

It's Alive! Or Is It?

Characteristics of Life and Cell Theory

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Grade Level	9th – 12th Grade	**Time Frame**	150 minutes
Subject	Science	**Duration**	2-3 class periods
Course	Biology		

Essential Question

What does it mean to be alive?

Summary

This lesson introduces students to what makes something living or nonliving. Students will investigate the characteristics of life by identifying the similarities and differences between organisms. Students will then use their knowledge to create dichotomous keys that will be used to determine if an object is living or nonliving. Finally, students will read articles about viruses and discuss whether they should be classified as living or nonliving.

Snapshot

Engage

Students read through a conversation and, based on their current knowledge, take stances on their perceptions of what a living organism is.

Explore

Students use the Card Sort strategy to categorize things as living or nonliving based on their similarities and differences.

Explain

Students share and justify their reasons for the Card Sort categories. Proper academic vocabulary should be introduced.

Extend

Students create dichotomous keys/flow charts to help them determine whether an unknown thing is living or not living.

Evaluate

Students read articles about viruses and then, based on their understanding, decide and provide justification for whether viruses are alive.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD402: Compare or combine data from a simple data presentation (e.g., order or sum data from a table)
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text
EMI502: Determine whether presented information, or new information, supports or contradicts a simple hypothesis or conclusion, and why

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Oklahoma Academic Standards (Biology)

B.LS3.1.3: Each chromosome consists of a single, very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA.

Attachments

- Am I a Living Nut—It's Alive! Or Is It - Spanish.docx
- Am I a Living Nut—It's Alive! Or Is It - Spanish.pdf
- Am I a Living Nut—It's Alive! Or Is It.docx
- Am I a Living Nut—It's Alive! Or Is It.pdf
- Definitions—It's Alive! Or Is It - Spanish.docx
- Definitions—It's Alive! Or Is It - Spanish.pdf
- Definitions—It's Alive! Or Is It.docx
- Definitions—It's Alive! Or Is It.pdf
- Example of Dichotomous Key—It's Alive! Or Is It - Spanish.docx
- Example of Dichotomous Key—It's Alive! Or Is It - Spanish.pdf
- Example of Dichotomous Key—It's Alive! Or Is It.docx
- Example of Dichotomous Key—It's Alive! Or Is It.pdf
- Organism Cards—It's Alive! Or Is It - Spanish.docx
- Organism Cards—It's Alive! Or Is It - Spanish.pdf
- Organism Cards—It's Alive! Or Is It.docx
- Organism Cards—It's Alive! Or Is It.pdf
- Unknown Organisms—It's Alive! Or Is It - Spanish.docx
- Unknown Organisms—It's Alive! Or Is It - Spanish.pdf
- Unknown Organisms—It's Alive! Or Is It.docx
- Unknown Organisms—It's Alive! Or Is It.pdf

Materials

- Am I a Living Nut? (attached)
- Organism Cards (attached)
- Definitions (attached)
- Example of Dichotomous Key (attached)
- Unknown Organisms (abiotic or biotic) (attached)
- Virus articles (linked in Evaluate section of the narrative)
- Sticky Notes

Engage

Students will begin by reading through the conversation on the attachment **Am I a Living Nut?** Students should be given time to respond to the reading by writing who they agree with. They should justify their answers using prior knowledge.

Teacher's Note

Before class begins, create one sign for each of the terms, "strongly agree," "agree," "disagree," or "strongly disagree." This is in preparation for the Four Corners activity.

Students will then consider the statement, "A nut is a living organism," and go to the signs in the four corners of the room that match their thoughts. Students gathered by each sign will spend 5–10 minutes discussing their positions and reasoning with each other. For each sign, students will form a summary justifying the position the group has taken. Each sign's group will choose a spokesperson to present the group's justification to the rest of the class.

Response

The most correct answer is that the nut was once living, but since it has been roasted, it is now dead, similar to the change that takes place after a lobster has been boiled.

Explore

Prior to this portion of the lesson, be sure to print out, cut apart, and shuffle the attached **Organism Cards**, with one set of cards prepared for every two students. Students will use the Organism Cards for a Card Sort activity. Students will sort the cards based on similarities.

After being given enough time to sort all of the cards, students will discuss whether each group they formed is living. In the next step of this lesson, student pairs will be asked to use a visual representation to justify how they sorted the cards. Students will identify common characteristics among the items in each category of cards and explain how those characteristics determine whether the items are living or non-living.

Teacher's Note

Be sure to shuffle the cards for the first class. The number of categories the students can sort the cards into does not need to be given, as long as students create at least two.

Explain

Give each group of students a large sheet of paper on which to create a visual presentation of the categories. In the visual, students will show why they sorted the cards the way they did, as well as why they classified each item as living or nonliving. Students should then explain their visuals in presentations to the class. As students share, keep a list of the reasons students classified items as living or nonliving.

As students describe their reasons, introduce the correct vocabulary. The vocabulary and definitions are provided in the **Definitions** attachment. Through class discussion, students will narrow down the common themes that make things living or nonliving and and decide whether the characteristics identified work with the categories created. Students will finish by writing a summary using the Six-Word Memoirs strategy. The summary should be six words long and identify the characteristics that make things living or nonliving. Students may write these summaries on small strips of paper that will be posted in the classroom.

Teacher's Note

Students should be guided, but not directly instructed, regarding the characteristics that can be used to identify living organisms. These characteristics include that living organisms respond to the environment and adapt, have a tendency toward homeostasis, possess cellular organization and metabolism, are subject to heredity, reproduce, and experience growth and development.

As needed, introduce the terms found in the Definitions that are attached to this lesson.

Extend

Set up this portion of the lesson by explaining that, based on the students' previous justifications for classifying living and non-living things, they will identify characteristics that determine whether an organism is biotic or abiotic.

Students will create a flow chart, a dichotomous key, of yes/no questions designed to determine whether an unknown organism is living or nonliving. Students will come up with at least seven questions to determine if an organism is living or not living. An **Example of Dichotomous Key** has been attached to this lesson.

Once students' dichotomous keys are finished, pass out the attached handout, **Unknown Organisms**, which includes pictures and lists of characteristics of of six unknown organisms. Students will use their dichotomous keys to determine whether the organisms are biotic or abiotic.

Evaluate

On the board, draw a scale labeled from 1 to 5, with 1 indicating absolute disagreement and 5 representing absolute agreement. On a sticky note, each student will record a numerical response to the statement, "Viruses are living organisms."

On the back of the sticky note, each student will write a justification for the rank chosen, indicating the reason for agreement, disagreement, or neutrality. Students will then place the sticky notes on the scale on the board. Ask some students to share their answers and discuss them with the entire class.

Then, give students a couple of articles on viruses and have them read using the C.U.S. and Discuss strategy. Teachers may choose the most appropriate articles for students from among these hyperlinked titles: "Study of Giant Viruses Shakes Up Tree of Life," "Are Viruses Alive?," "Hints of Life's Start Found in a Giant Virus," and "Defining Life: The Virus Viewpoint." The last article listed is most appropriate for an honors or pre-AP classroom.

First, students will read through the articles completely. Students will then read through the article a second time, circling new words, underlining evidence and details related to the main ideas, and placing a star by the main ideas. Students will then pair up and share the main ideas they identified and the evidence to justify them. Students will refer to their dichotomous keys during the process and discuss whether the articles they read changed their opinions.

After students have had time to discuss how the new information from the articles influenced their opinions, each will again give a ranked response on a sticky note, as earlier in the lesson, to the statement, "Viruses are living organisms." Ask students to justify their answers on the backs of the sticky notes. Then, select some students who changed their answers and some students who did not, and ask them to explain their reasoning with supporting evidence.

Teacher's Note

Before ending the lesson, ask students what makes something living. It may be beneficial to refer to the "Am I a Living Nut?" portion of the lesson and ask students if they would now change their answers.

Resources

- Arnold, C. (2014). Hints of life's start found in a giant virus. Quanta Magazine. https://www.quantamagazine.org/20140710-hints-of-lifes-start-found-in-a-giant-virus/
- Forterre, P. (2010). Defining life: The virus viewpoint. Origins of life and evolution of the biosphere, 40(2), 151-160. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2837877/
- Keeley, P., Eberle, F. & Farrin, L., (2005). "Functions of living things." In P. Keeley, F. Eberle, & L. Farrin, "Uncovering student ideas in science, volume 1: 25 formative assessment probes." Arlington, VA: NSTA Press.
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- K20 Center. (n.d.). CUS and Discuss. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5073969
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- K20 Center. (n.d.). Six-word memoirs. Strategies. https://learn.k20center.ou.edu/strategy/75
- Villarreal, L. (2004). Are viruses alive? Scientific American, 291, 100-105. http://www.scientificamerican.com/article/are-viruses-alive-2004/AR
- Yates, D. (2012). Study of giant viruses shakes up tree of life. Illinois News Bureau. https://news.illinois.edu/blog/view/6367/204989