Cicada

Life Science | Lesson Guide

4th Grade

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.

Cross-Curricular Ideas

1. Mathematics - Data Collection and Graphing: Have students create bar graphs showing the number of cicadas that might emerge in different years or the comparison between 13-year and 17-year cicada cycles. Students could also calculate how many times a cicada emerges in a human lifetime or measure and record the length of cicada wings using rulers.

2. English Language Arts - Narrative Writing: Students can write a "Life Story of a Cicada" from the insect's perspective, describing what it's like to live underground for 13 or 17 years and then emerge as an adult. This creative writing activity helps students understand and internalize the cicada life cycle while practicing sequencing and descriptive language.

3. Social Studies - Mapping and Geography: Create maps showing where different periodical cicada broods emerge across the United States. Students can research which states experience cicada emergences and learn how geography affects when and where these insects appear, connecting to concepts of regions and natural patterns.

4. Art - Nature Illustration and Observation Drawing: Have students create detailed drawings of the cicada, focusing on its intricate wing patterns, body segments, and coloring. This combines scientific observation with artistic skill and helps students develop a deeper appreciation for the insect's structural adaptations.

STEM Career Connection

1. Entomologist (Insect Scientist): An entomologist is a scientist who studies insects like cicadas. They observe how insects live, grow, and interact with their environments. Entomologists help us understand why cicadas emerge when they do and how they survive. Some entomologists work in universities or museums, while others work for the government helping farmers and protecting forests. Average Annual Salary: $65,000 - $75,000

2. Ecologist: An ecologist studies how different living things interact with each other and their environment. A forest ecologist might study how a massive cicada emergence affects birds, trees, and soil health in an ecosystem. They help us understand the bigger picture of how nature works together. Average Annual Salary: $68,000 - $80,000

3. Wildlife Biologist: A wildlife biologist studies animals in nature and helps protect them. Some wildlife biologists track cicada populations over many years to predict when they'll emerge and help people prepare for these natural events. They might also study how other animals, like birds, depend on cicadas for food. Average Annual Salary: $62,000 - $78,000

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: 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