

Work Samples

The published samples are mainly of four kinds:

- NGSS based
- State DoE Science Standards
- Indian clients' custom standards
- Based on self-designed standards

Samples 1 & 2 follow the NGSS style:

- Core standards performance expectations (PE)
- Science and engineering practices (SEP)
- Disciplinary core ideas (DCI)
- Crosscutting concepts (CCC)

Samples 3 & 4 follow:

- **Bloom's taxonomy**
 - Knowledge – Recall based
 - Comprehension – Understanding of description or passage
 - Application – Using the understanding to design or develop activities
 - Analysis – Interpreting graphs, tables, & diagrams to make predictions.
 - Synthesis – Developing hypotheses
 - Evaluation – Testing claims and solutions to problems.
- **Depth of knowledge (DoK) levels**
 - Dok 1 – Recall
 - Dok 2 – Understanding and comprehension
 - Dok 3 – Analysis, application, synthesis, and evaluation

Sample 5 has:

- Self-designed standard
- Storytelling

Other work samples:

- Solution writing
- Alternative text for the visually challenged

Work Sample 1

Passage style item for elementary school grades

PE:

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.[Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

SEP: Engaging in Argument from Evidence:

Developing and Using Models Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions.

Develop a model to describe phenomena.

DCI:

LS2.A. Interdependent Relationships in Ecosystems

The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

LS2.B. Cycles of Matter and Energy Transfer in Ecosystems

Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

CCC: Systems and System Models

A system can be described in terms of its components and their interactions.

Item Type: Part A: Drag-Drop, Part B: MS

Point: 2

Key: Part A: Drag-drop, Part B: A,B,E

Source: <https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/food-chains-food-webs>

<https://www.britannica.com/science/food-chain>

<https://sciencing.com/happens-something-food-chain-goes-extinct-18214.html>

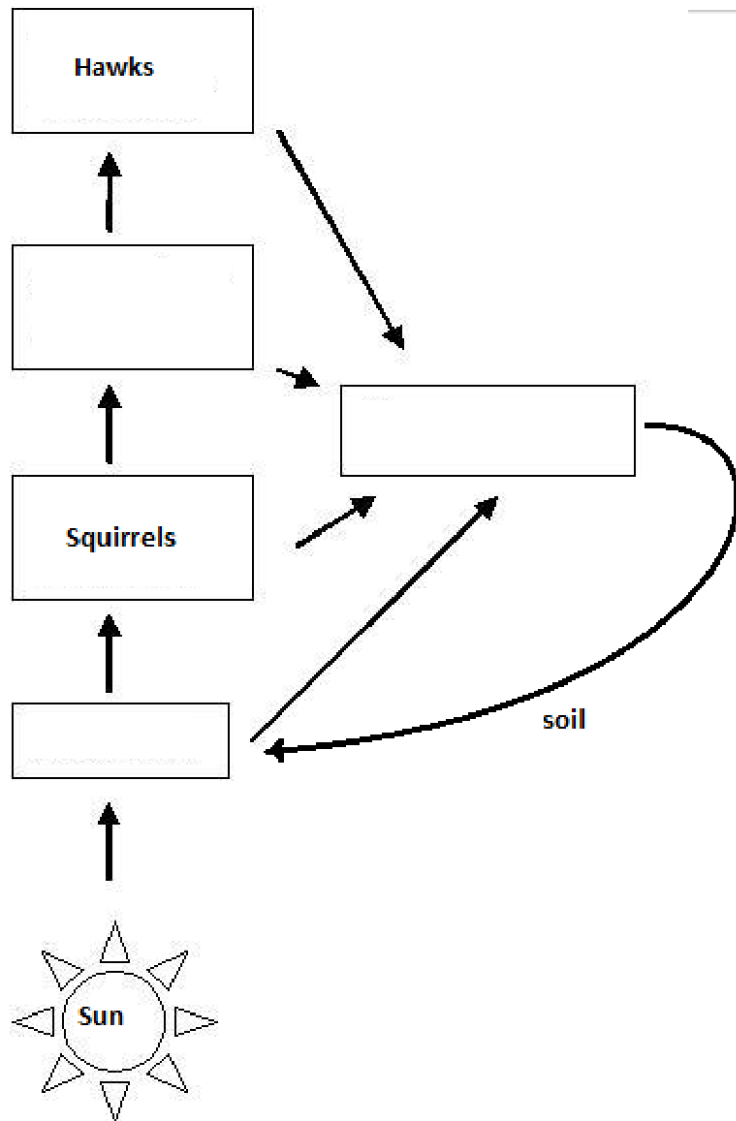
This question has two parts. Be sure to answer both parts of the question.

A student saw a documentary film about plants and animals of a forest. The film shows a squirrel collecting nuts fallen on ground of walnut trees. A snake hunts for the squirrels while it was looking for nuts on the ground. A hawk hunts and feeds on both the squirrel and snake. The dead remains of the squirrel and the snake left by the hawk decay over the time and mix up with the soil. Bacteria are shown feeding on the dead remains and fallen leaves and help them decay.

Part A

Metadata Required	Notes	NTS Blind Where Entered
Grade	5	Content - Attributes
Standards	PE: 5-LS 2-1 Dimensions: SEP: Engaging in Argument from Evidence, DCI: LS2.B. Cycles of Matter and Energy Transfer in Ecosystems	Content - Standards
Sources	https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/food-chains-food-webs https://www.britannica.com/science/food-chain	Content – Source Information

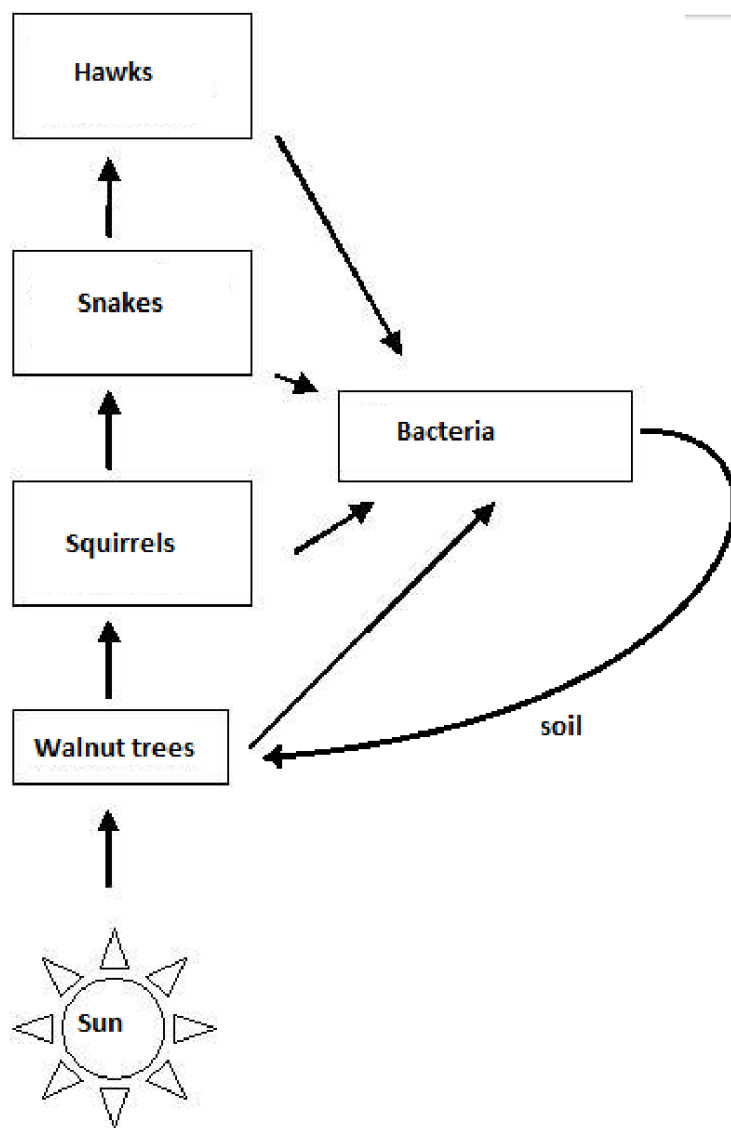
Complete the model of the food chain to show movement of matter in the form of food. Select the organisms and drag them into the correct spaces in the model.
Note: Each drag option will be used only once.



Draggers:

- A. Bacteria
- B. Walnut trees
- C. Snakes

Key:



Part B

Metadata Required	Notes	NTS Blind Where Entered
Grade	5	Content - Attributes
Standards	PE: 5-LS 2-1 Dimensions: DCI: LS2.A. Interdependent Relationships in Ecosystems, CCC: Systems and System Models	Content - Standards
Sources	https://sciencing.com/happens-something-food-chain-goes-extinct-18214.html	Content – Source Information

In the model, arrows connecting bacteria and walnut trees are shown in both the

directions. What statements correctly explain how bacteria and walnut trees interact in the food chain? Select all that apply.

- A. Bacteria feed on dead leaves of the walnut tree to obtain matter. *
- B. Bacteria add nutrients back to the soil for walnut trees to uptake.*
- C. Walnut trees feed on bacteria found in the soil to obtain matter.
- D. Walnut trees help bacteria in breaking down remains of the organisms.
- E. Bacteria and walnut trees depend on each other for matter.*

Rationale:

A. Key: Bacteria feed on the fallen leaves of the walnut tree. Hence a directional arrow is pointing from walnut trees to bacteria in the model.

B. Key: By feeding on dead walnut tree leaves, bacteria help in the decay and breaking down of dead leaves into simple matter which end up in the soil. The roots of the walnut trees absorb these matters from the soil.

C. Walnut trees do not feed on bacteria. The arrow from bacteria to walnut trees indicate that matter in the form of dead leaves is broken down into simpler matter by bacteria that the walnut trees uptake.

D. Walnut trees do not help bacteria in the process of decomposition, instead they uptake matter released during the decomposition process.

E. Key: The fallen leaves and parts of walnut trees are food for bacteria. Bacteria break down waste and dead remains of organisms to release matter into the soil which the walnut trees uptake for growth.

Work Sample 2

Passage style item for higher school grades

PE: HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

SEP: Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Create or revise a simulation of a phenomenon, designed device, process, or system.

DCI:

LS4.C: Adaptation • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline — and sometimes the extinction — of some species.

LS4.D: Biodiversity and Humans • Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (Note: This Disciplinary Core Idea is also addressed by HS-LS2-7.)

ETS1.B: Developing Possible Solutions • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary)

CCC: Cause and Effect • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Item Type: Multiple Choice – Multi-select

Depth of knowledge: 2

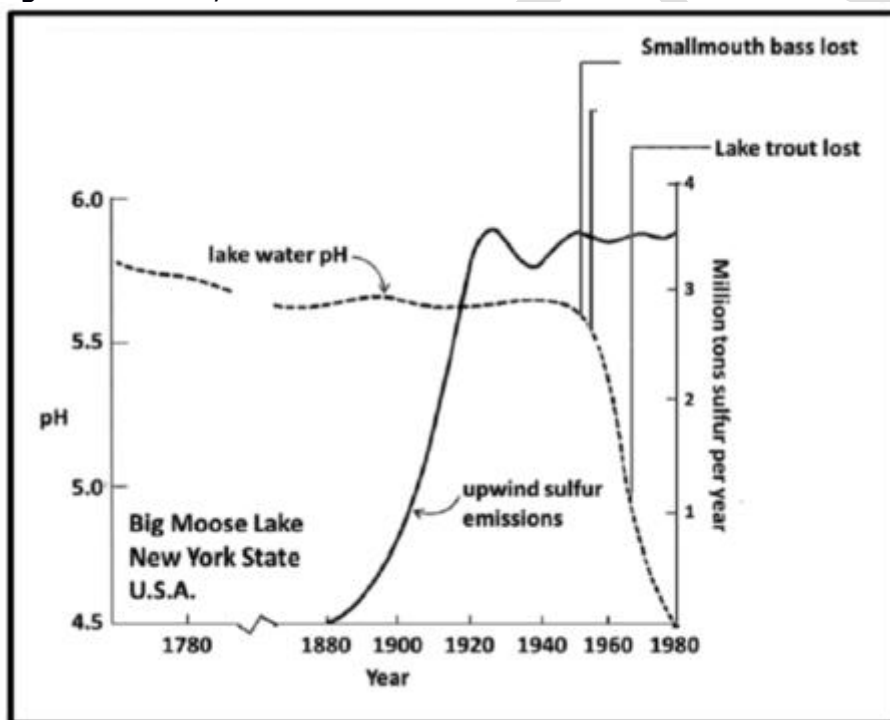
Points: 2

Key: Part a:, Part b:

This question has two parts. Be sure to answer both parts of the question.

The region around the Big Moose lake in New York state saw a steep rise in the industrial activity. The amount of sulfur dioxide released by the industries increased in the atmosphere. This caused acid rains which led to a decrease in the pH of the lake water. Smallmouth bass and Lake trout native to the lake were affected by it.

Big Moose Lake, New York State:



pH Tolerance of Bass and Trout fishes:

	pH 6.5	pH 6.0	pH 5.5	pH 5.0	pH 4.5	pH 4.0
TROUT						
BASS						

In an effort to restore, the population of these fishes, an agency has come up with a plan to reduce the acidity of the lake water. The agency decided to add either

aglime (CaCO_3) or the inexpensive quicklime (CaO) to the lake water.

Part a

Metadata	Notes
Grade	9-12
Name	HSLS46_MCMS2_FloridaCootersRoadkill
Standards	<p>PE: HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]</p> <p>Dimensions:</p> <p>SEP: Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Create or revise a simulation of a phenomenon, designed device, process, or system.</p> <p>DCI: ETS1.B: Developing Possible Solutions • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary)</p>
Sources	http://www2.gsu.edu/~mstnrhx/EnviroBio%20Projects/AcidRain/fishchart.html ; https://pubs.ext.vt.edu/420/420-254/420-254.html ; https://d32ogoqmya1dw8.cloudfront.net/files/integrate/workshops/risk_resilience/case/story_big_moose_lake.pdf

The researchers working for the agency perform an experiment to simulate the lake environment in the lab. What should the experimental setup look like?

- A. The simulation will contain water sample taken from the lake.*
- B. The simulation will contain water having the exact pH as the lake water.
- C. The fishes present in the simulation will have equal numbers of trout and bass.
- D. The fishes present in the simulation will have a scaled down representation of their numbers in the lake.*
- E. The simulation will contain water having a pH of 6 which is within the pH tolerance range of trouts and bass.

Part b

Metadata	Notes
Grade	9-12
Name	HSL546_MCMS2_FloridaCootersRoadkill
Standards	<p>PE: HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]</p> <p>Dimensions:</p> <p>DCI:</p> <p>LS4.C: Adaptation • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline — and sometimes the extinction — of some species.</p> <p>CCC: Cause and Effect • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.</p>
Sources	http://www2.gsu.edu/~mstnrhx/EnviroBio%20Projects/AcidRain/fishchart.html ; https://pubs.ext.vt.edu/420/420-254/420-254.html ; https://d32ogoqmya1dw8.cloudfront.net/files/integrate/worksh

Researchers performed an experiment and found that in the aglime treated sample the number of trouts increased significantly. The sample treated with quicklime had a sharp decrease in the both the trout and bass numbers. What could be the possible reason behind it?

- A. Addition of Aglime brought the pH in the range 4-5.5 while the addition of quicklime fails to increase the pH of the water sample.
- B. Addition of Aglime brought the pH in the range 4-5.5 while the addition of quicklime is caustic to the fishes. *
- C. Addition of Aglime brought the pH in the range 5-7 while the addition of quicklime reduced the pH below 5.
- D. Addition of Aglime brought the pH in the range 6-7 while the addition of quicklime increased the pH in the range 4.5-5.5.

Scoring keys:

Part a

A, D

Part b

B

Distractor Analysis

Part a:

A. Key. The simulation will contain water sample taken from the lake to take into account various other factors of the lake water (salinity, dissolved O₂).

B. The water sample fails to take into account the presence of dissolved salts in it.

C. Since the solution will be applied to the lake, a scaled down numbers of the trouts and bass will be needed to start with.

D. Key. The fishes present in the simulation will have a scaled down representation of their numbers in the lake. This helps in creating the real-world scenario.

E. The simulation will contain water having a normal pH of 6 which is within the pH tolerance range of trouts and bass. This fails to model the lake environment on

which the solutions will be tested.

Part b:

A. Quicklime is basic in nature. It will definitely increase the pH of the water sample.




B. Key. The pH range of 4-5.5 is within the tolerance range of trouts, hence their numbers increased in the aglime treated water. Quicklime is caustic in nature, which affects the health of the two fishes.


C. Addition of Aglime brought the pH in the range 5-7. This would favor both trouts and bass, but only trouts were seen to significantly grow in number in the simulated environment.

D. A pH range of 6-7 in the aglime treated sample would favor both bass and trouts, but only the trouts were seen growing in number in the simulated environment.

Work Sample 3

MCQ style item for elementary school grades

LOID	1_Staying Clean and Healthy
Difficulty Level	Easy
Depth of Knowledge	1
Bloom's level	Recall
Topic	Keeping Healthy: Good eating habits, Avoidance of unhealthy and dirty food
Question Id	Staying Clean and Healthy.Keeping Clean.01.D1.03
Title	Identify the figure in which a boy is taking bath.
Correct Option Number	1
Option 1	
Option 2	
Wrong Answer Type 2	Declarative Knowledge
Feedback	<p>The student failed to recall the activities which keep one clean.</p> <p>Option 1 shows the figure in which a boy is taking bath.</p>
Option 3	
Wrong Answer Type 3	Declarative knowledge
Feedback 3	<p>The student failed to recall the activities which keep one clean.</p> <p>Option 1 shows the figure in which a boy is taking bath.</p>

Option 4	
Wrong Answer Type 4	Declarative knowledge
Feedback 4	<p>The student failed to recall the activities which keep one clean.</p> <p>Option 1 shows the figure in which a boy is taking bath.</p>

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Work sample 4

MCQ style item for middle school grades

Standard: MS-LS2-1

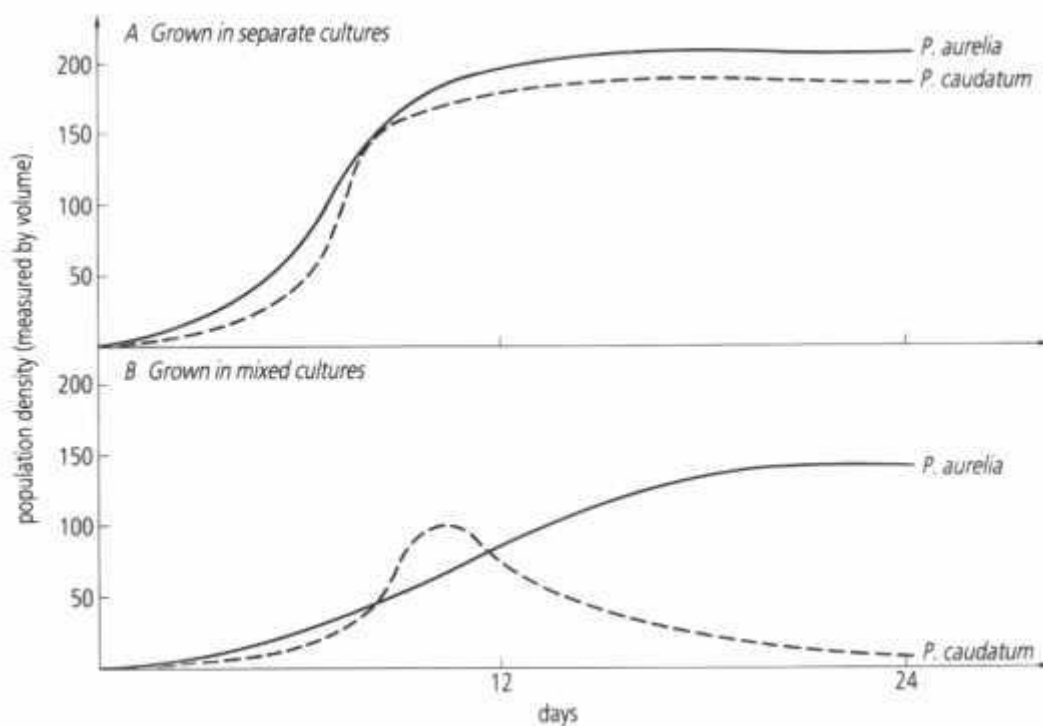
MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

[Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

DOK: 3

Difficulty: Medium

Parameciums are found in pond ecosystems. The image shows two parameciums first grown in two separate cultures and then grown in a mixed culture. The cultures contain food for these organisms.



Question:

What can be inferred from the image?

Distractor:

- A. *P. aurelia* grows by eating *P. caudatum*.
- B. *P. caudatum* uses more resources for growth than *P. aurelia*.
- C. *P. aurelia* uses more resources for growth than *P. caudatum*.
- D. *P. aurelia* outcompetes *P. caudatum* by using fewer resources initially. *

Rationale:

- A. This is incorrect. *P. Aurelia* does not grow by eating *P. Caudatum*, as it shows growth in separate culture.
- B. This is incorrect. *P. Caudatum* and *P. Aurelia* use similar amounts of resources for growth.
- C. This is incorrect. *P. Caudatum* and *P. Aurelia* use similar amounts of resources for growth.
- D. This is correct. *P. caudatum* outgrows *P. aurelia* in the initial phase but gets outcompeted by *P. aurelia* with time.

Work sample 5

Storytelling followed by MCQs for STEMQ quiz competition in Tinkerly

Passage:

09:48

SUBMIT

1


2

3

4

5


Mark: 1.0





Read this info carefully and answer the questions below.


Jugaadu is on a treasure hunt using a map. He would have to cross hills, marsh, river, and a dangerous bridge to reach the place where the treasure is kept hidden. You need to help Jugaadu in crossing these areas safely.

जुगाडू एक मानचित्र का उपयोग करके खजाने की खोज में है। उसे उस स्थान तक पहुँचने के लिए पहाड़ियों, दलदल, नदी और एक खतरनाक पुल को पार करना होगा जहाँ खजाना छिपा कर रखा गया है। आपको इन क्षेत्रों को सुरक्षित रूप से पार करने में जुगाडू की मदद करने की आवश्यकता है।









Passage Image:



MCQ 1:

You need to help Jugaadu in choosing the right type of footwear for his journey. Which one should he wear and why?

आपको उनकी यात्रा के लिए सही प्रकार के जूते चुनने में जुगाडू की मदद करने की आवश्यकता है। उसे कौन से फुटवियर पहनने चाहिए और क्यों?



A and B because they keep the feet ventilated and cool.



ए और बी क्योंकि वे पैरों को हवादार और शांत रखते हैं।

MCQ 2:

09:08

SUBMIT

1

2

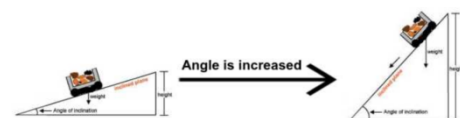
3


4


5


While planning to cross the hills, Jugaadu recalls an activity. In the activity, a block of wood is kept on an inclined surface as shown. When the tilt of the surface is increased, the block slides down. Based on this activity, what precaution should Jugaadu take?

पहाड़ियों को पार करने की योजना बनाते समय, जुगाडू एक गतिविधि को याद करता है। गतिविधि में, लकड़ी के एक ब्लॉक को एक झुका हुआ सतह पर रखा जाता है जैसा कि दिखाया गया है। जब सतह का झुकाव बढ़ जाता है, तो ब्लॉक स्लाइड हो जाता है। इस गतिविधि के आधार पर, जुगाडू को क्या सावधानी बरतनी चाहिए?









Others

Solution Writing (Chemistry)

Question:

22. Design an Experiment Describe a procedure you could follow to determine the specific heat of a 45-g piece of metal.

Solution:

<!--<INTERPRETATION-INTRODUCTION>-->

Interpretation: To describe a procedure to follow to determine the specific heat of a 45g piece of metal.

Concept introduction:

Heat capacity: The heat absorbed or released by a substance is dependent on three factors:

1. The mass of the substance.
2. The nature of the substance, its specific heat capacity.
3. The change in temperature of the substance.

The unit of heat is Joules (J), specific heat capacity is J/(kg degree Celsius), and that of mass is kg.

Calorimeter: A device used to measure the amount of heat exchanged between an unknown substance and fixed amount of water present in it.

<!--</INTERPRETATION-INTRODUCTION>-->

<!--<ANSWER>-->

Take a calorimeter with a fixed quantity of water at temperature T_i .

Drop the 45g metal at room temperature, t , into the calorimeter.

Record the change in temperature of the calorimeter when the metal comes in contact with the water. Let say the final temperature of water becomes T_f .

Since, the heat exchange is happening in an isolated system,

$$Q_m = -Q_{\text{water}}$$

$$c_m \times 45 \text{ g} \times (t - T_f) = -c_{\text{water}} \times m_{\text{water}} \times (T_i - T_f)$$

$$c_m = \frac{-c_{\text{water}} \times m_{\text{water}} \times (T_i - T_f)}{45 \text{ g} \times (t - T_f)}$$

By substituting the recorded values of temperatures and mass of water, the specific heat of metal can be calculated.

<!--</ANSWER>-->

<!--<EXPLANATION>-->

The experiment uses the fact that in an isolated system, the amount of heat released or absorbed is zero. The metal and water exchange heat inside the calorimeter and attain equilibrium. At equilibrium, the final temperature of both metal and water is the same. The known parameters like the amount of water, specific heat of water, room temperature, initial temperature of water, and final temperature can be substituted in the heat exchange formula to get the specific heat of the metal.

<!--</EXPLANATION>-->

<!--<CONCLUSION>-->

The specific heat of the 45g piece of metal can be calculated using the formula:

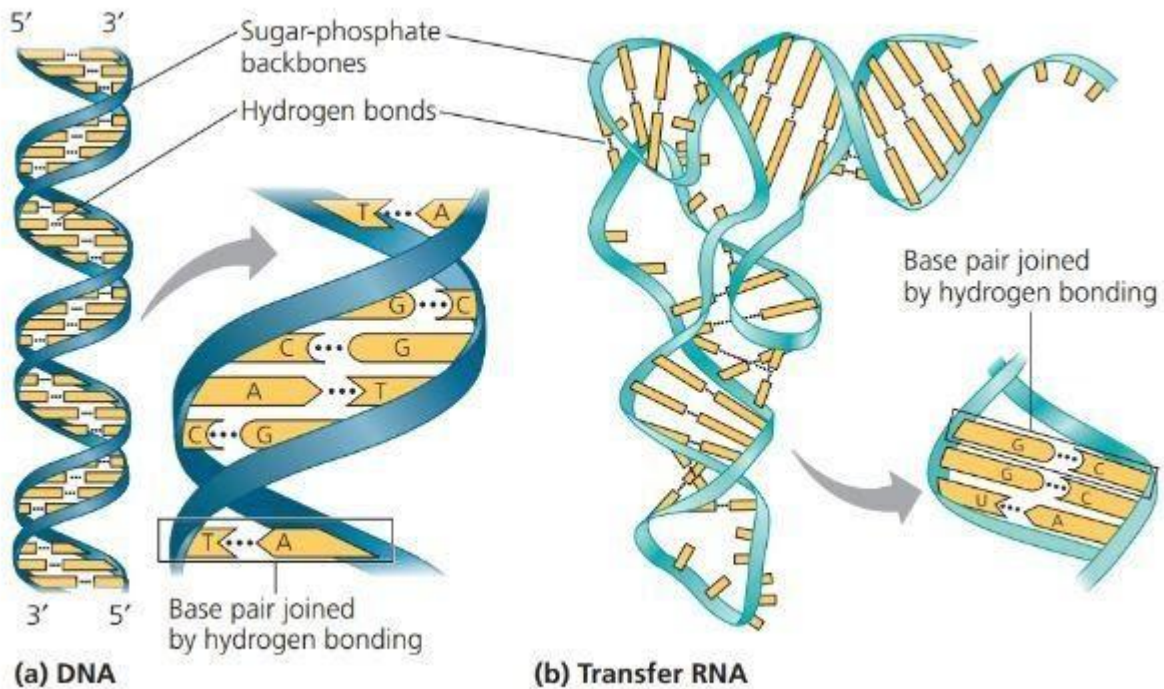
$$c_m = \frac{-c_{\text{water}} \times m_{\text{water}} \times (T_i - T_f)}{45 \text{ g} \times (t - T_f)}$$

<!--</CONCLUSION>-->

Others

Alternative Text For The Visually Challenged

Figure:



The figure shows the chemical structure of DNA and Transfer RNA molecules.

Figure (a), shows a segment of a DNA double helix with one strand in the 3' to 5' direction and the complementary strand in the 5' to 3' direction. The sugar-phosphate backbone of the DNA helix is depicted using blue ribbon-like strands. The DNA helix is zoomed-in to show nature of bonding between the two strands where a hydrogen bond is formed between the base pairs C-G and A-T.

Figure (b), shows a structure of Transfer RNA. The sugar-phosphate backbone is depicted using a light blue ribbon-like strand. The structure has twists and turns due to the presence of hydrogen bonds between the segments of the Transfer RNA. The twisted segment of the Transfer RNA is zoomed-in to show the presence of hydrogen bond between the base pairs, G-C and A-U.