

ENTOMOLOGY

LESSON PLAN

Meets the following 5th Grade Science Standards:

Life Sciences:

2g: Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide and water (respiration).

Investigation and Experimentation:

6a: Classify objects.

6f: Use appropriate tools and make observations.

6g: Record data by using appropriate graphs.

Meets the following 6th Grade Science Standards:

Ecology:

5a: Students know energy enters ecosystems as sunlight by producers into chemical energy through photosynthesis and then from organism to organism through food webs

5b: - Students know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. (Insects are low on the food chain)

5c: Students know populations of organisms can be categorized by the functions they serve in an ecosystem. (Insects are consumers of chemical energy; some are predators, scavengers, and decomposers)

Investigation and Experimentation:

7a: Develop a hypothesis

7b: Use tools to perform tests

7e: Recognize whether evidence is consistent with a proposed explanation

OBJECTIVES:

1. Teach students to distinguish between the four different groups of **arthropods** and specifically identify an insect by its physical characteristics.
2. Introduce students to the **taxonomy** of insects.
3. Teach students that in the food web, insects transfer energy from plants to themselves, and then become energy for other consumers, including humans.
4. Teach students the **important roles** insects play in an ecosystem.
5. Look at some of the fascinating facts about insects.
6. Have students collect, identify, and categorize insects from the field.
7. Have students find examples of crepuscular, diurnal and nocturnal insects.

BACKGROUND:

Although insects seem to be disease-ridden pests, they play an integral part in the food chain and are vital to the overall health of an ecosystem. Insects provide **food for consumers** and

pollination for producers; without these contributions many plants and animals would cease to exist. **Insects make up half of the known animal world.** They are amazing and diverse creatures with amazing abilities, living in **well-structured** and **organized communities**. The work ethic and community responsibility of an insect is a good example to follow (Proverbs 6:6 and Proverbs 30:27).

PROCEDURES:

1. Demonstrate the difference between a true Insect and other Arthropods with visual examples.
2. Test student understanding by having them point out the insects from a group of Arthropods.
3. Introduce students to the **taxonomy** of insects.
4. Teach students that in the food web, insects transfer energy from plants to themselves, and then become energy for other consumers, including humans.
5. Share interesting facts about insects with the students.
6. Demonstrate the safe and proper way to collect specimen from the field.
7. Have students collect specimen from the field, documenting where the insects were found, the time of day, and what activity the insects were engaged in.
8. Gather students together to analyze and identify the animals that were collected and categorize those animals.
9. Discuss what important contribution the collected specimen provides to the ecosystem. Do they assist in pollination? Decomposition? Do they provide a product? Do they eat harmful insects? Are they a harmful insect?

At the completion of this class the student

- Should know
 - How to identify an insect by its physical features.
 - There of four different groups of Arthropods: Insects, Myriapods, Arachnids, and Crustaceans
 - That insects are consumers, and what role they play in the transfer of energy in a food chain
 - The important contributions insects provide to an ecosystem
 - How to collect and classify insects
 - Examples of nocturnal, diurnal and crepuscular insects
- Should be able to
 - Name the features of an insect
 - Name the characteristics of Arthropods
 - Name several benefits of insects
 - Safely collect insects in the field
 - Be able to classify the animals that they collected

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TEACHER NOTES

Scripture References:

2 Corinthians 5:17 – *“Therefore, if anyone is in Christ, the new creation has come: The old has gone, the new is here!”*

Proverbs 6:6-8 – *Ants work hard – “Go to the ant, you sluggard; consider its ways and be wise! It has no commander, no overseer or ruler, yet it stores its provisions in summer and gathers its food at harvest.”*

Proverbs 30:27 – *Locust work together in ranks to advance – “locusts have no king, yet they advance together in ranks;”*

1 Corinthians 12:12-27 – *Just like bees, God has created different people to be One body – “Just as a body, though one, has many parts, but all its many parts form one body, so it is with Christ. For we were all baptized by one Spirit so as to form one body—whether Jews or Gentiles, slave or free—and we were all given the one Spirit to drink. Even so the body is not made up of one part but of many. Now if the foot should say, “Because I am not a hand, I do not belong to the body,” it would not for that reason stop being part of the body. And if the ear should say, “Because I am not an eye, I do not belong to the body,” it would not for that reason stop being part of the body. If the whole body were an eye, where would the sense of hearing be? If the whole body were an ear, where would the sense of smell be? But in fact God has placed the parts in the body, every one of them, just as he wanted them to be. If they were all one part, where would the body be? As it is, there are many parts, but one body. The eye cannot say to the hand, “I don’t need you!” And the head cannot say to the feet, “I don’t need you!” On the contrary, those parts of the body that seem to be weaker are indispensable, and the parts that we think are less honorable we treat with special honor. And the parts that are unpresentable are treated with special modesty, while our presentable parts need no special treatment. But God has put the body together, giving greater honor to the parts that lacked it, so that there should be no division in the body, but that its parts should have equal concern for each other. If one part suffers, every part suffers with it; if one part is honored, every part rejoices with it. Now you are the body of Christ, and each one of you is a part of it.”*

I. Vocabulary

A. Cover each vocabulary word and ask the class to give examples of each.

B. Metamorphosis:

1. Butterflies, beetles, flies, ants, bees, moths, wasps, fleas, frogs, etc.

2. Christians go through metamorphosis too. In 2 Corinthians 5:17, it says that we become like new creation, the old is gone, and the new has come. This is why the butterfly is a Christian symbol and is on jewelry.

II. Insects- Who they are:

A. Hand out the rubber bugs. Have them circle the bugs they believe are insects. Go over the characteristics that make insects who they are while inspecting/using the rubber bugs alongside the material on pages 31-32 to help students understand which creatures are insects verses other arthropods (**section III**).

- B. Insects belong to the phylum Arthropod and class Insecta. All insects are Arthropods, but not all Arthropods are insects. There are four groups of Arthropods: **Insects**, Myriapods (millipedes, centipedes), Arachnids (spiders, ticks, scorpions), and Crustaceans (lobsters, crabs).
- C. For an animal to be an insect it needs to have:
1. Six legs
 2. Three main body parts
 3. A pair of antennae
 4. An exoskeleton
 5. Two pairs of wings (optional, but likely)
- D. The Insect has three main body parts with various features that help the insect gather food, change that food into energy, digest, circulate blood and oxygen, reproduce and perform many other life-sustaining functions.
1. The **head** bears mouth parts, eyes and antennae. The head is used for eating, sensing and gathering information.
 2. The **thorax** bears the legs and wings of an insect. The legs and wings of each insect are unique in each of the different orders of insects.
 3. The **abdomen** contains organs for digestion and reproduction.
- E. The **Taxonomy** of insects: **Half** of all known animals are insects.
- Kingdom: Animalia
 Phylum: Arthropoda
 Class: Insecta
 Order: (29 Orders)
 Family: Up to 1000
 Genus:
 Species: Up to 1 million
- F. Play **20 Questions** as an example of Taxonomy. Choose an animal in your head – tell them it won't be an insect to make it easier. Choose something familiar to them like panda or crocodile. Make sure that you will know the answers to their "yes or no" questions. Instruct them to think of broad questions first that will include large amounts of animals. "Is it a Black Bear?" is not a broad question. Play until they get it right, or close enough.

III. Insects and the other 3 Arthropods:

- A. **Insects** are just one class of the Arthropod phylum.
- B. **Myriapods** are the many legged creatures. They include only two creatures, the centipede and the millipede, Centipedes have one pair of legs per segment, while millipedes have two pairs of legs per segment.
- C. **Arachnids** must have 8 legs in the adult life stage, two body segments (chelicerae for feeding or defense, and the pedipalps for feeding, movement, or reproduction). Types of arachnids include spiders, ticks, mites, and scorpions.
- D. **Crustaceans** are invertebrates with a hard exoskeleton, a segmented body that is bilaterally symmetrical, more than four pairs of jointed legs, and an open circulatory system. Types of crustaceans include lobsters, crabs, crayfish, and the pill bug (roly poly).

IV. Insects in the Food Chain:

- A. While insects are very low on the food chain, they play an important role in the food chain.
- B. A majority of insects get their energy from plants (herbivores). They might eat leaves, roots, or nectar.
- C. Other insects get their energy from consuming other insects (carnivores), consuming waste (decomposers), and consuming the flesh or blood of larger creatures (parasites).
- D. Insects can be consumed by larger creatures which continues the food chain by passing on the energy they acquired to the next tier.

V. Insects- What are they good for? Insects are not just the scourge of the earth; they have very important jobs in an ecosystem.

- A. One of the most important functions they contribute to an ecosystem **is the pollination of plants**. Without pollination, plants would cease to exist. As an insect works to collect nectar from a flower, it transfers pollen within the flower. If the flower is a complete flower, both female and male, the insect assists in pollination. If the flower is only male, the pollen sticks to the legs of the insect and when the insect flies to a female flower the insect transfers the pollen from a male flower to a female flower. The insect pollinates the incomplete flower. Pollination could not happen without the insect's assistance. Bees and butterflies are common pollinators.
- B. **Recycling organic matter** is another job insects perform. Without the assistance of insects to decompose dead organisms, the world would be covered with dead carcasses. Insects eat the flesh of dead animals, which breaks down the matter. Insects then either regurgitate or excrete the digested matter and bacterium in their excretions further break down the dead organism. The larva form of flies (maggots) and other insects do a lot of the work. Different adult beetles and yellow jackets also help with the decomposition of dead organisms.
- C. **Insects are food for humans**. It is estimated that $\frac{1}{2}$ of the world's population of people eats insects for food. Insects are inexpensive and a good source of protein. In Thailand, open air markets sell silkworms, grasshoppers and water bugs by the pound. Japanese supermarkets sell aquatic insect larva, and South American movie theaters sell roasted ants as a tasty treat.
1. Hand out one cricket per person to those who WANT to eat them.
- D. Insects are **food for other animals**. The bird population relies heavily on insects for food. Other animals, such as frogs, bats and spiders, also need insects for food.
- E. **Insects are a source of beauty**. Many artist use butterflies and beetles as the subject of their paintings. Photographers take beautiful photos of insects in action. The poets of Scripture use insects to teach lessons in their prose and poetry.
- F. **Insects produce materials** such as silk, honey, wax and other products.
- G. Insects are also **predators** and eat other insects. Farmers will release crop friendly lady bugs to help eat plant- destroying insects like aphids.

1. There are many fascinating facts about insects. They range in size from one 100th of an inch to 20 inches long, to weighing up to 3 ounces. Some migrate; some travel around the world twice just to make one pound of product. See Entomology booklet for more interesting facts.

VI. Interesting Insect Facts:

- A. Fastest = Cockroach
- B. Shortest Life = Mayfly
- C. Loudest = Water boatman (sounds like a jackhammer)
- D. Smells like peanut butter = Giant prickly stick
- E. Eats bats = Amazonian Giant Centipede
- F. Shoots “fire” out of rear = Bombardier beetle
- G. Can be remotely controlled = Elephant beetle
- H. Heaviest = African Goliath beetle
- I. Tastes with their feet (and vomits before they eat) = House Flies

VII. Interesting Bee Facts

- A. “If the bee disappears from the surface of the earth, man would have no more than 4 years to live” –Albert Einstein
- B. Bees are responsible for 90% of fruits and vegetables.
- C. The honey bee is the only insects that produces food for humans.
- D. To make 1lb of honey, bees will travel a distance equal to going around the world twice.
- E. Each hive has a unique odor for member identification
- F. Bees communicate with each other by dancing.
- G. Roles of the Super Organism
 1. Queen: Fills the hive with eggs. She has control over whether she lays males or females.
 2. Drones: Males mate with the queen – that’s it. They don’t have a stinger. They mate all day, and die while mating.
 3. Female bees do all the work! Worker bees will sting if they feel threatened and will die for the sake of the colony.
 1. Cleaners (Day 1-2): Clean the new cells to receive eggs, nectar, and pollen. The queen will inspect it and if it’s not clean enough, they will do it again.
 2. Nurses (3-11): Care for developing larvae by feeding them honey with pollen and then royal jelly. Nurses check a single larvae over a thousand times daily.
 3. Builders (Day 12-17): Secrete wax flakes for the construction of the hive
 4. Guards (Day 18-21): Inspect every bee that enters the hive looking for the member odor.
 5. Foragers (Day 22-35): Sunrise to sunset will look for water, nectar, and pollen.

VIII. Collecting Specimens

- A. Have students trade in their rubber bugs for a spoon and cup. Students are to go outside and collect insects and other small creatures for 10-20 minutes depending on time.
- B. Bring students back into the classroom with their specimens and have them take field notes on page 35 regarding what they found. Discuss what they found with the class.
- C. Close in Prayer.

IX. Answers to Other Potential Questions

- A. Worms are in the phylum Annelida. They are asexual.
- B. Snails and slugs are in the phylum Mollusca and the class Gastropoda.
- C. Butterflies will lay their eggs on a plant that their eggs will eat.
- D. If you are an Arachnophobe, you are scared of scorpions, ticks, mites, and spiders.
- E. Ladybugs are great insect killers. Farmers will buy them to protect their crops.
- F. Ask for reasons that butterflies have designs on them. They can ward off predators, act as camouflage, or attract mates.
- G. Silk comes from silk worms and spiders.
- H. Mayflies cannot eat because they do not have mouths or stomachs. They simply mate and then die.
- I. Velvet worm that shoots glue out of his mouth to trap its prey.
- J. Giant Prickly Stick – drops an egg out of his tail looking thing and then an ant will pick it up and take it to the ant hill (because they think it's an acorn) and it will be protected from the elements until it hatches.
- K. Elephant Beetle – they have found a way to neurologically control this beetle for the purpose of surveillance and search and rescue
- L. Bombardier beetle – shoots a boiling, corrosive substance. They have two chambers in their abdomen that keeps the reactant substances apart. If the two chambers were not there at the same time the beetle would not survive.