NGSS Grade 11 NGSS Practice Test Answer Key

Item 1

Alignment: HS-PS2-3: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

- **SEP:** Constructing Explanations and Designing Solutions
- **DCI:** PS2.A: Forces and Motion
- **CCC:** Cause and Effect

Part A

Complete the table to indicate how force is affected by changes in collision properties. Click on each blank box and select the words or phrases that describe how the force affecting the cell phone changes.

- In each scenario, assume that the cell phone is dropped directly down, that it is not thrown or given any extra momentum, and that all of the other variables remain unchanged.

Change in Collision Properties	Change in Force Affecting the Cell Phone
The mass of the cell phone is doubled.	The force [ ]
The cell phone automatically powers off during fall.	The force [ ]
The change in velocity of the cell phone during the collision is doubled.	The force [ ]
The time interval of the collision is doubled.	The force [ ]

Options:

- Increases.
- Decreases.
- Is not affected.

Answer:

Change in Collision Properties	Change in Force Affecting the Cell Phone
The mass of the cell phone is doubled.	The force increases.
The cell phone automatically powers off during fall.	The force is not affected.
The change in velocity of the cell phone during the collision is doubled.	The force increases.
The time interval of the collision is doubled.	The force decreases.

Part B

Click on each blank box and select a word or phrase to describe one feature that the cell phone case design must have.

The cell phone case should be designed to [ ] the force on the cell phone in a collision. To do this, the design should [ ]

Options:

- The cell phone case should be designed to
  - Reduce
  - Increase
  - Maximize
  - Eliminate
- The force on the cell phone in a collision. To do this, the design should
  - Increase the mass of the cell phone.
  - Decrease the mass of the cell phone.
  - Increase the time interval of the collsion.
  - Decrease the time interval of the collision.
  - Increase the height from which the cell phone falls.
  - Decrease the height from which the cell phone falls.

Answer:

The cell phone case should be designed to [reduce] the force on the cell phone in a collision. To do this, the design should [increase the time interval of the collision.]

Part C

The first priority of the design is that the cell phone case should protect the cell phone from damage when it is dropped. However, other criteria can also be considered when designing a cell phone case.

Select **two** more criteria that you would like to prioritize in your design. Click on the blank boxes and select the words or phrases to complete the table.

- Prioritize only **two** design criteria.
- Select "Second" and "Third" for the criteria you would like to designate as second and third priority, respectively.
- For the design criteria **not** prioritized, select "Not prioritized".

Priority	Criteria
First	The cell phone case should protect the cell phone from damage when it is dropped.
	The cell phone case should be easy to grip.
	The cell phone case should be recyclable.
	The cell phone case should be inexpensive.

Answer: Responses may vary based on the student's preferences. The student receives a point for Part C by prioritizing only two criteria.

Part D

Based on your choices in part C, select the material from Table 2 you will use for your cell phone case design.

Ⓐ Material 1

Ⓑ Material 2

Ⓒ Material 3

Ⓓ Material 4

Ⓔ Material 5

Ⓕ Material 6

Answer: Responses will vary based on the student's response in Part C.

Part E

Design parameters

Material number: Material 1

Thickness of cell phone case (mm): 1 mm

Height from which cell phone case is dropped (m):

0.5 m (height of a pocket while seated on a bench)

Start

Prototype	Material	Case thickness (mm)	Height phone is dropped from (m)	% Volume (size) increase of phone	Force on phone (N)

Answer: Responses will vary. The student receives one point for using the material chosen in Part D for all trials; one point for varying the thickness of the case while holding other variables constant; and one point for varying the height the phone is dropped from while holding other variables constant. This is an example of an output table that would receive all three points if the material chosen in Part D is Material 3:

Prototype	Material	Case thickness (mm)	Height phone is dropped from (m)	% Volume (size) increase of phone	Force on phone (N)
1	Material 3	1	0.5	10	4.0
2	Material 3	3	0.5	30	3.7
3	Material 3	5	0.5	50	3.4
4	Material 3	3	1.0	30	5.2

Part F

Based on your prioritized criteria in part C, which prototype worked the best?

Ⓐ Prototype 1

Ⓑ Prototype 2

Ⓒ Prototype 3

Ⓓ Prototype 4

Answer: Responses will vary based on the student's trials in Part E.

Part G

A company wants to produce your cell phone case and sell it to construction workers. Construction workers often work on tall structures.

Select a change to improve the prototype you chose in part F to make it more suitable for construction workers.

Ⓐ The cell phone case needs to be easier to grip.

Ⓑ The cell phone case needs to be less expensive.

Ⓒ The cell phone case needs to add less volume to the cell phone.

Ⓓ The cell phone case needs to protect the cell phone from damage when dropped from a height of more than 3 meters.

Answer: D

Item 2

Alignment: HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

- **SEP:** Developing and Using Models
- **DCI:** PS1.A: Structure and Properties of Matter
- **CCC:** Patterns

Part A

Which element would form structures similar to carbon?

Ⓐ iodine

Ⓑ silicon

Ⓒ lithium

Ⓓ titanium

Answer: B

Part B

Using the periodic table, enter the number of valence electrons that would be contained in the element that forms structures similar to carbon. Enter your answer in the blank box provided.

Number of valence electrons in element: ⌨

Answer: 4

Item 3

Alignment: HS-LS1-6: Construct explanations and revise, as needed, based on evidence for 1) how carbon, hydrogen, and oxygen may combine with other elements to form amino acids and/or other large carbon-based molecules, and 2) how other hydrocarbons may also combine to form large carbon-based molecules.

- **SEP:** Constructing Explanations and Designing Solutions
- **DCI:** LS1.C: Organization of Matter and Energy Flow in Organisms
- **CCC:** Energy and Matter
-

Part A

Which claim about the antimicrobial compound is supported by the evidence in Tables 1–3?

Ⓐ The antimicrobial compound is a nucleic acid in the tick's cells.

Ⓑ The antimicrobial compound is a lipid found in the tick's intestine.

Ⓒ The antimicrobial compound is a carbohydrate consumed by the tick.

Ⓓ The antimicrobial compound is a protein produced in the tick's digestive system.

Answer: D

Part B

Select **two** pieces of information that could help determine what type of macromolecule the antimicrobial compound is.

- ☐ elemental composition of protein
- ☐ elemental composition of glucose
- ☐ elemental composition of cholesterol
- ☐ range of concentration of protein in blood
- ☐ range of concentration of glucose in blood
- ☐ range of concentration of cholesterol in blood
- ☐ elemental composition of the antimicrobial compound

Answer:

- ☑ elemental composition of protein
- ☐ elemental composition of glucose
- ☐ elemental composition of cholesterol
- ☐ range of concentration of protein in blood
- ☐ range of concentration of glucose in blood
- ☐ range of concentration of cholesterol in blood
- ☑ elemental composition of the antimicrobial compound

Part C

Select **two** processes that must be understood to explain how the antimicrobial compound is produced in the tick.

- [ ] DNA replication
- [ ] protein synthesis
- [ ] calcium absorption
- [ ] membrane synthesis
- [ ] digestion of macromolecules

Answer:

- [ ] DNA replication
- [x] protein synthesis
- [ ] calcium absorption
- [ ] membrane synthesis
- [x] digestion of macromolecules

Part D

Click on the blank boxes and select phrases for each step to explain the process of antimicrobial compound production in the black-legged tick.

Steps of Antimicrobial Compound Formation

Number	Step
1	
2	
3	
4	
5	

Options:

- Tick consumes the blood of a guinea pig.
- Chains of amino acids are linked and folded.
- Proteins in the blood are broken down into smaller molecules and atoms.
- Amino acids are attached in long chains according to the mRNA sequence.
- Elements from the sugar molecules in the blood are rearranged into amino acids.
- Sugar molecules in the blood are broken down into smaller molecules are atoms.
- Elements from the protein molecules in the blood are rearranged into amino acids.

Answer:

Steps of Antimicrobial Compound Formation

Number	Step
1	Tick consumes the blood of a guinea pig.
2	Sugar molecules in the blood are broken down into smaller molecules and atoms.
3	Elements from the sugar molecules in the blood are rearranged into amino acids.
4	Amino acids are attached in long chains according to the mRNA sequence.
5	Chains of amino acids are linked and folded.

Item 4

Alignment: HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

- **SEP:** Constructing Explanations and Designing Solutions
- **DCI:** LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- **CCC:** Stability and Change

Part A

Select boxes in the table to identify the potential outcome(s) for each solution.

- More than one box can be selected in each row.

Solution	Negative Impact on the Surrounding Environment	Positive Impact on the Number of Mating Females	Negative Impact on Commercial Fishing Industry
Catch restrictions	☐	☐	☐
Restore seagrass beds	☐	☐	☐
Natural predator removal	☐	☐	☐

Answer:

Solution	Negative Impact on the Surrounding Environment	Positive Impact on the Number of Mating Females	Negative Impact on Commercial Fishing Industry
Catch restrictions	☐	☑	☑
Restore seagrass beds	☐	☑	☐
Natural predator removal	☑	☑	☐

Part B

Select **two** solutions that, when combined, would be the **best** method to help increase the population of blue crabs in the Chesapeake Bay. Then, select an explanation for the two methods you chose.

Solution Combinations	Explanation

Options:

- Solution Combinations:
  - Catch restrictions and restore seagrass beds
  - Catch restrictions and natural predator removal
  - Restore seagrass beds and natural predator removal
- Explanation
  - Increased nutrients, habitat availability and biodiversity
  - Increased nutrients and biodiversity; decreased predators
  - Increased habitat availability and biodiversity; decreased predators

Answer:

Solution Combinations	Explanation
Catch restrictions and restore seagrass beds	Increased nutrients, habitat availability and biodiversity

Item 5

Alignment: HS-ESS2-7: Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

- **SEP:** Engaging in Argument from Evidence
- **DCI:** ESS2.E: Bioecology
- **CCC:** Stability and Change

Part A

Based on Figure 1, enter numbers in the blank boxes to indicate the percentage of each atmospheric gas for each time period.

Atmospheric Gas	3 bya	2 bya	1 bya
CO_2	%	%	%
O_2	%	%	%
N_2 (and trace gases)	%	%	%

Answer:

Atmospheric Gas	3 bya	2 bya	1 bya
CO_2	26 %	2 %	1 %
O_2	0 %	2 %	5.5 %
N_2 (and trace gases)	74 %	96 %	93.5 %

Part B

Select **two** statements that are supported by Figure 1 and your answers to part A.

- [ ] CO_2 and O_2 have an inverse relationship.
- [ ] CO_2 and O_2 are currently equal in abundance.
- [ ] O_2 began increasing only one billion years ago.
- [ ] N_2 was the most abundant gas for two billion years.
- [ ] There is no relationship between CO_2 and O_2 abundance.

Answer:

- [x] CO_2 and O_2 have an inverse relationship.
- [ ] CO_2 and O_2 are currently equal in abundance.
- [ ] O_2 began increasing only one billion years ago.
- [x] N_2 was the most abundant gas for two billion years.
- [ ] There is no relationship between CO_2 and O_2 abundance.

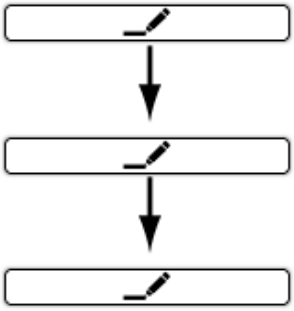
Part C

Select the sentences in order to complete the causal chain describing the relationship between the appearance of cyanobacteria and the decline of anaerobic organisms.

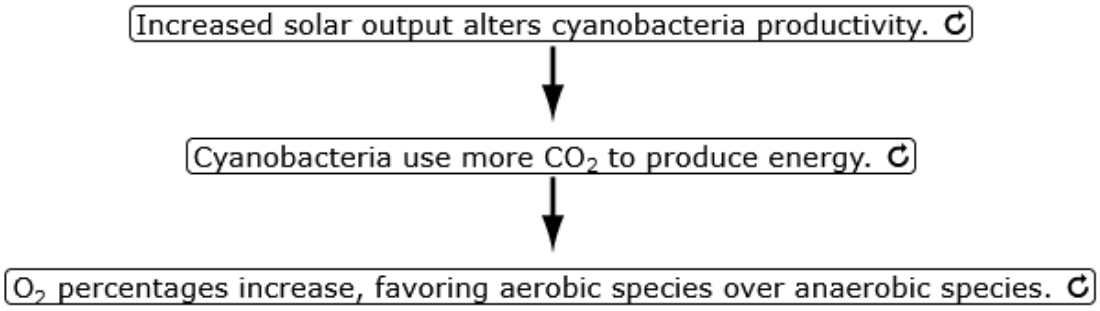
- Click on the pencil icon.
- Then, click on a highlighted sentence from the list with the pencil to make your first selection.
- Click on the next pencil icon(s) to make another selection.
- Click on the circular arrow that follows any selection you would like to change.

Sentences:

- CO_2 percentages increase.
- N_2 percentages drop in the atmosphere.
- Cyanobacteria use more CO_2 to produce energy.
- Increased solar output alters cyanobacteria productivity.
- O_2 percentages increase, favoring aerobic species over anaerobic species.
- Anaerobic organisms use more O_2 to produce energy, allowing them to outcompete aerobic species.



Answer:



Part D

Which statement describes why the abundance of anaerobic organisms changed, starting three bya?

Ⓐ Anaerobic organisms could not survive the increased solar radiation.

Ⓑ Anaerobic organisms no longer had access to abundant CO_2 in the atmosphere.

Ⓒ Anaerobic organisms were consumed by aerobic organisms during energy production.

Ⓓ Anaerobic organisms adjusted to the environment by evolving into aerobic organisms.

Answer: B

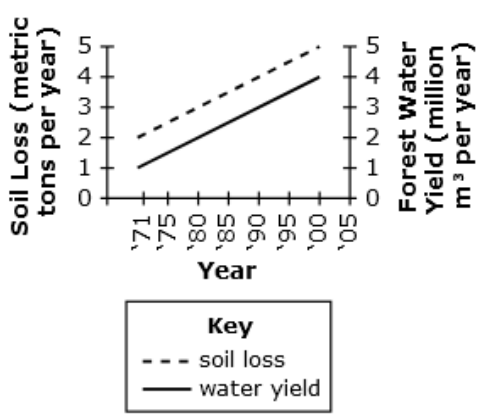
Item 6

Alignment: HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

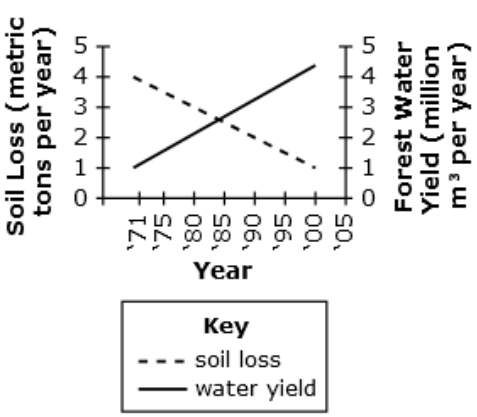
- **SEP:** Using Mathematics and Computational Thinking
- **DCI:** ESS3.D: Global Climate Change
- **CCC:** Systems and System Models

Based on the information in Figure 1, which model best describes the relationship between forest density, the amount of water a forest supplies (Forest Water Yield) and the amount of soil loss in South Korea between 1971 and 2005?

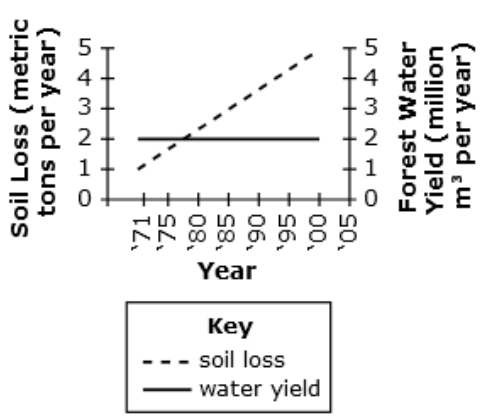
Ⓐ



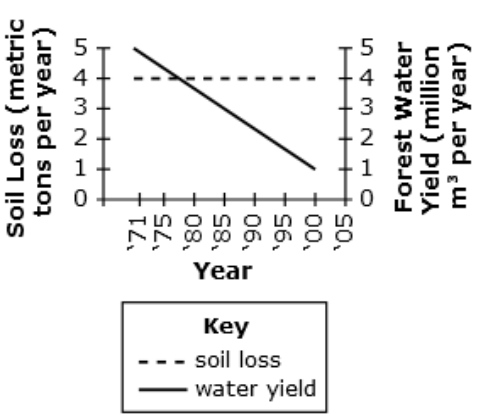
Ⓑ



Ⓒ



Ⓓ



Answer: B