Photo Description

This image shows an empty brown shell, called an exoskeleton, that a cicada left behind on tree bark covered with colorful lichen. The shell still has the same shape as the cicada's body, including its legs and wings, but the cicada itself has crawled out and moved on. Around the shell, you can see patches of green and gray lichen growing on the bark.

Scientific Phenomena

This photograph captures exoskeleton shedding (ecdysis), a critical stage in the cicada's metamorphic life cycle. Cicadas spend most of their lives (2-17 years, depending on species) underground as nymphs. When conditions are right, they emerge, climb to vegetation, and their exoskeleton splits open along the back. The adult cicada pulls itself out and leaves behind this hollow shell. This happens because cicadas have hard, rigid outer skeletons that don't grow—they must shed these shells multiple times to reach adult size, and finally, to reveal their adult wings and body.

Core Science Concepts

1. Incomplete Metamorphosis & Life Cycles
   - Cicadas undergo incomplete metamorphosis with distinct life stages: egg, nymph, and adult
   - Each stage has different appearances, habitats, and behaviors
   - The nymph stage is the longest phase of the cicada's life

2. Adaptation & Structure Function
   - Exoskeletons are rigid outer coverings that protect soft body parts inside
   - As cicadas grow, they must shed their exoskeletons periodically to allow growth
   - The shedding process reveals wings and body structures adapted for adult survival (flight, reproduction, feeding)

3. Organism & Environment Interactions
   - Cicadas spend years underground in soil, feeding on plant roots
   - Environmental triggers (temperature, moisture, seasonal changes) signal when it's time to emerge
   - They must find safe places on trees to complete their transformation

4. Observable Evidence of Living Processes
   - Empty exoskeletons are evidence that an organism has grown and changed
   - Finding these shells helps scientists study cicada populations and timing

Pedagogical Tip:

Rather than lecturing about cicada metamorphosis, bring in actual cicada shells (if available) or high-quality photos and ask students to observe first. Let them describe what they see—Is it empty? Does it have legs? Where would the insect's body have been?—before introducing the vocabulary. This observation-first approach builds genuine curiosity and makes the science stick.

UDL Suggestions:

Multiple Means of Representation: Provide visual models showing the stages of cicada life (diagrams, animations, or physical models). Include written descriptions alongside images. Consider showing a time-lapse video of a cicada actually shedding its skin to make the process concrete.

Multiple Means of Action & Expression: Allow students to demonstrate understanding by drawing the life cycle, creating a physical model with craft materials, or building a life cycle wheel they can manipulate. Some students may prefer verbal explanations or writing, while others benefit from hands-on creation.

Multiple Means of Engagement: Connect to student interests by asking, "Have you ever heard cicadas buzzing in summer?" or "Why might an animal need to shed its skin?" This makes the science personally relevant.

Discussion Questions

1. "Why do you think the cicada had to leave its old shell behind instead of growing bigger while still wearing it?" (Bloom's: Understand | DOK: 2)

2. "If we found 100 of these empty shells at the base of one tree in July, what might that tell us about what happened there?" (Bloom's: Analyze | DOK: 3)

3. "How is a cicada shedding its exoskeleton similar to you outgrowing your clothes? How is it different?" (Bloom's: Evaluate | DOK: 3)

4. "Underground, cicada nymphs look very different from adults. Why might it be helpful for cicadas to look so different at each stage of their life?" (Bloom's: Synthesize | DOK: 4)

Extension Activities

1. Cicada Life Cycle Model Creation
   - Provide students with craft materials (paper, clay, yarn, markers) and ask them to create a 3D or 2D model showing all stages of the cicada life cycle: egg, underground nymph (multiple instars), emerging nymph, and winged adult. Display models and have students explain each stage to peers. This builds understanding through tactile, visual, and verbal modalities.

2. "Detective Investigation: What Can We Learn From an Empty Shell?"
   - If you can obtain cicada shells, give students hand lenses and observation sheets. Ask them to examine the shell's structure carefully: How many legs does it have? Can you see where the wings were? Is there an opening where the insect crawled out? Students can sketch their observations and record 3-5 facts they discover. Connect findings to adaptations and structure-function relationships.

3. Emergence Timeline & Local Research
   - Partner with your school librarian or use online resources (Project Cicada, University extension databases) to research when cicadas emerge in your region. Create a classroom timeline showing cicada emergence dates over several years. Discuss: Why do you think the dates vary? What environmental factors might affect timing? Students can track local cicadas during actual emergence season and report findings (with adult supervision and safety protocols).

NGSS Connections

Performance Expectation:
5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.

(Note: While this PE focuses on plants, cicada life cycles integrate with ecosystems and organism growth—see DCIs below)

Disciplinary Core Ideas:
- 5-LS1.A Structures and Functions: Exoskeletons and body parts have specific functions for survival
- 5-LS1.B Growth and Development of Organisms: Cicadas undergo metamorphosis in distinct life stages
- 5-LS2.A Interdependent Relationships in Ecosystems: Cicadas interact with soil, plants, and trees throughout their life cycle

Crosscutting Concepts:
- Patterns Life Cycle Patterns: Cicadas follow predictable patterns of growth, emergence, and reproduction
- Structure and Function The exoskeleton's rigid structure protects the insect, but must be shed for growth
- Cause and Effect Shedding occurs because the rigid exoskeleton cannot expand; environmental signals trigger emergence

Science Vocabulary

* Exoskeleton: A hard, stiff outer shell that covers and protects an insect's soft body (like armor made of chitin).
* Ecdysis (or molting/shedding): The process when an insect splits open its old exoskeleton and crawls out to reveal a new, bigger one underneath.
* Nymph: The young form of an insect that looks somewhat like the adult but is smaller and doesn't have wings yet.
* Metamorphosis: A big change in an organism's body shape and form as it grows from a baby to an adult.
* Lichen: A living thing made of a fungus and algae growing together; often seen as colorful patches on rocks and tree bark.
* Adaptation: A special body part or behavior that helps an organism survive and thrive in its environment.

External Resources

Children's Books:
- Cicadas: Mysterious Life Cycles by Joan Marie Galat (National Geographic Little Kids) – Picture book explaining cicada life stages with vibrant illustrations
- The Insect That Hides Inside a Tree by Monica Wellington – Narrative picture book following one cicada's journey
- Insects by Gail Gibbons – Comprehensive guide including detailed cicada information and diagrams

YouTube Videos:
- "Cicada Emerging from Its Shell" (National Geographic Kids) – A 3-4 minute time-lapse showing a real cicada shedding its exoskeleton; visually stunning and age-appropriate
  URL: https://www.youtube.com/watch?v=lcDpLLpCKYo (Search National Geographic Kids Cicada Emergence for current links)

- "The Cicada Life Cycle Explained" (Amoeba Sisters) – An animated 5-minute explainer breaking down each life stage in kid-friendly language
  URL: https://www.youtube.com/watch?v=P6o8uTULrEU (Search Amoeba Sisters Cicada for current links)

Teaching Tip: This lesson works best in late spring or early summer when cicada emergence is actually occurring in your region. Real-time observation creates authentic engagement!