

## Photo Description



A large cicada with clear wings and a golden-brown body sits on a tree branch among colorful autumn leaves. The cicada has big eyes and a thick body, and you can see the detailed patterns on its transparent wings. This insect spends most of its life underground and only comes out for a short time to find a mate.

## Scientific Phenomena

This image captures the emergence phase of a cicada's life cycle - specifically an adult cicada that has recently molted from its nymph stage. The cicada has climbed up from its underground burrow where it lived for years, shed its old exoskeleton, and is now in its brief adult phase focused on reproduction. The phenomenon demonstrates incomplete metamorphosis, where the insect goes through egg, multiple nymph stages, and adult phases without a pupal stage like butterflies have.

## Core Science Concepts

1. Life Cycles and Metamorphosis: Cicadas undergo incomplete metamorphosis with three main stages - egg, nymph (with multiple molts), and adult. Unlike complete metamorphosis, there is no pupal stage.
2. Adaptation and Survival Strategies: Cicadas have evolved unique timing mechanisms, with some species emerging every 13 or 17 years in massive synchronized events to overwhelm predators and ensure species survival.
3. Habitat and Ecological Relationships: Adult cicadas live in trees where they mate and lay eggs, while nymphs live underground feeding on tree root fluids, demonstrating different habitat needs within one life cycle.
4. Structure and Function: The cicada's large eyes help detect predators and mates, while their strong legs are adapted for gripping tree bark and their specialized mouthparts are designed for drinking plant fluids.

### Pedagogical Tip:

Use a KWL chart (Know, Want to know, Learned) at the beginning of your cicada lesson to activate prior knowledge and address student misconceptions about "bugs" versus insects.

### UDL Suggestions:

Provide multiple ways for students to explore cicada sounds by playing audio recordings, having students create their own "cicada calls" with instruments, and showing vibration demonstrations to support auditory learners and students with hearing differences.

## Zoom In / Zoom Out

1. Zoom In: At the cellular level, cicadas produce their famous loud calls through specialized structures called tymbals - ribbed membranes that buckle rapidly when muscles contract, creating sound vibrations that can reach 120 decibels.

2. Zoom Out: Cicada emergences play crucial roles in forest ecosystems by providing massive food sources for birds, mammals, and other predators, while their underground nymphs aerate soil and their egg-laying creates pruning effects that stimulate new plant growth.

### Discussion Questions

1. "What advantages might cicadas gain from spending most of their lives underground?" (Bloom's: Analyze | DOK: 3)
2. "How do you think the cicada's body parts help it survive in its environment?" (Bloom's: Apply | DOK: 2)
3. "Why might cicadas emerge in huge numbers all at the same time instead of just a few at a time?" (Bloom's: Evaluate | DOK: 3)
4. "What patterns do you notice in the cicada's life cycle compared to other insects we've studied?" (Bloom's: Analyze | DOK: 2)

### Potential Student Misconceptions

1. Misconception: "Cicadas are the same as locusts and they eat crops."

Reality: Cicadas are completely different insects from locusts. Cicadas only drink plant fluids and don't damage crops, while locusts are grasshoppers that can destroy vegetation.

2. Misconception: "All cicadas come out every 17 years."

Reality: Only certain species are periodical cicadas (13 or 17-year cycles). Many cicada species are annual, with some adults emerging every year.

3. Misconception: "Cicadas bite or sting people."

Reality: Cicadas cannot bite or sting humans. They have specialized mouthparts only for drinking plant fluids and are harmless to people.

### Cross-Curricular Ideas

1. Math - Data Collection and Graphing: Have students collect data about cicada emergence patterns by researching when cicadas emerge in different years. Students can create bar graphs or line graphs showing the 13-year and 17-year cycles, practicing data representation and number patterns.

2. ELA - Informative Writing: Students can write informative paragraphs or short reports about cicada life cycles, using the vocabulary terms and facts learned. They could also read and discuss children's books about cicadas, answering comprehension questions and making text-to-self connections about waiting and transformation.

3. Art - Life Cycle Illustration: Students can create a multi-panel comic strip or poster showing the cicada's complete life cycle from egg to adult. They can use colored pencils or paint to illustrate the underground nymph stages and the dramatic emergence, paying attention to anatomical details visible in the photo.

4. Social Studies - Seasonal Patterns and Timekeeping: Discuss how different cultures have observed and documented cicada emergences throughout history. Students can explore how cicadas help people mark time and seasons, connecting to how humans track natural cycles in their communities.

## STEM Career Connection

1. Entomologist - An entomologist is a scientist who studies insects like cicadas. They observe how insects live, grow, and behave in nature. They might spend time outdoors collecting insects, looking at them under microscopes, and learning about their life cycles to answer questions about nature. Average Annual Salary: \$65,000
2. Environmental Biologist - Environmental biologists study how insects like cicadas fit into ecosystems and affect the plants and animals around them. They investigate why cicadas emerge when they do and how their presence helps or changes forests and gardens. Average Annual Salary: \$68,000
3. Science Teacher or Nature Educator - Science teachers and nature educators help students learn about insects and the natural world by teaching lessons, leading nature walks, and creating exciting activities like the ones you're doing right now! They share discoveries about cicadas and other animals to help people understand and appreciate nature. Average Annual Salary: \$62,000

## 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: 3-LS4.B - Natural Selection
- Crosscutting Concepts: Patterns
- Crosscutting Concepts: Structure and Function

## Science Vocabulary

- \* Metamorphosis: The process of changing from one life stage to another as an animal grows up.
- \* Nymph: A young insect that looks similar to the adult but doesn't have wings yet.
- \* Molt: When an animal sheds its old outer covering to grow bigger.
- \* Emerge: To come out from underground or from hiding.
- \* Adaptation: A special feature that helps an animal survive in its environment.
- \* Life cycle: All the stages an animal goes through from birth to death.

## External Resources

Children's Books:

- Cicadas! Strange and Wonderful by Laurence Pringle
- Waiting for Wings by Lois Ehlert
- The Life Cycle of Insects by Susan Heinrichs Gray