Introduction

Formative Assessment Exemplar - 7.3.1

Introduction:

The following formative assessment exemplar was created by a team of Utah educators to be used as a resource in the classroom. It was reviewed for appropriateness by a Bias and Sensitivity/Special Education team and by state science leaders. While no assessment is perfect, it is intended to be used as a formative tool that enables teachers to obtain evidence of student learning, identify gaps in that learning, and adjust instruction for all three dimensions (i.e., Science and Engineering Practices, Crosscutting Concepts, Disciplinary Core Ideas) included in a specific Science and Engineering Education (SEEd) Standard.

In order to fully assess students' understanding of all three dimensions of a SEEd standard, the assessment is written in a format called a cluster. Each cluster starts with a phenomenon, provides a task statement, necessary supporting information, and a sequenced list of questions using the gather, reason, and communicate model (Moulding et al., 2021) as a way to scaffold student sensemaking. The phenomenon used in an assessment exemplar is an analogous phenomenon (one that should not have been taught during instruction) to assess how well students can transfer and apply their learning in a novel situation. The cluster provides an example of the expected rigor of student learning for all three dimensions of a specific standard. In order to serve this purpose, this assessment is NOT INTENDED TO BE USED AS A LESSON FOR STUDENTS.

Because this assessment exemplar is a resource, teachers can choose to use it however they want for formative assessment purposes. It can be adjusted and formatted to fit a teacher's instructional needs. For example, teachers can choose to delete questions, add questions, edit questions, or break the tasks into smaller segments to be given to students over multiple days.

Of note: All formative assessment clusters were revised based on feedback from educators after being utilized in the classroom. During the revision process, each cluster was specifically checked to make sure the phenomena was authentic to the DCI, supporting information was provided for the phenomena, the SEPs, CCCs, and DCIs were appropriate for the learning progressions, the cluster supported student sensemaking through the Gather, Reason, and Communicate instructional model, and the final communication prompt aligned with the cluster phenomena. As inconsistencies were found, revisions were made to support student sensemaking. If other inconsistencies exist that need to be addressed, please email the current Utah State Science Education Specialists with feedback.

General Format:

Each formative assessment exemplar contains the following components:

1. Teacher Facing Information: This provides teachers with the full cluster as well as additional information including the question types, alignment to three dimensions, and answer key. Additionally, an example of a proficient student answer and a proficiency scale for all three dimensions are included to support the evaluation of the last item of the assessment.
2. Students Facing Assessment: This is what the student may see. It is in a form that can be printed or uploaded to a learning platform. (Exception: Questions including simulations will need technology to utilize during assessment.)

Accommodation Considerations:

Teachers should consider possible common ways to provide accommodations for students with disabilities, English language learners, students with diverse needs or students from different cultural backgrounds. For example, these accommodations may include: Providing academic language supports, presenting sentence stems, or reading aloud to students. All students should be allowed access to a dictionary.

References:

Moulding, B., Huff, K., & Van der Veen, W. (2021). *Engaging Students in Science Investigation Using GRC*. Ogden, UT: ELM Tree Publishing.

Teacher Facing Info

Teacher Facing Information

Standard: 7.3.1

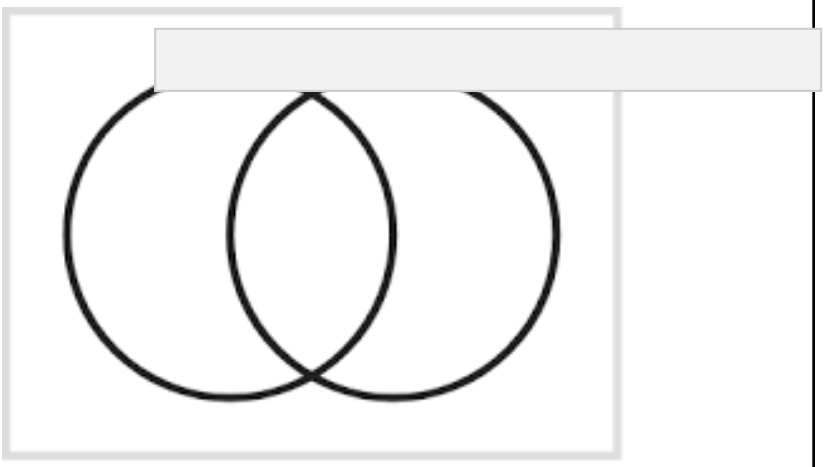
Plan and carry out an investigation that provides evidence that the basic structures of living things are cells. Emphasize that cells can form single-celled or multicellular organisms and that multicellular organisms are made of different types of cells. (LS1.A)

Assessment Format: Printable or Online Format (Does not require students to have online access, if the printable version is needed the video will need to be shown to all students)

Phenomenon	
A student walking in rural Utah sees a large rock with a flaky white substance and wonders what it is. Figure 1 - Rock with Flaky White Substance  https://www.flickr.com/photos/32454422@N00/2993119441 8 "lichen on rock, Blue Ridge Parkway" by Martin LaBar is licensed under CC BY-NC 2.0 This image shows a rock with a flaky white substance attached to it.	Proficient Student Explanation of Phenomenon: Proficient students plan an investigation using microscopes to view lichen under a microscope. They determine that lichen is alive based on the fact that it contains cell-like structures.
Cluster Task Statement	
(Represents the ultimate way the phenomenon will be explained or the design problem will be addressed) In the questions that follow, you will plan and carry out an investigation that would provide evidence to support whether or not lichen should be considered a living organism.	
Supporting Information	
You show the picture to a friend who says it is called a lichen. It comes in lots of different colors and shapes and can be found on rocks, trees, bricks, and other surfaces. Video 1 - Time Lapse of Growing Moss	

Cluster Questions	
Gather: pictures of lichen Cluster Question #___1___ Question Type: Multiple Choice Addresses: ___X_ DCI (LS1.A) ___X_ SEP (Asking Questions) ___X_ CCC (Structure) Answer: Correct answer is A	Question 1: Which of the following would be the best question to guide an investigation that would help determine if the lichen is alive? A. Are cells present in the lichen? B. Are atoms present in the lichen? C. Can you see the molecules in the lichen? Or how much mass does the lichen have? D. Does the lichen change color?
Gather: Cluster Question #___2___ Question Type: Multiple select Addresses: ____ DCI (LS1.A) _X___ SEP (Plan Investigation) __X__ CCC (Structure) Answer: A- Microscope, B- Slides	Question 2: Select the two tools that would be most helpful to investigate if an organism is living or not? A. Microscope B. Slides C. Ruler D. Stopwatch E. Scale
Gather: Cluster Question #___3___ Question Type: Multiple choice Addresses: __X__ DCI (LS1.A) _X___ SEP (Developing and Using Models) __X__ CCC (Structure) Answer:	Question 3: Looking at these four images of lichen, which one will be the best for identifying if lichen has individual cells?

	"Green Lichen" by kaibara87 is licensed under CC BY 2.0 "Lichen orange" by Dr Pitch is marked with CC PDM 1.0 Low Magnification "Lichen ascocarp, ~100x" by Marc Perkins - OCC Biology Department is licensed under CC BY-NC 2.0

	 "Lichen ascocarp, ~400x" by Marc Perkins - OCC Biology Department is licensed under CC BY-NC 2.0
Gather: Cluster Question #___4___ Question Type: Venn Diagram Addresses: __X__ DCI (LS1.A) _X___ SEP (Developing and Using Models) __X__ CCC (Structure) Answer: Single: Only has one cell Multicellular: Has more than one cell. Cells are connected. There are specialized cells that complete a specific task in order for the organism to maintain homeostasis, etc. Both: They are living	Question 4: Fill in the venn diagram below to compare and contrast the characteristics of a single celled organism and a multicellular organism. 
Reason: Cluster Question #___5___ Question Type: Short Answer Addresses: __X__ DCI (LS1.A) __x__ SEP (Developing and	Question 5: Given the following samples of objects or substances, which of them most closely resembles the structure of lichen and why? (Objects in images have been dyed for visibility)

Using Models)
_x___ CCC (Structure, Pattern)
Answer: The plant stem is the most similar because there are visible cells in both and they are both multicellular.'

(These photos are donated without copyright restrictions)

Communicate:
Cluster Question #_6_____
Question Type: Multiple Choice Table
Addresses:
__x__ DCI (LS1.A)
__x__ SEP (Constructing Explanations)
___x_ CCC (Structure and Function)
Answer:

State your claim as to whether or not the lichen is living	The lichen is a living thing.
Provide evidence from the investigation to support the claim	Cells are seen in the images of the lichen under a microscope

Question 6:
Complete the chart below with information gathered from the pictures above. Choose one correct answer for each part (A-C):

Part A: State your claim as to whether or not the lichen is living.	a. The lichen is living. b. The lichen is not living. c. The lichen is dangerous. d. The lichen is endangered.
Part B: Provide evidence to support your claim.	a. Cells are present in the lichen. b. The lichen has many different colors. c.The lichen can be found on trees, rocks, and other objects. d. The lichen can have many different shapes.
Part C: Explain how the evidence supports the claim.	a. The lichen is living because it is made of cells. b. The lichen is non-living because it is made of cells. c. The lichen is non-living because it is not made of cells.

Explain how the evidence supports the claim	Because there are cells present, the lichen must be living because all living things are made of cells.

	d. The lichen is living because it can be different colors.

Communicate:
Cluster Question #_7_____
Question Type: Short Answer Table
Addresses:
__x__ DCI (LS1.A)
__x__ SEP (Constructing Explanations)
___x_ CCC (Structure and Function)
Answer:

State your claim as to whether or not the lichen is unicellular or multicellular	The lichen is considered multicellular
Provide evidence from the investigation to support the claim	There are many cells seen in the microscopic images. These cells do not appear to be functioning as a single unit, but as a group to perform a specific function.
Explain how	Multicellular

Question 7:

Complete the chart below with information gathered from the investigation.

Part A: State your claim as to whether or not the lichen is unicellular or multicellular.	
Part B: Provide evidence to support the claim.	
Part C: Explain how the evidence supports the claim.	

the evidence supports the claim	organisms are made up of many cells that work together to perform a specific function. Unicellular organisms are capable of performing all of the life functions as a single unit.

Proficiency Scale

Proficient Student Explanation:

Because cells are seen under the microscope, lichens can be determined to be living because all living things have cells that carry out the basic functions of life. I am very confident that this evidence supports my claim that lichens are living because if they have cells, all other characteristics of life are also present.

Level 1 - Emerging	Level 2 - Partially Proficient	Level 3 - Proficient	Level 4 - Extending
SEP: Does not meet the minimum standard to receive a 2.	**SEP:** Plan and conduct an investigation collaboratively to serve as the basis for evidence,	**SEP:** Plan an investigation individually or collaboratively, and in the design: identify what tools are needed to do the gathering, Conduct an investigation to serve as the basis for evidence that meet the goals of the investigation.	**SEP:** Extends beyond proficient in any way.

	Evaluate appropriate methods and/or tools for collecting data. Make observations to serve as the basis for evidence for an explanation of a phenomenon.	Evaluate the accuracy of various methods for collecting data. Collect data to serve as the basis for evidence to answer scientific questions	
CCC: Does not meet the minimum standard to receive a 2.	**CCC:** Observes different materials have different substructures. Identifies substructures have shapes and parts that serve functions.	**CCC:** Visualizes, models, and uses complex and microscopic structures and systems to describe how their function depends on the shapes, composition, and relationships among its parts.	**CCC:** Extends beyond proficient in any way.
DCI: Does not meet the minimum standard to receive a 2.	**DCI:** Plants and animals have both internal and external structures that serve various functions in growth,	**DCI:** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	**DCI:** Extends beyond proficient in any way.

(Student Facing Format on following page)

Student Assessment

Name: _____ Date: _____

Stimulus

A student walking in rural Utah sees a large rock with a flaky white substance and wonders what it is.

Figure 1 - Rock with Flaky White Substance

This image shows a rock with a flaky white substance attached to it.

You show the picture to a friend who says it is called a lichen. It comes in lots of different colors and shapes and can be found on rocks, trees, bricks, and other surfaces.

Video 1 - Time Lapse of Growing Moss

Your Task

In the questions that follow, you will plan and carry out an investigation that would provide evidence to support whether or not lichen should be considered a living organism.

Question 1

Which of the following would be the best question to guide an investigation that would help determine if the lichen is alive?

A. Are cells present in the lichen?
B. Are atoms present in the lichen?
C. Does the lichen move?
D. Does the lichen exchange gases?

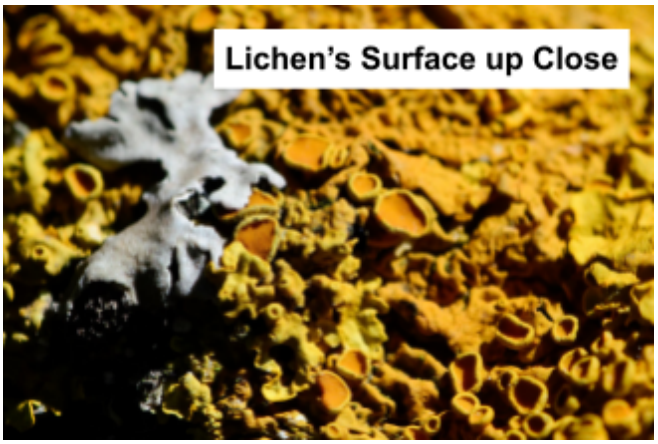
Question 2

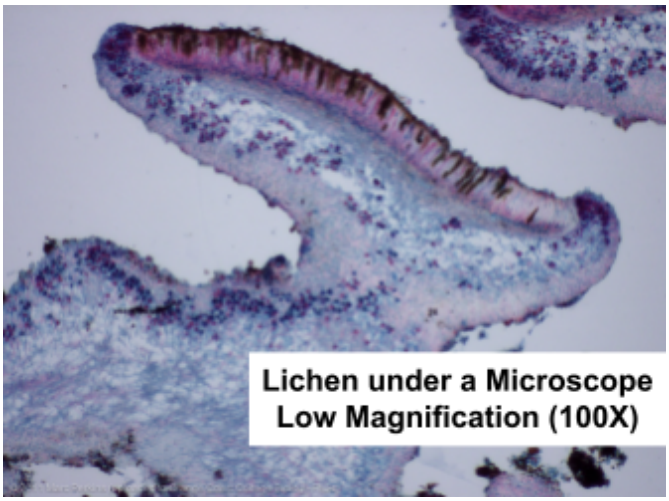
Select the two tools that would be most helpful to investigate if an organism is living or not?

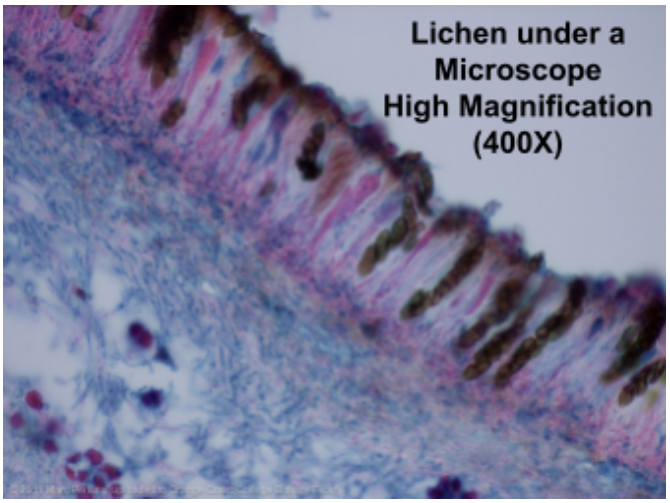
A. Microscope
B. Slides
C. Ruler
D. Stopwatch
E. Scale

Question 3

Looking at these four images of lichen, which one will be the best for identifying if lichen has individual cells?

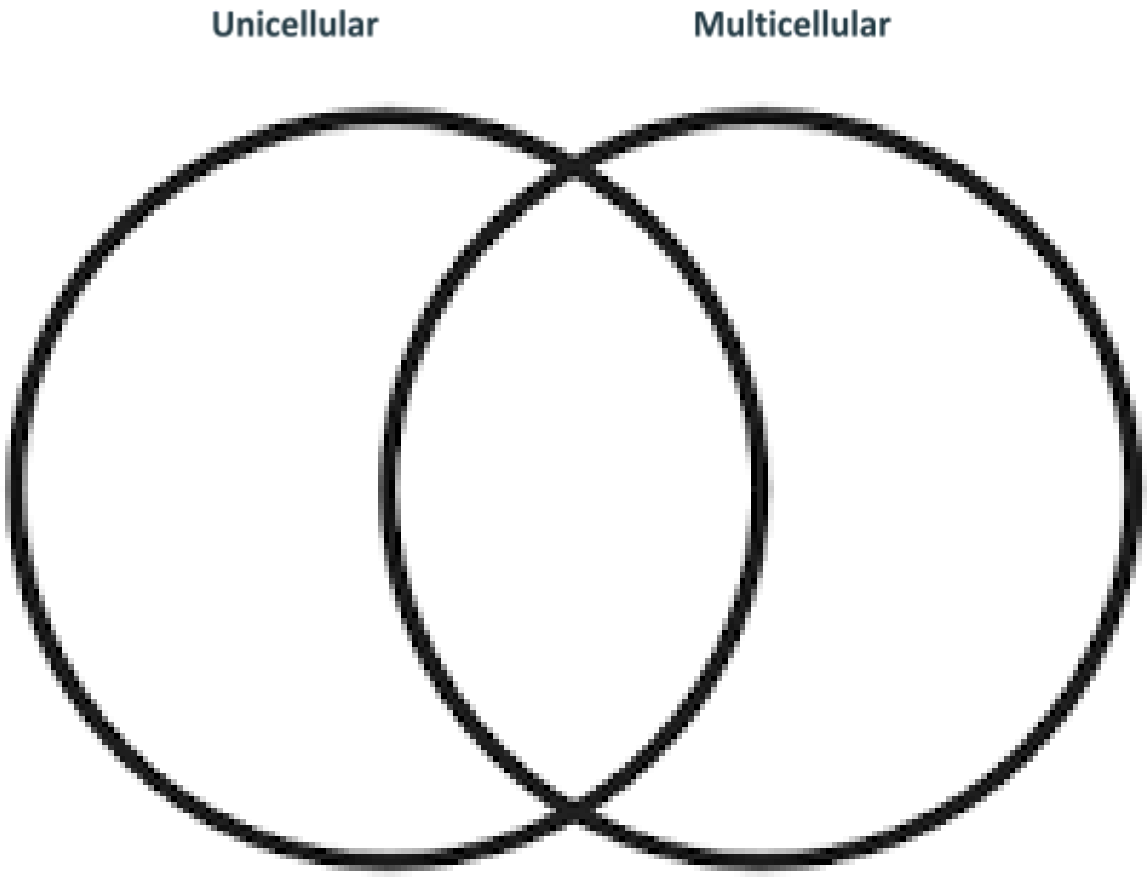






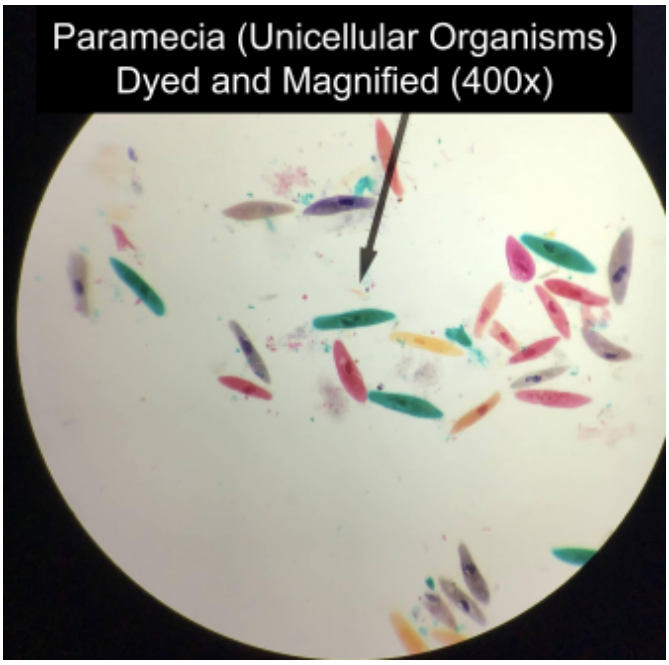
Question 4

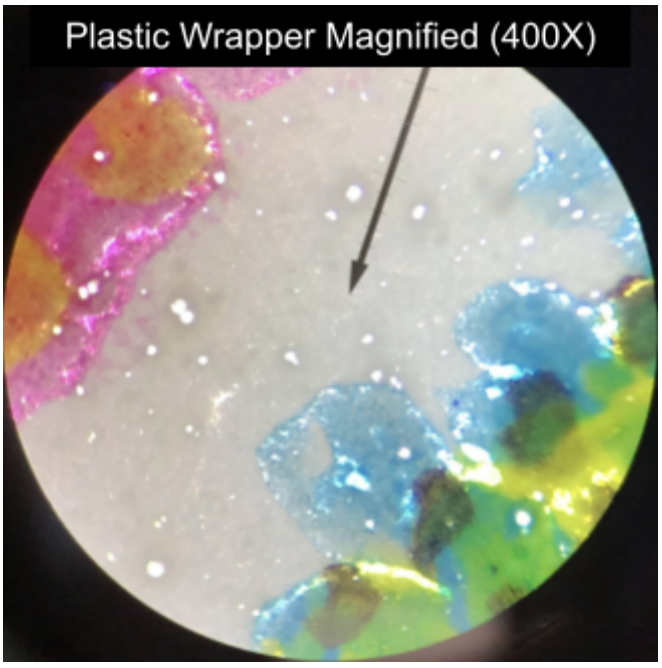
Fill in the venn diagram below to compare and contrast the characteristics of a single celled organism and a multicellular organism.

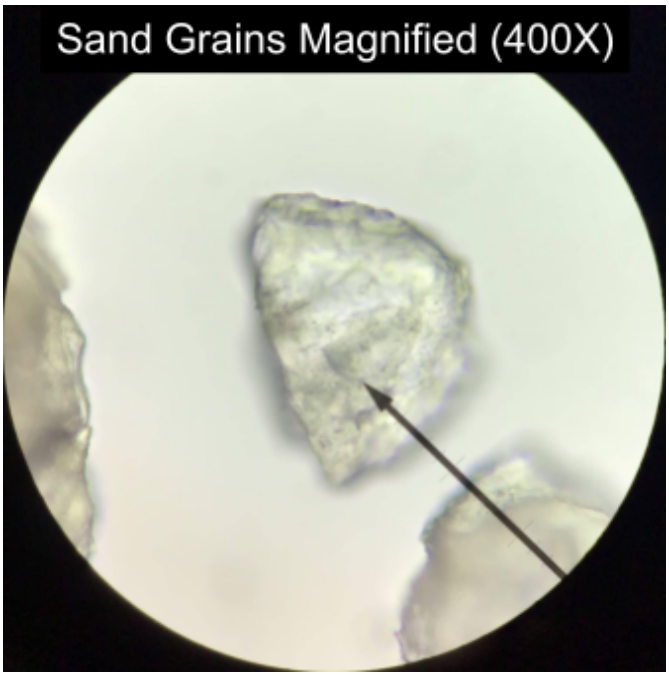


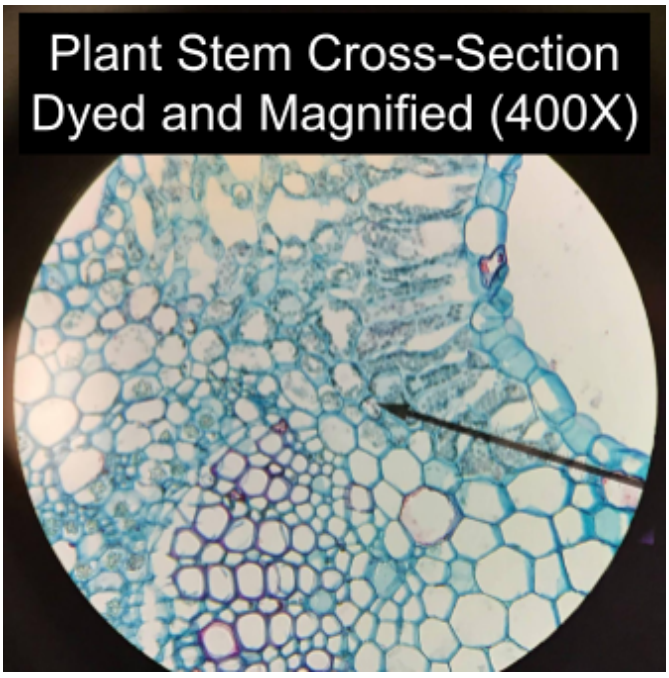
Question 5

Given the following samples of objects or substances, which of them most closely resembles the structure of lichen and why?
(Objects in images have been dyed for visibility)









I selected the _____ sample

because _____

_____

Question 6

Complete the chart below with information gathered from the pictures above. Choose one correct answer for each part (A-C):

Part A: State your claim as to whether or not the lichen is living.	a. The lichen is living. b. The lichen is not living. c. The lichen is dangerous. d. The lichen is endangered.
Part B: Provide evidence to support your claim.	a. Cells are present in the lichen. b. The lichen has many different colors. c.The lichen can be found on trees, rocks, and other objects. d. The lichen can have many different shapes.
Part C: Explain how the evidence supports the claim.	a. The lichen is living because it is made of cells. b. The lichen is non-living because it is made of cells. c. The lichen is non-living because it is not made of cells. d. The lichen is living because it can be different colors.

Question 7

Complete the chart below with information gathered from the investigation.

Part A: State your claim as to whether or not the lichen is unicellular or multicellular.	
Part B: Provide evidence to support the claim.	
Part C: Explain how the evidence supports the claim.	