Cicada Shell

Life Science | Lesson Guide

4th Grade

Photo Description

This image shows a brown, papery shell clinging to tree bark surrounded by light-colored lichen. The shell is hollow and looks like the outline of an insect with visible legs, wings, and head. This empty shell was left behind when a cicada grew too big for its outer skin and shed it to become an adult.

Scientific Phenomena

Anchoring Phenomenon: Exoskeleton shedding (ecdysis) during insect metamorphosis

This image captures evidence of incomplete metamorphosis, where cicadas must shed their rigid exoskeletons multiple times as they grow. Unlike human skin that stretches, insect exoskeletons are hard and cannot expand. When a cicada nymph grows too large for its exoskeleton, it splits the shell open and crawls out, leaving behind this papery "ghost skin." The cicada may do this 4-5 times before becoming a winged adult. This is a visible, tangible example of how organisms change and grow over time—a fundamental life science concept.

Core Science Concepts

* Life Cycles: Insects go through predictable stages of growth and change called metamorphosis. Cicadas have an incomplete life cycle with egg, nymph, and adult stages.

* Adaptations: The exoskeleton is a protective outer covering that helps insects survive, but it must be shed periodically to allow growth.

* Observable Evidence of Change: Shed exoskeletons are physical proof that organisms grow and transform—students can find and study these remains to understand life processes.

* Interaction with Environment: Cicadas live in trees and use them as habitat. The lichen visible here shows how multiple organisms share the same living space.

Pedagogical Tip:

Consider taking students on a "nature walk exoskeleton hunt" in late spring/early summer near trees or shrubs. When students discover shells themselves, ownership and engagement increase dramatically. Take photos and create a class display to revisit throughout the year. This makes the abstract concept of "growth" concrete and observable.

UDL Suggestions:

Representation: Provide labeled diagrams showing what the inside of a cicada looks like so students can compare the empty shell to the living insect. Include videos of the actual shedding process for students who benefit from motion and sequential visual learning.

Action & Expression: Allow students to choose how they demonstrate learning—through drawing, building a model with craft materials, creating a comic strip sequence, or verbal explanation to a peer.

Engagement: Connect to student curiosity by asking "What animal skin can you shed?" (snakes, hermit crabs) to broaden the concept beyond insects.

Zoom In / Zoom Out

Zoom In: Cellular Level – How the New Skin Grows Underneath
Beneath the hard exoskeleton, a cicada's body is already growing a brand new, larger exoskeleton made of special cells. As the cicada grows bigger inside, pressure builds up between the old shell and the new one underneath. The old shell actually splits open along weak seams (like where a package has a tear line), and the soft new exoskeleton underneath slowly hardens and darkens in the air. This new outer layer is made of a material called chitin—the same tough stuff that makes up crab shells and beetle armor. At the cellular level, the cicada is constantly producing new chitin cells to create a larger protective layer, even while still trapped in the old one.

Zoom Out: Forest Ecosystem – Nutrient Cycling and Habitat Dynamics
When a cicada molts, it doesn't just leave behind an empty shell—it's contributing to the larger forest ecosystem. That shed exoskeleton becomes food and material for decomposers like fungi, bacteria, and arthropods that break it down. The tree the cicada lives on provides shelter and moisture for the cicada's life cycle, while the cicada (especially as an adult) becomes food for birds, spiders, and reptiles. The lichen visible in the photo also depends on clean air and the tree's bark for survival. All these organisms—the cicada, the tree, the lichen, the decomposers—are interconnected in a web where one organism's waste becomes another's resource. The cicada's exoskeleton, though it looks insignificant, is part of this larger nutrient cycle that keeps the forest healthy.

Discussion Questions

1. Why do you think the cicada left this shell behind instead of keeping it on its body? (Bloom's: Analyze | DOK: 2)

2. If you could compare this empty shell to a living cicada, what differences would you notice? What would be the same? (Bloom's: Compare | DOK: 3)

3. How do you think the cicada got out of this shell? What clues can the shell show us? (Bloom's: Evaluate | DOK: 3)

4. What might happen to this shell over time if it stays on the tree? What other living things might use it? (Bloom's: Synthesize | DOK: 3)

Potential Student Misconceptions

Misconception 1: "The cicada died and left a dead bug behind."
Clarification: The exoskeleton is NOT the cicada—it's only the outer shell, like taking off a coat. The cicada is still alive and has crawled out of this shell. The shell is empty because the living insect has moved on to grow bigger. We can tell it's empty by looking through it or feeling how light and papery it is.

Misconception 2: "All animals shed their skin like cicadas do."
Clarification: Most animals (like humans, dogs, and birds) have skin that stretches and grows with their bodies. Insects are special because their exoskeletons are hard and cannot stretch, so they must shed them completely to get bigger. Snakes, spiders, and crabs also shed their outer coverings, but many animals don't need to do this at all.

Misconception 3: "The cicada sheds its shell once and then it's done growing."
Clarification: Cicadas molt (shed) many times—usually 4 to 5 times—as they grow from a tiny egg to a full-sized adult. Each time they outgrow their exoskeleton, they leave behind a bigger shell than the last one. This happens over several years underground before the adult cicada finally emerges and flies away.

Extension Activities

1. Exoskeleton Collection & Display: Have students search their school grounds or nearby outdoor space for shed exoskeletons (cicadas, grasshoppers, spiders). Create a labeled display with hand-drawn diagrams showing which insect left each shell and why. Students can measure shells and estimate how much bigger the insect grew.

2. Model the Molt: Provide each student with a small paper bag, markers, and craft materials to create a "before and after" model. Have them draw an insect on the outside of the bag, then decorate the inside to show what the insect looks like after molting. Students can present their models and explain why insects must molt to grow.

3. Life Cycle Sequencing Timeline: Display large pictures or have students draw the cicada life cycle stages (egg !’ nymph !’ more nymphs !’ adult). Include the exoskeleton shedding at each stage. Create a classroom timeline on a hallway wall showing that cicadas can spend 2-17 years underground as nymphs before emerging as adults.

Cross-Curricular Ideas

Language Arts – Narrative Writing & Sequencing:
Have students write a first-person narrative from the cicada's perspective: "A Day in My Life as I Grow and Molt." They can use time-order words (first, next, then, finally) to sequence the stages of growth and shedding. Encourage vivid sensory language: "I felt squeezed inside my tight shell until..." This combines life science understanding with storytelling and vocabulary development.

Mathematics – Measurement & Data:
Students can collect cicada exoskeletons (or use photos) and measure their length, width, and compare sizes to estimate how much the insect grew between molts. Create a bar graph showing shell sizes from smallest (first molt) to largest (final molt before adulthood). Students can calculate the difference in size between shells and make predictions: "If the first shell is 1 cm and the last is 3 cm, how much did the cicada grow?"

Art – Nature Sculpture & Mixed Media:
Students can create 3D art pieces using natural materials found on a nature walk (twigs, leaves, lichen, bark) arranged around a photo or drawing of a cicada exoskeleton. This celebrates the interconnectedness of forest life and encourages close observation of textures and colors. Display these "habitat dioramas" to show cicadas in their real environment.

Social Studies – Animal Behavior & Human Connection:
Discuss how different cultures around the world view cicadas—in some Asian countries, cicada songs are celebrated in poetry and art; in others, cicadas are considered pests. Have students research how cicadas affect human communities (the noise they make, what people eat in different regions) and present findings to the class. This builds cultural awareness while deepening science understanding.

STEM Career Connection

Entomologist (Insect Scientist)
An entomologist is a scientist who studies insects—their bodies, behaviors, life cycles, and how they live in their environments. An entomologist might spend time in forests collecting and observing cicadas, measuring exoskeletons, and recording data about when they molt and emerge as adults. They help us understand how insects fit into nature and why they're important. Some entomologists even work to protect endangered insects or stop harmful insects from damaging crops.
Average Annual Salary: $65,000–$75,000 USD

Wildlife Biologist
A wildlife biologist studies how animals live in their natural habitats and how they interact with plants, other animals, and their environment. A wildlife biologist might track cicada populations in a forest to see if they're healthy, study what eats cicadas, and understand how cicadas help or affect the ecosystem. They use tools like cameras, notebooks, and computers to collect and analyze information about animal behavior and survival.
Average Annual Salary: $63,000–$72,000 USD

Museum Educator or Natural History Curator
A museum educator teaches visitors (including school groups) about insects and natural history through displays, demonstrations, and hands-on activities. A curator collects and cares for specimens like cicada exoskeletons, arranging them in displays that tell stories about nature. They might create the exact kind of labeled exhibit you see in a natural history museum, helping people of all ages learn and wonder about the living world.
Average Annual Salary: $40,000–$60,000 USD

NGSS Connections

Performance Expectation:
4-LS1-1: Use evidence to construct an explanation that plants get the materials they need for growth chiefly from air and water. (Note: Also connects to general growth/life cycle understanding)

Disciplinary Core Ideas:
* 3-LS1.B Growth and Development of Organisms
* 3-LS2.C Ecosystem Dynamics, Functioning, and Resilience (organisms and habitats)

Crosscutting Concepts:
* Patterns (The pattern of shedding occurs repeatedly)
* Change and Stability (Physical structures change as organisms grow)
* Structure and Function (The exoskeleton provides protection but limits growth)

Science Vocabulary

* Exoskeleton: A hard outer covering that protects an insect's body on the outside, like a suit of armor.

* Molt (or Shed): When an animal grows too big for its outer skin or shell and leaves it behind to reveal new skin underneath.

* Nymph: The young stage of an insect like a cicada that looks somewhat like an adult but is smaller and doesn't have wings yet.

* Metamorphosis: The process of an animal changing and growing into its adult form through different life stages.

* Habitat: The place where an animal or plant naturally lives, such as a tree, pond, or forest.

External Resources

Children's Books:
Cicadas: The Largest Bugs on Earth* by Lorijo Metz (Illustrated nonfiction, Grade 2-4 level)
The Life Cycle of a Cicada* by Rebecca Stefoff (Clear diagrams and accessible text)
Are You a Butterfly?* by Judy Allen and Tudor Humphries (Metamorphosis concept for younger learners)

Teacher Note: This lesson bridges observational learning with life science standards by making an abstract concept—growth and metamorphosis—visible and tangible. The exoskeleton provides a "real thing" students can hold, measure, and wonder about, naturally generating curiosity and deeper thinking.