Default Question Block

Grade 8 Form B
Task #1 Pirate Bay

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State Student ID

[   ]

Use the information provided in any part of this task to answer the questions.

Several hundred years ago, a group of pirates discovered a place to hide their treasure. They found an unusual bay that faintly glowed at night. Surprisingly, the glow was stronger around their small boat when it moved through the bay.

More recently, scientists have examined samples of the glowing water from the bay under a microscope. Scientists now know that the light in the bay is produced by bioluminescent organisms.

The image shows one of the microorganisms, a dinoflagellate.
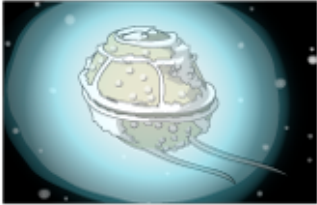
The glowing microorganisms in the water may be like fireflies. They can produce light as well.

Fireflies produce a protein called luciferase. The luciferase protein helps a chemical reaction that uses oxygen and other compounds to produce light. No heat is generated in this reaction. This is called bioluminescence. The diagram shows this reaction.
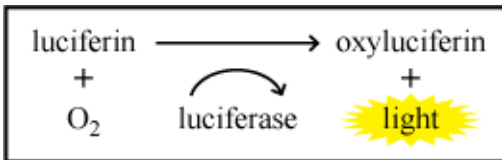
Question 1

Move the labels into the boxes to show how genetic information affects the production of light in fireflies.

Items
light production trait
luciferase gene
luciferase protein

Genetic Information Model

results in...

results in...

Question 2

Using what you know about fireflies, which statement is MOST LIKELY also true about the dinoflagellates in the pirate's bay?

○ A) The microorganisms generate heat from the light.

○ B) The microorganisms use luciferase to produce light.

○ C) The microorganisms have a protein that produces light.

○ D) The microorganisms produce many different colors of light.

Question 3

Bioluminescence is a heritable trait. It has many uses for organisms. Some use bioluminescence to attract mates. The angelfish uses it like a lure to attract prey. The larvae of some cave flies glow to attract prey, which gets stuck in sticky web like structures. The midshipman fish uses bioluminescence to hide if the Sun or other light source is shining behind it. The light is often used to distract or repel predators. The vampire squid can eject a cloud of glowing liquid to help it escape predators. Some species use the light to warn a predator that they are toxic or use it to attract other creatures that will eat the predator.

Based on the passage, select all the possible reasons the microorganisms in the pirate's bay might have the bioluminescence trait.

☐ A) Bioluminescence is used to attract prey.

☐ B) Bioluminescence is used to help them see.

☐ C) Bioluminescence is used to startle predators.

☐ D) Bioluminescence is used to attract predators.

☐ E) Bioluminescence is used as camouflage to help them hide.

Question 4

The graph shows the relative population of two types of microorganisms over time, as the number of predators increases.
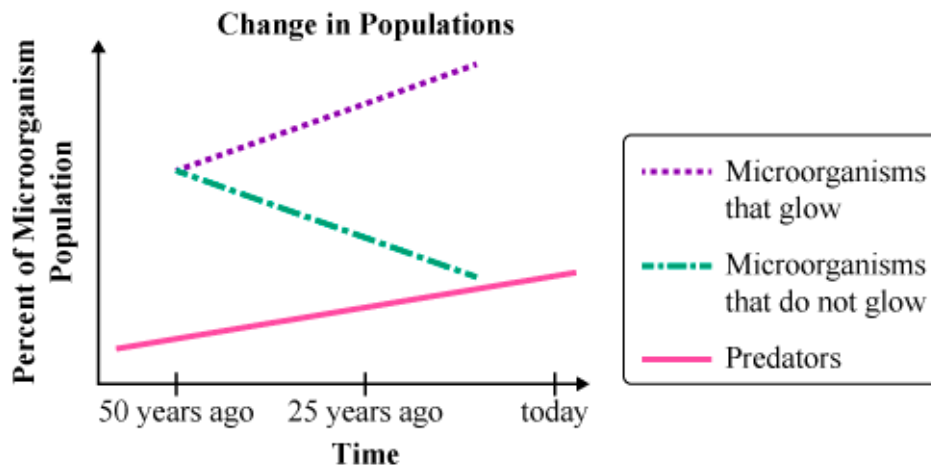
Which pattern is shown in the data that would support a claim that microorganisms use bioluminescence to startle predators?

○ A) As the population of predators increases, the trait for bioluminescence increases in the population.

○ B) As the population of predators decreases, the trait for bioluminescence decreases in the population.

○ C) As the percentage of nonbioluminescent microorganisms increases, the population of predators decreases.

○ D) As the percentage of bioluminescent microorganisms increases, the population of nonbioluminescent microorganisms decreases.

Question 5

This question has two parts. Answer Part A, then answer part B.

Part A

Make a claim about whether the trait of bioluminescence is harmful or beneficial to the glowing microorganisms in the pirate's bay.

○ A) Bioluminescence is beneficial.

○ B) Bioluminescence is harmful.

○ C) Bioluminescence is neutral.

Part B

Select the evidence that supports the claim in part A.

○ A) In the pirate's bay, the nonbioluminescence trait in populations is increasing while bioluminescence traits are decreasing.

○ B) In the pirate's bay, the bioluminescence trait in populations is increasing while nonbioluminescence traits are decreasing.

○ C) In the pirate's bay, the bioluminescence trait is useful for some microorganisms but is harmful to the predators of those organisms.

○ D) In the pirate's bay, the population of microorganisms with bioluminescence increases as the population of predators increases.

Prompt 6

This question has two parts. Answer Part A, and then answer part B.

Part A

The pirates noticed that the light was brighter when the boat was moving than when it was stopped. Which wave model BEST represents the light when the boat was stopped compared to when the boat was moving?

Stopped　　　　Moving

Stopped　　　　Moving

Stopped　　　　Moving
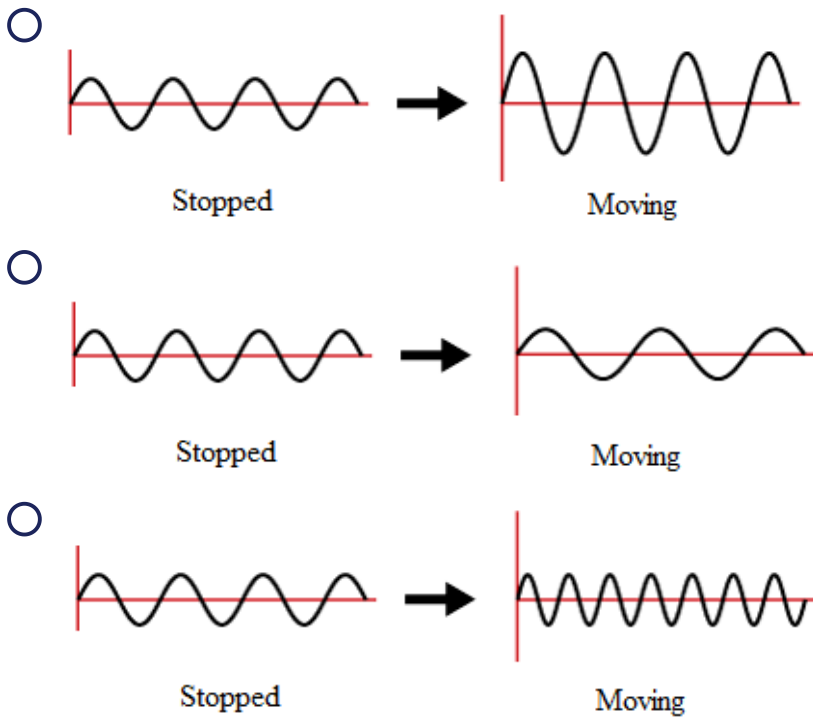
Part B

Why is the model chosen in Part A the BEST representation?

○ A) Wave speed causes the brightness of light waves. The faster the wave, the brighter the light.

○ B) Wavelength causes the brightness of light waves. The longer the wave, the brighter the light.

○ C) Wave amplitude causes the brightness of light waves. The taller the wave, the brighter the light.

○ D) Wave frequency causes the brightness of light waves. The more waves per second, the brighter the light.

Student Feedback

Feedback Question #1

How interesting was the task you just completed?

1 star is not interesting and 5 stars is very interesting.

Feedback Question #2

How difficult was the task as a whole?

1 star is not difficult and 5 stars is very difficult.

Feedback Question #3

Please rate the difficulty **to understand how to respond to each question.**

1 star is not difficult and 5 stars is very difficult.

Question 1

Question 2

Question 3

Question 4

Question 5

Grade 8 Form B
Task #2 Sculpture Setup

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Use the information provided in any part of this task to answer the questions.

A two-part sculpture of a butterfly donated to a school and needs to be placed onto a pedestal. Students will program a robot to place the sculpture into the pedestal safely without

breaking the sculpture or the pedestal.

butterfly
sculpture

sculpture
base
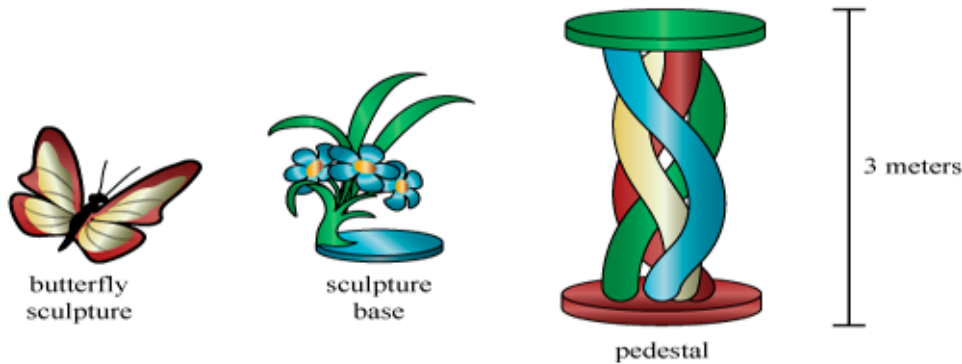
pedestal

3 meters

- The sculpture base has a mass of 10 kilograms.
- The butterfly sculpture has a mass of 40 kilograms.
- The robot applies an unbalanced force of 1000 newtons.
- The pedestal is 3 meters tall.
- The safe acceleration rate for the sculpture is 2 meters per second squared.

Question 1

The students think about how forces will affect the motion of the sculpture. Move one force arrow into each box for each location in the diagram to show how they cause the sculpture to be lifted upward.

Up

butterfly
sculpture
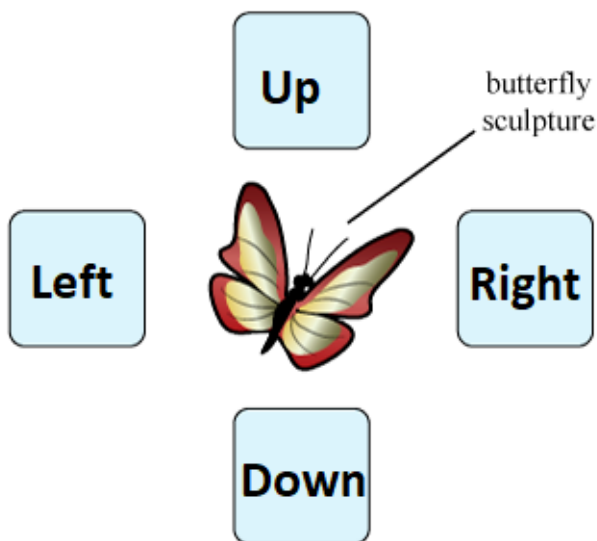
Left

Right

Down

Items

Small Up

Large Up

Small Left

Large Left

Small Right

Large Right

Small Down

Large Down

Up	Right

Left	Down

Question 2

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

To program the robot, students do an investigation to determine how much applied force is needed to lift objects with different masses. The students lift the objects with a spring scale and record the results in the data table.

Mass of Objects (kilograms)	Applied Force (newtows)
1	10
2	20
3	30
4	40

Part A

Which relationship do the students find between the mass of an object and the applied force?

○ A) The object's mass is 10 times the applied force.

○ B) The mass of the objects causes the applied force to increase.

○ C) The less the applied force, the greater the mass of the objects.

○ D) The greater the mass of an object, the greater the applied force.

Part B

Calculate the minimum applied force needed (in newtons) to lift the sculpture base and the butterfly together onto the pedestal.

Question 3

Students do another investigation to determine the relationship between acceleration and force. They lift a 10-kilogram object repeatedly with increasing unbalanced forces. They measure the resulting accelerations and record the results in the data table.

Mass of Object (kilograms)	Unbalanced Force (newtons)	Acceleration of Object (meters per second squared)
10	10	1
10	50	5
10	100	10
10	150	15

Which relationship do the students find between acceleration and force?

○ A) As the unbalanced force increases, the mass of the object stays the same.

○ B) As the unbalanced force increases, the acceleration of the object increases.

○ C) As the acceleration of the object increases, the unbalanced force decreases.

○ D) As the acceleration of the object increases, the mass of the object stays the same.

Question 4

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

Part A

Use patterns in the data as evidence to make a scientific claim about the relationship between the unbalanced force applied to an object, the mass of the object, and the change in motion.

Mass of Objects (kilograms)	Applied force (newtons)
1	10
2	20

3	30
4	40

Mass of Object (kilograms)	Unbalanced Force (newtons)	Acceleration of Object (meters per second squared)
10	10	1
10	50	5
10	100	10
10	150	15

Which conclusion can the students make from the patterns of data from their investigations?

○ A) If mass increases from 1 kilogram to 4 kilograms, the motion stays the same.

○ B) If the force increases from 2 newtons to 8 newtons, the motions stays the same.

○ C) If the force increases by 10 newtons for each 1-kilogram increase in mass, then the change in motion will stay the same.

○ D) If the mass increases by 2 times, then the force must also increase by 2 times to keep the change in motion the same.

Part B

Which mathematical formula BEST represents the data?

○ A) $a = m / F$

○ B) $F = ma$

○ C) $m = Fa$

○ D) $m = a / F$

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A two-part sculpture of a butterfly donated to a school and needs to be placed onto a pedestal. Students will program a robot to place the sculpture into the pedestal safely without breaking the sculpture or the pedestal.

butterfly
sculpture

sculpture
base
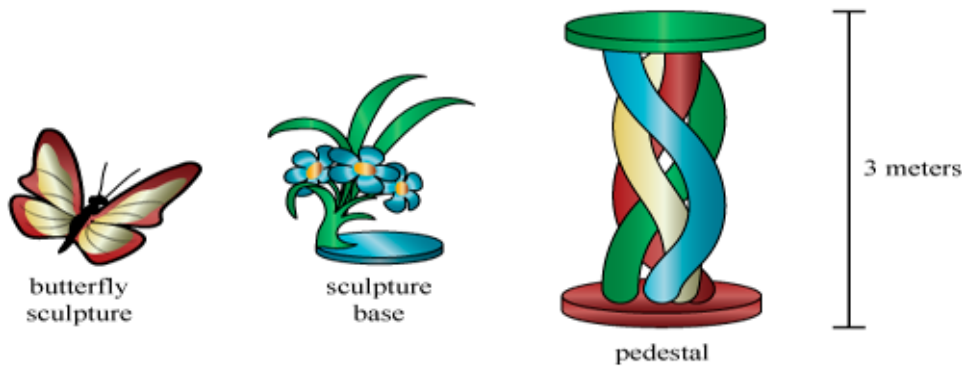
3 meters

pedestal

- The sculpture base has a mass of 10 kilograms.
- The butterfly sculpture has a mass of 40 kilograms.
- The robot applies an unbalanced force of 1000 newtons.
- The pedestal is 3 meters tall.
- The safe acceleration rate for the sculpture is 2 meters per second squared.

Mass of Objects (kilograms)	Applied force (newtons)
1	10
2	20
3	30
4	40

Mass of Object (kilograms)	Unbalanced Force (newtons)	Acceleration of Object (meters per second squared)
10	10	1
10	50	5
10	100	10
10	150	15

Question 5

The students have two options to set up the sculpture.

- Assemble the 40-kilogram butterfly sculpture on the 10-kilogram sculpture base and move them together onto the pedestal.
- Move the 40-kilogram sculpture base onto the pedestal, then move the 10-kilogram sculpture onto the pedestal.

Use the equation to determine the acceleration of the parts and the assembled sculpture when the robot moves them with an unbalanced force of 1,000 newtons.

$F = ma$

Enter the acceleration (in meters per second squared) of each part of the sculpture and the assembled sculpture into the boxes.

Acceleration of the 10-kilogram butterfly sculpture:

Acceleration of the 40-kilogram sculpture base:

Acceleration of the 50-kilogram sculpture and sculpture base together:

Question 6

How could the sculpture be safely placed onto the pedestal using the robot? Make a claim for what is the best solution to the problem. Use the data and your calculations as evidence to support your claim.
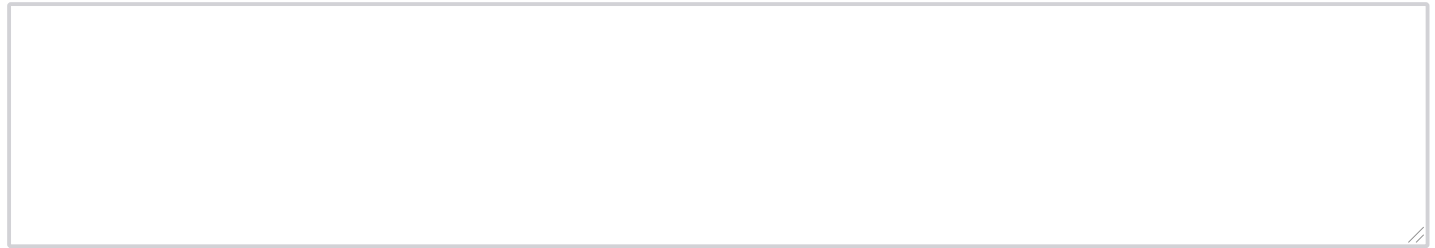
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Question 1

Question 2

Question 3

Question 4

Question 5

Question 6

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