

**Maryland Integrated  
Science Assessment  
(MISA)**

2018 Public Release

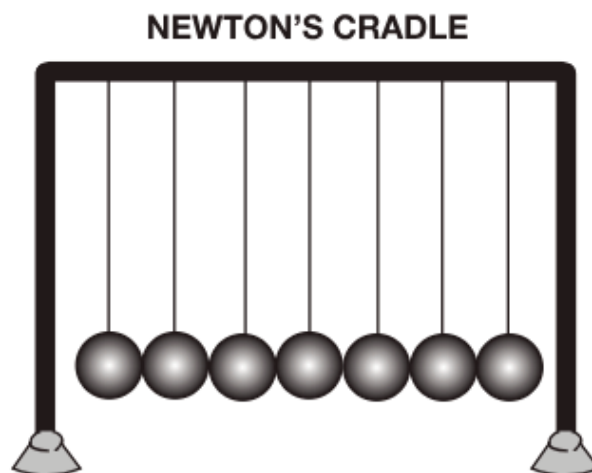
Grade 5

# Unit 1

# Unit 1

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

A group of students used a Newton's cradle to investigate force and motion. The Newton's cradle, named after Sir Isaac Newton, is a device that demonstrates conservation of the force of motion and energy using a series of swinging spheres. A Newton's cradle is constructed using several steel spheres that are hung on a rack by wires so that the spheres line up with each other. When one sphere on an end is lifted and released, it strikes the stationary spheres; a force is transmitted through the stationary spheres and pushes the last sphere upward. A diagram of a Newton's cradle is shown below.



# Unit 1

## Sphere Release Investigation

The students used Newton's cradle to measure how the movement of the sphere on the left affects the movement of the sphere on the right. They measured the distance the sphere on the left was pulled away from the sphere next to it, released the sphere, and measured the distance the sphere on the right moved away from the other spheres. The students performed three trials for each distance. Shown below in the data table are the averages of their observations.

**SPHERE RELEASE DATA**

| <b>Trial</b> | <b>Distance Sphere on Left Pulled Back Before Release (millimeters)</b> | <b>Distance Sphere on Right Moves After Release of Ball (millimeters)</b> |
|--------------|---|---|
| 1            | 10  | 10  |
| 2            | 20  | 20  |
| 3            | 30  | 30  |

# Unit 1

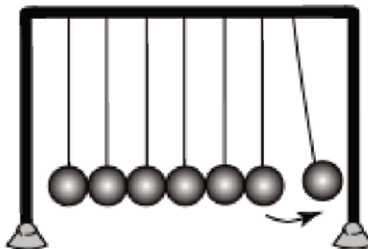
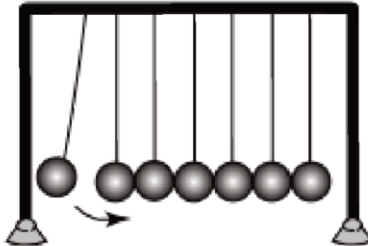
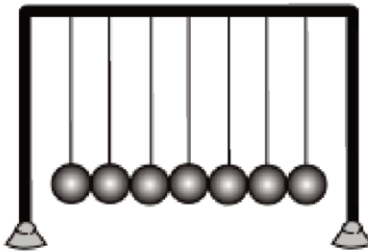
- 1 During the investigation, the students observed unbalanced and balanced forces.

Determine which type of force impacts the spheres in the cradle.

Write the type of force in the box next to each diagram. Each type of force may be used more than once.

unbalanced forces

balanced forces



# Unit 1

- 2 The students changed the release distance of the sphere during their investigation.

Which statements best describe the purpose for increasing the release distance between the trials?

Select all that apply.

- A to indicate balanced forces are acting on the spheres
- B to determine the types of forces acting on the spheres
- C to measure the strength of the force acting on the spheres
- D to change the direction of the force acting on the spheres
- E to observe the effect of unbalanced forces acting on the spheres

- 3 In order to gather additional evidence, the students modified their investigation on the forces that affect the movement of the spheres.

Identify the steps the students will most likely follow when investigating the effect of unbalanced forces on the spheres.

Write the description of each step in the table.

Release the sphere.

Pull the left sphere out 50 millimeters.

Record the distance the sphere on the right moves.

Record the amount of time it takes the spheres to stop moving.

| Step 1 | Step 2 | Step 3 |
|--------|--------|--------|
|        |        |        |

# Unit 1

- 4 The students decided to expand the type of data reported in the Newton's cradle investigation to describe the force that caused the movement of the spheres.

The additional data the student will most likely use to determine the type of force applied to the cradle balls is the difference in

- A the movement of the spheres
- B the height of the spheres
- C the speed of the spheres
- D the mass of the spheres

# Unit 1

## 5 Part 1

The students performed an investigation to determine how many spheres moved on the right when different numbers of spheres were pulled back and released from the left. The table below shows their results.

| Number of Spheres Pulled Back and Released from the Left | Number of Spheres That Moved on the Right |
|--|---|
| 1  | 1   |
| 2  | 2   |
| 3  | 3   |

Which evidence from the students' investigation demonstrates that the pattern of motion for the spheres is predictable?

- A The spheres eventually stop moving.
- B The spheres on the right side can be pulled back.
- C The movement of the spheres occurs over different periods of time
- D The movement of the sphere on the right matches the movement of the released spheres.

## Part 2

The students used the data from their investigation to predict future motion of the spheres in Newton's cradle.

How many spheres on the right will most likely move if a student releases 4 spheres on the left?

Enter your answer in the box.



# Unit 1

- 6 Use evidence from the students' investigations to develop an argument in support of the need for multiple trials to produce sufficient data.

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# Unit 2

# Unit 2

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

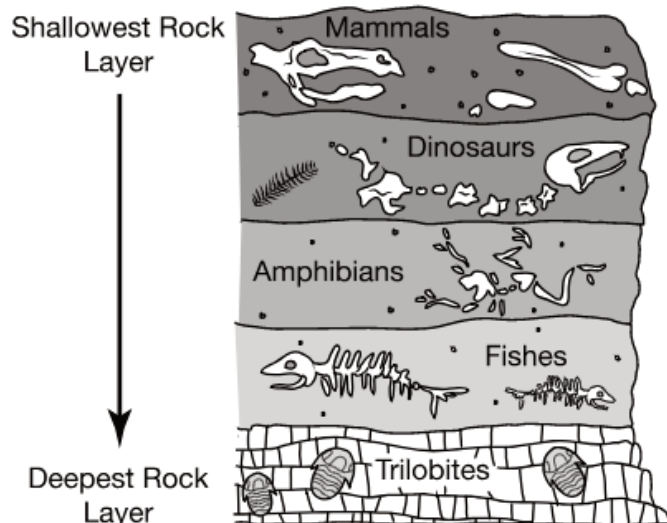
While researching dinosaurs and fossils, a student found interesting facts about trilobites, which are a group of fossils without backbones. Trilobites inhabited Earth long ago and were arthropods such as insects, spiders, and shellfish. The research also indicated that there are two main types of fossils, which have taken millions of years to form. A table with data about each type of fossil is shown below.

## TYPES OF FOSSILS

| Body Fossils  | Trace Fossils  |
|---|--|
| <ul style="list-style-type: none"><li>• Remains of organisms that were once living</li><li>• Usually only the hard parts of animals become fossilized<ul style="list-style-type: none"><li>◦ shells</li><li>◦ teeth</li><li>◦ bones</li></ul></li><li>• However, feathers, fur, and skin have also been found</li></ul> | <ul style="list-style-type: none"><li>• Imprints from organisms that were once present<ul style="list-style-type: none"><li>◦ tracks &amp; footprints</li><li>◦ trails &amp; burrows</li><li>◦ eggs &amp; nests</li><li>◦ leaf impressions</li></ul></li></ul> |

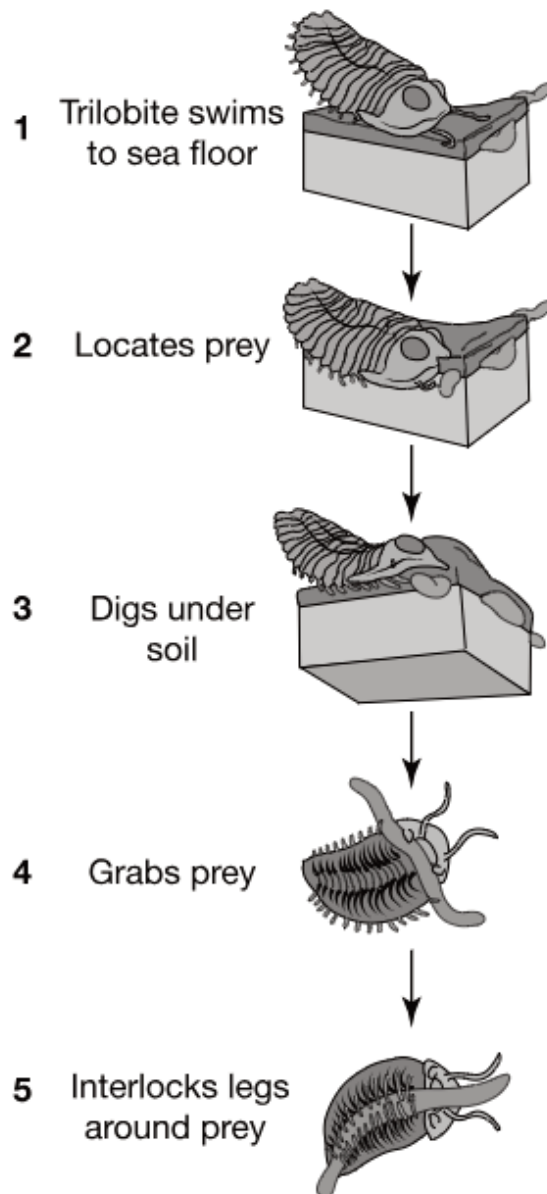
While collecting additional information on fossils, the student found that rock layers contain trilobites and other types of fossils. The diagram below shows the types of fossils that can be found in the rock layers of many canyons in North America.

## FOSSILS IN ROCK LAYERS



# Unit 2

For many years, body fossils and trace fossils have enabled scientists to identify many of the physical characteristics of extinct organisms, and recently, scientists have developed ways to study the behaviors of these organisms. The research indicated that trilobites lived in shallow seas and were very successful predators for 300 million years. Trilobites were crablike animals that ranged from 1 millimeter to more than 500 millimeters in length. By closely studying the sediments surrounding trilobite fossils, scientists have determined that trilobites would dig under soil to obtain prey, such as worms, and capture the prey with their many legs. With its legs interlocked around the prey, the prey could not swim away. The series of diagrams below illustrate how a trilobite most likely looked when capturing worms for food.



# Unit 2

- 1** The data from the table about the types of fossils could be used as evidence to help scientists determine certain characteristics of extinct organisms.

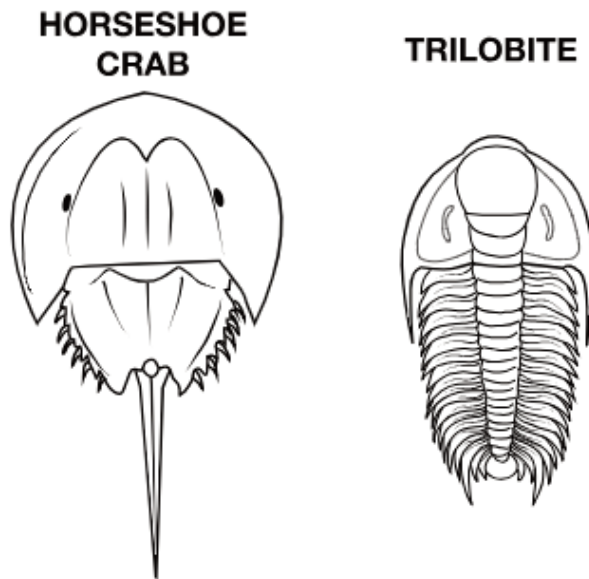
**Use evidence from the fossils to identify the characteristics of extinct organisms.**

**Select all that apply.**

- A** the size of the organisms
- B** the shape of the organisms
- C** the sounds the organisms made
- D** the number of organisms that existed
- E** the type of environment in which the organisms lived

# Unit 2

- 2 Evidence in the research indicated that horseshoe crabs found in Atlantic coastal waters today are sometimes called “living fossils” because they also lived at the same time as trilobites, a close relative, over 500 million years ago. A diagram of a horseshoe crab and a trilobite is shown below.



The evidence that best explains that horseshoe crabs are relatives of trilobites is that horseshoe crabs

- A live in similar habitats
- B have similar life spans
- C have similar eating habits
- D have similar body structures

# Unit 2

- 3** Use the data on trilobites to identify the type of environment in which trilobites once lived.

Trilobites most likely lived in an environment that was

- A** a desert
- B** a grassland
- C** an ocean
- D** a rain forest

- 4** Evidence in the diagram of fossils in rock layers can be used to determine that the fossils of dinosaurs are

✓ Choose...  
younger than  
older than  
the same age as

the mammal fossils and

✓ Choose...  
younger than  
older than  
the same age as

the trilobite fossils.

# Unit 2

**5** Scientists would most likely determine the behavior of trilobites by examining evidence of

- A** the age of extinct organisms
- B** the size of extinct organisms
- C** the color of modern land-related organisms
- D** the actions of modern ocean-related organisms



# Unit 2

- 6** Use evidence from the diagram of fossils in rock layers to describe how the environment has changed over time. In your description, be sure to include the types of fossils present in each layer.

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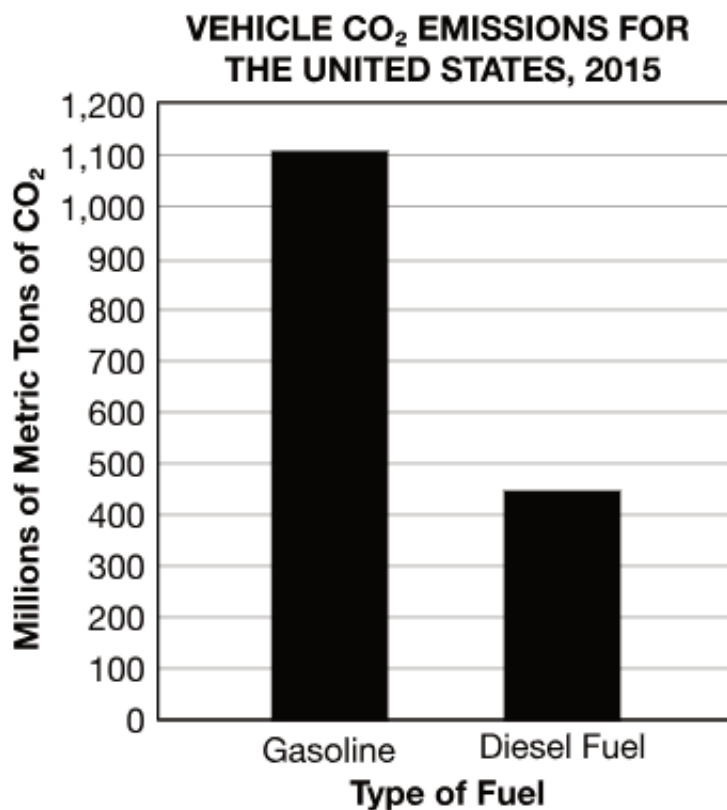
# Unit 3

# Unit 3

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

After seeing advertisements promoting vehicles that use cleaner-burning fuels, a student decided to research the fuels that cars use. The research indicated that most vehicles use gasoline and diesel as fuel. Gasoline and diesel are fossil fuels. One issue with the use of fossil fuels is that when burned, carbon dioxide ( $\text{CO}_2$ ) and other harmful gases are released into the atmosphere.

Through Internet research the student also found that vehicles release millions of metric tons of  $\text{CO}_2$  into the atmosphere every year, and just one metric ton is commonly compared to the mass of an adult polar bear. A graph that shows the millions of metric tons of  $\text{CO}_2$  produced by vehicles in the United States in 2015 is shown below.



# Unit 3

The student continued research on three other types of vehicles carmakers are producing that release fewer harmful gases than gasoline and diesel engines. The student constructed a table of the energy sources and how the energy sources power the vehicles, shown below.

**THREE TYPES OF VEHICLES**

| Vehicle   | Source of Energy   | Emissions   |
|-----------|--|---|
| Hybrid    | <ul style="list-style-type: none"><li>• Battery</li><li>• Gasoline</li></ul>         | <ul style="list-style-type: none"><li>• Zero CO<sub>2</sub> emissions at low speeds</li><li>• CO<sub>2</sub> emissions at higher speeds</li></ul> |
| Electric  | <ul style="list-style-type: none"><li>• Battery</li></ul>                            | <ul style="list-style-type: none"><li>• Zero CO<sub>2</sub> emissions when driven</li></ul>   |
| Biodiesel | <ul style="list-style-type: none"><li>• Vegetable oil</li><li>• Animal fat</li></ul> | <ul style="list-style-type: none"><li>• Less CO<sub>2</sub> emissions than gasoline engine</li></ul>  |

# Unit 3

- 1 The research indicated that some fuels that are used by vehicles are fossil fuels.

Fossil fuels are

- A nonrenewable resources formed from lava
- B renewable resources formed from burning coal
- C renewable resources formed from rocks and minerals
- D nonrenewable resources formed from the remains of plants and animals

- 2 The student's research indicates that gasoline- and diesel-powered vehicles would most likely affect the environment by

- A decreasing the use of fossil fuels
- B increasing the amount of air pollution
- C increasing the number of animal habitats
- D decreasing the amount of water pollution

- 3 The student's research about fuels such as biodiesel and electricity to power vehicles shows evidence that carmakers are most likely attempting to conserve

✓ Choose...

renewable resources  
nonrenewable resources

and

✓ Choose...

increase  
decrease  
not affect

the

amount of carbon dioxide in the atmosphere.

# Unit 3

- 4 The student constructed a table to identify the positive and negative effects of using a hybrid vehicle on the environment.

Write the effects in the appropriate box.

|   |  |
|---|--|
| Releases no CO <sub>2</sub> at low speeds | Releases CO <sub>2</sub> at higher speeds      |
| Uses nonrenewable resources               | Uses less fuel than a gasoline-powered vehicle |
| Positive Effect of Hybrid Vehicles        | Negative Effect of Hybrid Vehicles             |

- 5 The student used research to identify the types of fuel that are renewable and nonrenewable resources used to power vehicles.

Write each type of fuel in the appropriate box.

|                     |                        |           |
|---------------------|------------------------|-----------|
| Gasoline            | Diesel                 | Biodiesel |
| Renewable Resources | Nonrenewable Resources |           |

# Unit 3

- 6** Use evidence from the research to compare how using different energy sources to power vehicles affects the environment.

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