

## Reading Preview

## Key Concepts

- What are the main characteristics of insects?
- What is one way insects are adapted to obtain particular types of food?
- What are two types of metamorphosis that insects undergo?

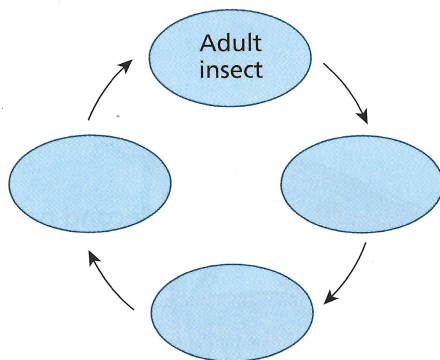
## Key Terms

- insect • thorax
- complete metamorphosis
- pupa
- gradual metamorphosis
- nymph

## Target Reading Skill

**Sequencing** A sequence is the order in which a series of events or steps in a process occurs. As you read, make a cycle diagram that shows the steps in the complete metamorphosis of an insect. Write each step in a separate circle.

## Complete Metamorphosis




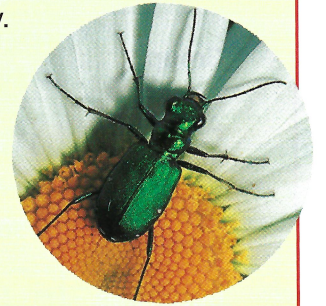
Thorn insect ►

Lab  
zone

## Discover Activity

## What Characteristics Do Insects Share?

1.  Your teacher will give you a collection of insects. Observe the insects carefully.
2. Note the physical characteristics of each insect's body covering. Count the number of body sections.
3. Count the number of legs, wings, and antennae on each insect. Then return the insects to your teacher and wash your hands.



## Think It Over

**Inferring** Compare the legs and the wings of two different species of insect. How is each insect adapted to move?

What do you do if you want to avoid being noticed? You keep perfectly quiet and you don't do anything that will attract attention. You might even wear clothes that help you to blend into the environment—a tactic called camouflage. The thorn insect is a master of camouflage. Not only does it look like a thorn, but it acts like one, too, staying quite still unless a predator like a bird comes too close. Then it springs away to safety.

Other kinds of insects have different camouflage tactics. For example, some caterpillars look like bird droppings, and others look and act like twigs. Plant hoppers may gather in clusters that look like yellow blossoms. And many kinds of moths resemble dead leaves.





### Graphing

Use the data to make a circle graph that shows the percentage of total insect species in each group. (See the Skills Handbook.)

**Insect Groups**

Group	Number of Species
Ants, bees, and wasps	115,000
Beetles and weevils	350,000
Butterflies and moths	178,000
Flies and mosquitoes	110,000
Other insect groups	147,000

## Body Structure

Moths are **insects**, as are caterpillars, plant hoppers, dragonflies, cockroaches, and bees. You can identify insects, like other arthropods, by counting their body sections and legs. **Insects are arthropods with three body sections, six legs, one pair of antennae, and usually one or two pairs of wings.** The three body sections are the head, thorax, and abdomen, as you can see in Figure 17.

**Head** Most of an insect’s sense organs, such as the eyes and antennae, are located on the head. Insects usually have two large compound eyes. These eyes contain many lenses, which are structures that focus light to form images. Compound eyes are especially keen at seeing movement. Most insects also have small simple eyes that can distinguish between light and darkness.

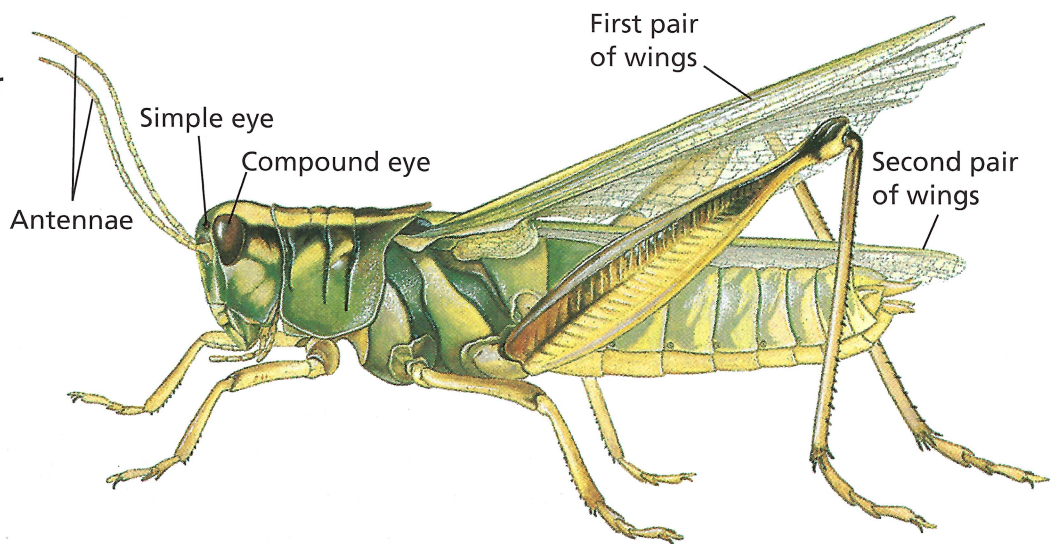
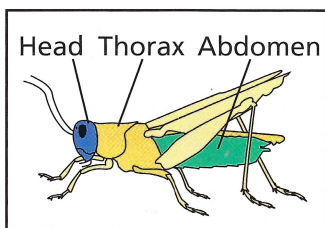
**Thorax** An insect’s midsection, or **thorax**, is the section to which wings and legs are attached. Most species of insects can fly once they are adults. Insects are the only invertebrates that can fly. By flying, insects can travel long distances to find mates, food, and new places to live. Being able to fly also enables insects to escape from many predators.

**Abdomen** Inside the abdomen are many of the insect’s internal organs. Small holes on the outside of the abdomen lead to a system of tubes inside the insect. These tubes allow air, which contains oxygen, to enter the body. The oxygen in the air travels directly to the insect’s cells.



What are the three sections of an insect’s body?

**FIGURE 17**  
**Structure of a Grasshopper**  
A grasshopper’s body, like that of every insect, has three sections.



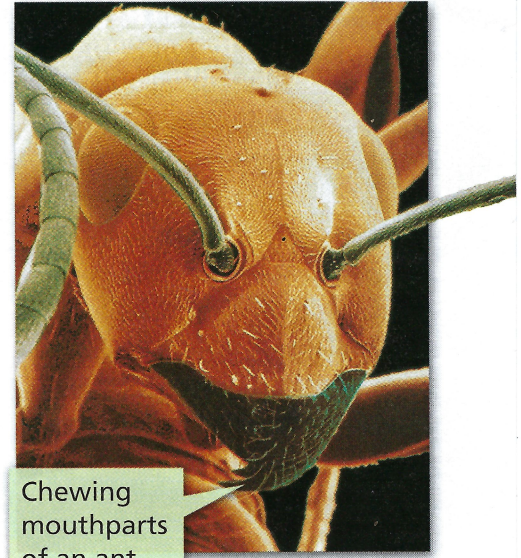




Lapping mouthparts of a fly



Sucking mouthparts of a butterfly



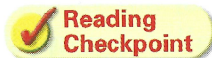
Chewing mouthparts of an ant

## Obtaining Food

The rule seems to be this: If it is living, or if it once was living, some kind of insect will eat it. You probably know that many insects eat parts of plants, such as leaves or nectar. But insects also eat products that are made from plants, such as paper. If you open a very old book, watch for book lice. These tiny insects live in old books, chewing crooked tunnels through the pages.

Insects may feed on animals, too. Some, like fleas and mosquitoes, feed on the blood of living animals. Others, like dung beetles, feed on animal droppings. Still others, like burying beetles, feed on the decaying bodies of dead animals.

**An insect's mouthparts are adapted for a highly specific way of getting food.** You can see some of these adaptations in Figure 18. Some flies have a sponge-like mouthpart that they use to lap up decaying flesh. A butterfly's mouthparts are shaped like a coiled tube, which can be uncoiled and used like a drinking straw to suck up nectar from flowers. Most ants have sharp-edged mouthparts that can cut through seeds, wood, and other foods.



How does a butterfly obtain food?

## Life Cycle

Insects begin life as tiny, hard-shelled, fertilized eggs. After they hatch, insects begin a process of metamorphosis that eventually produces an adult insect. **Each insect species undergoes either complete metamorphosis or gradual metamorphosis.**

FIGURE 18

### Diversity of Mouthparts

The mouthparts of this fly, butterfly, and wood ant are very different in their structure.

**Inferring** Could a butterfly eat an ant's food? Explain.

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FIGURE 19

## Insect Metamorphosis

Depending on the species, most insects develop into adults through complete metamorphosis or gradual metamorphosis.

### 1 Egg

Female fireflies lay their eggs in moist places. The eggs of fireflies glow in the dark.

### 2 Larva

The eggs hatch into larvae that feed on snails and slugs.

### Complete Metamorphosis

### 4 Adult

When its development is complete, an adult firefly crawls out of its pupal case and unfurls its wings. Adult fireflies flash their light to attract mates.

### 3 Pupa

After a time, the firefly larva becomes a pupa. Inside the protective pupal case, wings, legs, and antennae form.

**Complete Metamorphosis** In Figure 19 you can see that an insect with **complete metamorphosis** has four different stages: egg, larva, pupa, and adult. Eggs hatch into larvae. The larvae, such as the caterpillars of butterflies and the grubs of beetles, usually look something like worms. Larvae are specialized for eating and growing. After a time, a larva enters the next stage of the process and becomes a **pupa** (PYOO puh). As a pupa, the insect is enclosed in a protective covering.

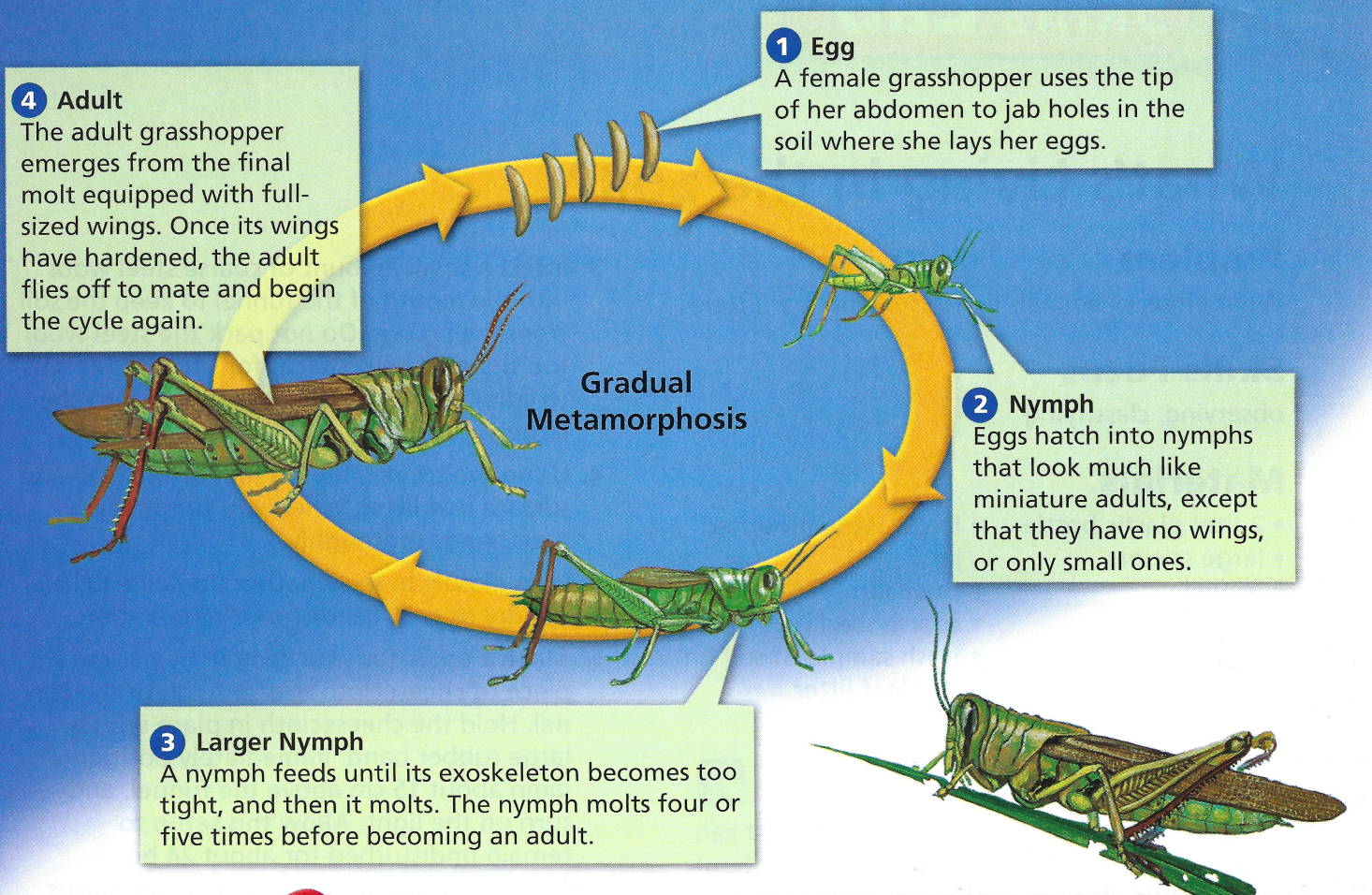
Although the pupa does not eat and moves very little, it is not resting. Major changes in body structure are taking place in this stage, as the pupa becomes an adult insect. Beetles, butterflies, flies, and ants all undergo complete metamorphosis.

**Gradual Metamorphosis** In contrast, the second type of metamorphosis, called **gradual metamorphosis**, has no distinct larval stage. An egg hatches into a stage called a **nymph** (nimf), which usually looks like the adult insect without wings. A nymph may molt several times before becoming an adult. Grasshoppers, termites, cockroaches, and dragonflies go through gradual metamorphosis.



What is gradual metamorphosis?





## Section 3 Assessment

**Target Reading Skill Sequencing** Refer to your cycle diagram about complete metamorphosis as you answer Question 3.


### Reviewing Key Concepts

1. a. **Identifying** What characteristics do insects share?  
 b. **Interpreting Diagrams** Look at Figure 17. To which body section are a grasshopper's wings attached?  
 c. **Making Generalizations** Suppose the adaptation of wings was suddenly lost in all insects. Predict what would happen to the number and diversity of insects.
2. a. **Naming** Name a type of insect that has chewing mouthparts.  
 b. **Reviewing** What are three ways that the mouthparts of insects are adapted for obtaining food?

3. a. **Listing** List the stages of gradual metamorphosis and the stages of complete metamorphosis.  
 b. **Interpreting Diagrams** Look at Figure 19. How are complete metamorphosis and gradual metamorphosis different?  
 c. **Applying Concepts** Why is a nymph more likely than a larva to eat the same food as its parents?

**Lab zone**

### At-Home Activity

**Bug Hunt**  Walk with a family member in your backyard or neighborhood. Search the undersides of leaves, under woodchips or rocks, and other likely places for insects. Show your family member what distinguishes an insect from other kinds of arthropods.