

## Photo Description



This image shows a large cicada insect resting on a plant branch with reddish leaves. The cicada has clear, veined wings, large eyes, and a brown and green striped body. You can see the detailed wing patterns and the insect's sturdy legs gripping the branch.

## Scientific Phenomena

The anchoring phenomenon here is insect metamorphosis and life cycles, specifically the emergence of periodical cicadas. Cicadas spend most of their lives underground as nymphs, feeding on tree root fluids for 13 or 17 years depending on the species. When soil temperatures reach about 64°F, they emerge en masse, molt one final time, and transform into winged adults. This synchronized emergence is an evolutionary adaptation that ensures survival through "predator satiation" - emerging in such large numbers that predators cannot possibly eat them all.

## Core Science Concepts

1. Complete vs. Incomplete Metamorphosis: Cicadas undergo incomplete metamorphosis (egg → nymph → adult) rather than complete metamorphosis like butterflies (egg → larva → pupa → adult).
2. Adaptation and Survival Strategies: The long underground development and synchronized emergence are adaptations that help the species survive predation and environmental challenges.
3. Life Cycle Patterns: Periodical cicadas demonstrate predictable, cyclical patterns in nature with their 13 or 17-year emergence cycles.
4. Insect Body Structure: The cicada displays classic insect characteristics - six legs, three body segments (head, thorax, abdomen), compound eyes, and wings.

### Pedagogical Tip:

Use the "Think-Pair-Share" strategy when introducing cicada life cycles. Have students first think individually about what they know about insects that live underground, then pair up to discuss, and finally share with the whole class. This builds on prior knowledge before introducing new concepts.

### UDL Suggestions:

Provide multiple ways to represent the cicada life cycle by combining visual diagrams, hands-on models using clay or play dough, and kinesthetic activities where students act out each life stage. This supports learners with different processing strengths.

## Zoom In / Zoom Out

**Zoom In:** At the cellular level, cicadas undergo hormonal changes triggered by temperature and internal biological clocks. Special cells produce hormones that signal when it's time to emerge and molt, coordinating the massive synchronized emergence across entire populations.

**Zoom Out:** Cicada emergences play crucial roles in forest ecosystems by providing massive food sources for birds, mammals, and other insects. Their tunneling aerates soil, and their decomposing bodies add nutrients to forest floors, supporting plant growth and the broader food web.

## Discussion Questions

1. "What advantages might cicadas gain by staying underground for so many years before emerging?" (Bloom's: Analyze | DOK: 3)
2. "How do you think the forest ecosystem changes during a major cicada emergence?" (Bloom's: Evaluate | DOK: 3)
3. "What patterns do you notice in the cicada's body structure that are similar to other insects?" (Bloom's: Apply | DOK: 2)
4. "Why might it be beneficial for millions of cicadas to emerge at the same time rather than gradually throughout the years?" (Bloom's: Analyze | DOK: 3)

## Potential Student Misconceptions

1. Misconception: "Cicadas are the same as locusts and will eat all the plants."  
Reality: Cicadas are not locusts and don't eat plants. Adult cicadas primarily drink tree sap and don't cause agricultural damage like locusts do.
2. Misconception: "Cicadas sleep underground for 17 years."  
Reality: Cicadas are active underground as nymphs, continuously growing, molting, and feeding on tree root fluids throughout their development.
3. Misconception: "All cicadas emerge every 17 years."  
Reality: There are both 13-year and 17-year periodical cicadas, plus annual cicadas that emerge every year in smaller numbers.

## NGSS Connections

- Performance Expectation: 3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- Disciplinary Core Ideas: 3-LS1.B Growth and Development of Organisms
- Disciplinary Core Ideas: 5-LS2.A Interdependent Relationships in Ecosystems
- Crosscutting Concepts: Patterns
- Crosscutting Concepts: Systems and System Models

## Science Vocabulary

- \* Nymph: A young insect that looks similar to the adult but without wings and cannot reproduce yet.
- \* Metamorphosis: The process of changing from one life stage to another as an animal grows and develops.
- \* Emergence: When cicadas come up from underground and transform into their adult form.

- \* Periodical: Happening in regular cycles or time periods, like every 13 or 17 years.
- \* Synchronous: Happening at the same time across a large area or population.
- \* Adaptation: A special trait that helps an organism survive in its environment.

### External Resources

Children's Books:

- Cicadas! by Laurence Pringle
- Thirteen-Year Cicadas by Rebecca Hirsch
- The Life Cycle of a Cicada by Bobbie Kalman

YouTube Videos:

- "Cicada Emergence - Nature's Most Amazing Phenomenon" - National Geographic documentary showing mass cicada emergence with excellent close-up footage: <https://www.youtube.com/watch?v=R0ys8Tgle4U>
- "Brood X Cicadas: The Science Behind the Emergence" - Smithsonian National Museum of Natural History's kid-friendly explanation of cicada biology and behavior: <https://www.youtube.com/watch?v=qQF4dFDAkKc>