Moderate
Bottom	Minor

Item 5

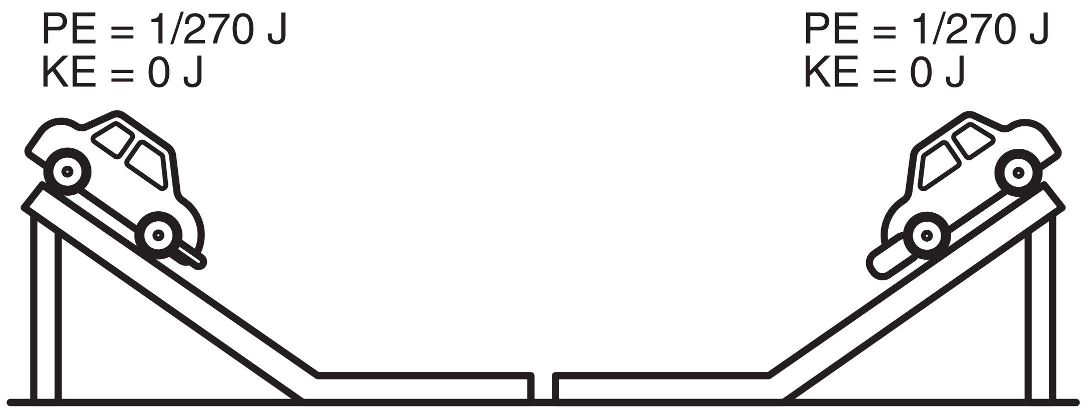
Where should cars be released on the ramps in order to have the **most** kinetic energy when they collide?

- ◯ top
- ◯ middle
- ◯ bottom

Item 6

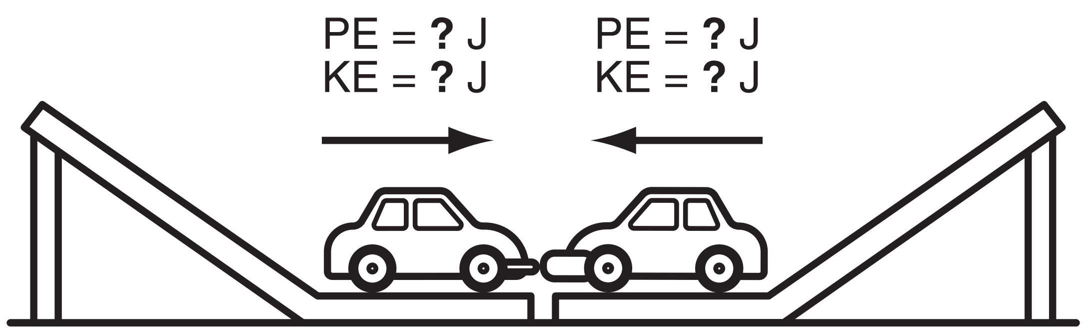
Sarah added the potential energy (PE) and kinetic energy (KE) values for each car to her model of the collision in Experiment 1. Her model shows that as cars move down the ramp, potential energy changes into kinetic energy. One part of her model shows the energy of the cars in Joules (J) before the collision.

Experiment 1 before Collision



The other part of Sarah's model shows that the energy of the cars in Joules (J) after the collision is unknown.

Experiment 1 after Collision



Item 6

How should Sarah complete the model to show that there is no change in each car’s total amount of energy?

- ◯ show that the PE decreases and the KE increases for each car
- ◯ show that the PE increases and the KE stays the same for each car
- ◯ show that the PE doubles and the KE decreases by half for each car

Items 7–12 | Cluster Stimulus

Tamara is at school doing a biology project. While working on her project, she learns about many different organisms.

Tamara learns that many organisms look different from each other. However, almost all of them have a protein called catalase in their bodies. Catalase helps quickly break down hydrogen peroxide (H_2O_2) into water (H_2O) and two oxygen atoms (O_2). H_2O_2 forms naturally in the body as a byproduct of normal life processes.

In addition, Tamara learns that the ancestors of present-day organisms also had catalase in their bodies. Her teacher shows her a data table that describes how the size of the catalase protein changed for an ancestor of an organism and a present-day organism.

Size of Catalase Protein in Organisms

	Size of Catalase Protein
Ancestral Organism	Large
Present-Day Organism	Small

Items 7–12 | Cluster Stimulus

Tamara’s teacher also tells her that because many different organisms have catalase, data on catalase can indicate patterns of relatedness between those organisms. The teacher shows Tamara a chart that lists partial catalase amino acid sequences in three organisms.

Partial Catalase Amino Acid Sequences

Organism	Catalase Amino Acid Sequence
Dog	○ □ ☆ ◺
Cow	○ □ ☆ ⬠
Fungus	○ □ ♡ ⏢

The teacher also shows Tamara a data table that lists partial catalase DNA sequences in three additional organisms.

Partial Catalase DNA Sequences

Organism	Catalase DNA Sequence
Fly	ACA GAA TTC
Mouse	CGT CCG TCC
Monkey	CGC CAT GGC

Item 7

Tamara wants to use a model to show how catalase helps break down hydrogen peroxide (H_2O_2) into water (H_2O) and two oxygen atoms (O_2) inside different organisms. She uses these shapes to represent oxygen (O) and hydrogen (H).

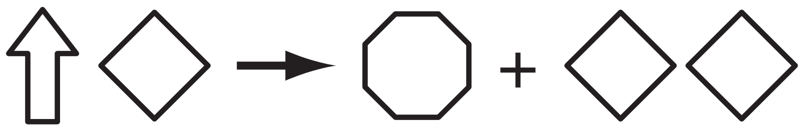
Oxygen (O) Hydrogen (H)

Item 7

Which model shows the equation: $H_2O_2 \rightarrow H_2O + O_2$?

○ 

Model X

○ 

Model Y

○ 

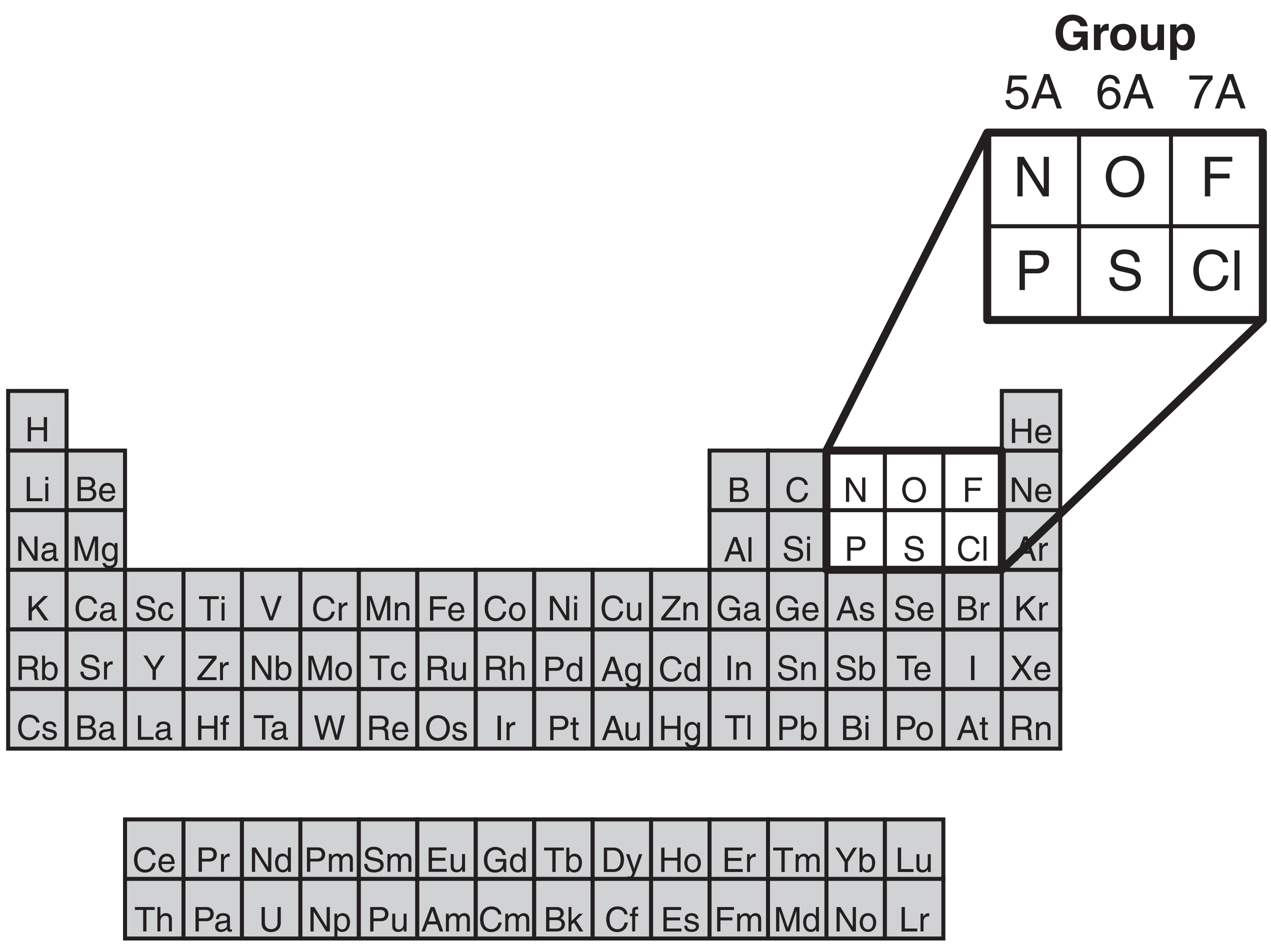
Model Z

Item 8

Tamara knows that when hydrogen peroxide (H_2O_2)is broken down by catalase, oxygen (O) and hydrogen (H) react to form water (H_2O). She wonders if there are other elements that react like oxygen (O).

She looks at part of the periodic table.

Part of the Periodic Table



Item 8

Which element will react **most** like oxygen (O) in a chemical reaction?

- ◯ sulfur (S)
- ◯ boron (B)
- ◯ fluorine (F)

Item 9

Tamara learns that when elements react, a certain number of electrons are needed to fill the outer shell of the elements in order to be stable. When hydrogen peroxide (H_2O_2) is broken down by catalase, 2 hydrogen (H) atoms react with 1 oxygen (O) atom to form water (H_2O).

The data table shows electron information about hydrogen and oxygen.

Electron Information for Hydrogen and Oxygen

Element	Number of Electrons in Outer Shell	Number of Electrons Needed to be Stable
Hydrogen (H)	1	2
Oxygen (O)	6	8

Item 9

Based on the data table, how do 2 H atoms and 1 O atom react to form H_2O in the catalase reaction?

- ○ After reacting, H has 1 electron and O has 6 electrons in their outer shells.
- ○ After reacting, H has 2 electrons and O has 1 electron in their outer shells.
- ○ After reacting, H has 2 electrons and O has 8 electrons in their outer shells.

Item 10

Tamara looks at the catalase protein data table.

Size of Catalase Protein in Organisms

	Size of Catalase Protein
Ancestral Organism	Large
Present-Day Organism	Small

Item 10

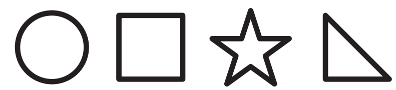
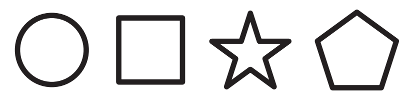
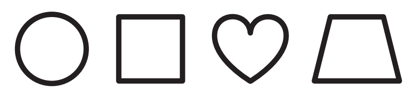
How did this organism change over time?

- ◯ The organism can move faster.
- ◯ The organism can make louder noises.
- ◯ The organism has smaller catalase proteins.

Item 11

Tamara wonders how the presence of catalase in different organisms can show evidence of those organisms being related. She looks at the information in the data table.

Partial Catalase Amino Acid Sequences

Organism	Catalase Amino Acid Sequence
Dog	
Cow	
Fungus	

Item 11

Based on the amino acid data table, which organism is **most** closely related to the cow?

- ○ dog
- ○ fungus
- ○ chicken

Item 12

Tamara wonders how DNA information about catalase can provide further information about organisms and common ancestry. She looks at the information in the catalase DNA data table.

Partial Catalase DNA Sequences

Organism	Catalase DNA Sequence
Fly	ACA GAA TTC
Mouse	CGT CCG TCC
Monkey	CGC CAT GGC

Tamara claims it is more likely that a mouse shares an earlier common ancestor with a monkey than with a fly.

Item 12

What information from the catalase DNA data table supports Tamara's claim?

- ○ The sequences of the fly and the mouse are most alike.
- ○ The sequences of the monkey and the fly are most alike.
- ○ The sequences of the mouse and the monkey are most alike.

Item 13

The data table shows how snakes affect the percent of rabbits that survive in an area.

How Many Rabbits Survive?

Snakes	No Snakes
78%	100%

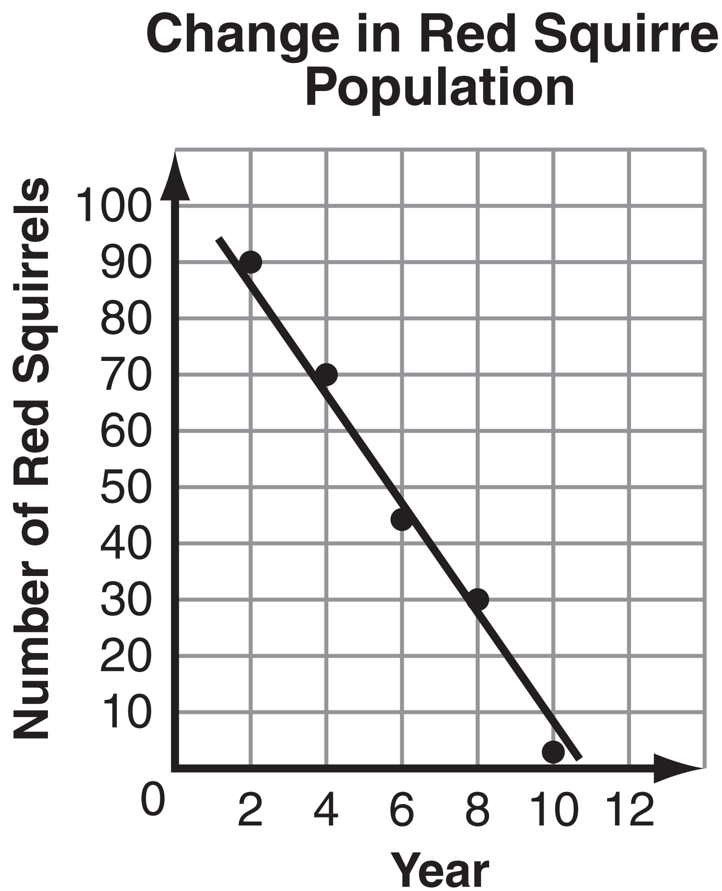
Item 13

Based on the data table, which factor affects how many rabbits survive?

- ◯ cars
- ◯ plants
- ◯ snakes

Item 14

Red squirrels were the only kind of squirrel on an island for many years. People later brought gray squirrels to the island. The graph shows how the red squirrel population changed after gray squirrels were put on the island.



Item 14

According to the graph, how did gray squirrels affect the population of red squirrels?

- ◯ Red squirrels increased in number.
- ◯ Red squirrels decreased in number.
- ◯ Red squirrels had larger places to live.

Item 15

Maria learned that animals attack some birds' nests. This data table shows how the thickness of the forest affects how often a nest is attacked.

Forest Thickness and Nest Attacks

Forest Thickness (%)	Nests Attacked per Day (%)
10	9
30	8
50	6
70	4
90	2

Item 15

Which explanation is supported by the data in the data table?

- ◯ Thick forests allow nests to be hidden better, so they have fewer nests attacked each day.
- ◯ Thick forests have more places for birds to make nests, so they have more nests attacked each day.
- ◯ Thick forests have more places for predators to hide, so they have more nests attacked per day.

Item 16

Alya learns that the soil on the Moon contains elements from the Sun. The data table lists information about the Moon and the Sun.

Moon Soil

Type of Elements in Moon Soil	Is the Element from the Sun?
Helium (He)	Yes
Neon (Ne)	Yes

Item 16

What do the data show about elements?

- ◯ There are many clouds around Earth.
- ◯ It is fun to play outside when it is raining.
- ◯ Elements travel from the Sun to the Moon.

Item 17

Dante learns that Earth is made up of elements that can be classified as either heavy or light. He finds a data table that lists information about heavy and light elements and their location inside Earth.

Types of Elements inside Earth

Type of Element	Sinks or Floats?	Earth Layer Location
Heavy	Sinks	Core
Light	Floats	Crust

Dante also learns that the core is a layer deep in the center of Earth, while the crust is a layer on Earth's surface.

Item 17

Which question can be answered by using these data?

- ◯ How did the layers of Earth form?
- ◯ Are there many elements that float?
- ◯ Why do scientists study the universe?

Item 18

Sam learns that some craters on Earth were caused millions of years ago by asteroid impacts. He finds data that compare the estimated crater size millions of years ago to the current size of different craters. The data table lists some of the data.

Comparing Sizes of Craters over Time

Crater Name	Estimated Crater Size Millions of Years Ago (kilometers)	Current Size of Crater (kilometers)
Chesapeake Bay	85	40
Kara	120	65
Acraman	90	40

Sam also learns that currently there are few craters on Earth’s surface.

Item 18

How do Sam’s data help explain why there are few craters?

- ◯ The asteroids that struck Earth make craters of different sizes.
- ◯ The craters become smaller over time as Earth’s surface is changed.
- ◯ The size of craters decreases as fewer asteroids impact Earth’s surface.

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Multi-State Alternate Assessment