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Overview

With approximately one million species, insects are by far the most diverse and numerous organisms on earth. Scientists say that there are more individual insects than all other animals put together!

This Delta Science Module introduces students to many aspects of insect life. By observing insects closely, they learn about insect characteristics, behaviors, and life cycles.

In the first activity, students are introduced to the criteria that distinguish insects from other animals. They learn that insects have three body parts, six legs, simple and compound eyes, antennae, and sometimes wings. They build a model insect with these characteristics and make their first observations of living insects. In Activity 2, they turn their observations to the insect young, or larvae, that they will continue to watch, measure, and describe as the insects undergo metamorphosis.

In Activity 3, students predict where they might find insects in or around their school and collect them by building traps.

In Activity 4, students predict where they would find insects in nature and then go outdoors to test their predictions. They also learn techniques of specimen collection in the field.

Activity 5 encourages students to carefully observe and draw both captured and supplied insects. Then they use the information they obtained through observation, along with the Simple Key to Insects, to make rudimentary identifications of their insects in Activity 6.

Activity 7 directs the students in their discovery of the dramatic process of metamorphosis as first the larvae pupate, and later adult butterflies and beetles emerge from the brown pupal cases.

Students learn that some insects undergo simple metamorphosis—changing from eggs to nymphs to adults—while others undergo complete metamorphosis—changing from eggs to larvae to pupae to adults.

Activities 8 and 9 help students understand what being an insect must be like. Students first test environmental preferences of mealworms: dry versus damp, and dark versus light. Then they experiment with simulated insect eyes to gain a better understanding of how insects see the world.

In Activity 10, students discover how many other animals view insects—as food! Students create a model food web and see how important insects are to other organisms in nature. They also note how living things are intertwined in complex ways.

In Activity 11 students learn how insects avoid becoming food for others by using camouflage and mimicry. Students camouflage their own paper butterflies to try to make them disappear into classroom surroundings and then stage a butterfly hunt to see how many of their classmates' camouflaged insects they can spot.

Activity 12 has students observing how insects themselves eat. Students discover that butterflies' and crickets' mouths are quite different. They begin to realize that insects' mouths vary widely according to the particular food each eats.

Finally, in Activity 13, students take a broad look at how insects are both helpful and harmful to humans. Students cooperatively research a particular insect with their team members. Then they synthesize and present their findings as a skit, and watch and learn from the skits of their classmates.

Materials List

Qty		Description
17	c	aluminum foil, 30 cm x 30 cm
33	c	balls, foam, large
66	c	balls, foam, medium
100	c	balls, foam, small
2		butterfly feeders
2		caps for vials, with hole
2	c	cotton rolls
2		vials, plastic
1		butterfly tower
1		cards, Food Web
9	c	cellophane, metallic, 30 cm x 50 cm
2		containers, large
1		dish, plastic
8		funnels
2	c	glitter, 2 oz
2	c	glue, 4 oz
1		Insects Chart
1		Insects Guide
8		lenses, multifaceted
2		lids for containers
32		lids for tumblers, with hole
8		magnifier boxes
32		magnifiers
4	c	oatmeal, 1 oz
8	c	paper, construction, black
8	c	paper, tissue, 10 cm x 10 cm
9	c	pipe cleaners, p/36
1	c	sand, white, 1 lb
1		Scientific Key to Insects
1	c	screen, plastic, 15 cm x 15 cm
1	c	soil, 4 qt

Qty		Description
3	c	sugar, packets
2	c	tape, masking
1	c	toothpicks, p/750
16		trays, foam
8		tubes, cardboard, 2 cm x 3 cm
8		tubes, cardboard, 3 cm x 13 cm
32		tumblers
1		teacher's guide
1	c	Living Material Order Card Shipment includes: 10 butterfly larvae (with food) 25 adult crickets (with food) 125 mealworms (with food)

Teacher provided items

–	c	apples or potatoes
–	c	bananas
1		box, small
1		clock or timer
–	c	construction paper
1		knife
–		markers or crayons
–	c	paints
–	c	paper towels
8	c	paper, blank, 11" x 17"
32		rulers, metric
32		scissors
1		spoon, stirring
–		tape, transparent
–	c	water, tap

c = consumable item

Activity 1
Build a Bug

Objectives

Students build a fantasy insect that exhibits all the features of a real insect.

The students

- identify the features of insects
- create their own insects that meet the identified criteria

Schedule

About 40 minutes—Begin Activity 1 a few days prior to the arrival of the living materials.

Vocabulary

abdomen
antenna(e)
bilaterally symmetrical
head
thorax

Materials

For each student

1	Activity Sheet 1
1	ball, foam, large
2	balls, foam, medium

For each team of four

2	crickets
2	lids for tumblers, with hole
1	*marker, black
2	tumblers
2 pairs	*scissors

For the class

8 sht	aluminum foil, 30 cm x 30 cm
1	ball, foam, large
2	balls, foam, medium
9 sht	cellophane, metallic, 30 cm x 50 cm
2 btl	glitter
2 btl	glue
1	Insects Chart
	*paint, bits of felt, construction paper (optional)
7 pkg	pipe cleaners
	*tape, transparent
1 box	toothpicks

*provided by the teacher

Preparation

1. Make a copy of Activity Sheet 1 for each student. Borrow one of the teams' scissors to cut the 30 cm x 30 cm (12 in. x 12 in.) sheets of aluminum foil into nine 10 cm x 10 cm (4 in. x 4 in.) squares and the 30 cm x 50 cm (12 in. x 20 in.) sheets of cellophane into four 15 cm x 25 cm (6 in. x 10 in.) pieces. Each student will need two squares of foil and one piece of cellophane.

2. Prepare a demonstration model that meets the criteria for an insect. (See Figure 1-1 and Teaching Suggestions for more assembly detail.) You will need one large and two medium foam balls, seven pipe cleaners, eight toothpicks, two pieces of aluminum foil—10 cm x 10 cm (4 in. x 4 in.)—for eyes, and one piece of cellophane. Choose a large ball for the insect's abdomen and medium balls for the head and thorax. Cut wings from the cellophane. Tape a toothpick to the end of each wing so you will be able to insert the wing into the model's thorax.

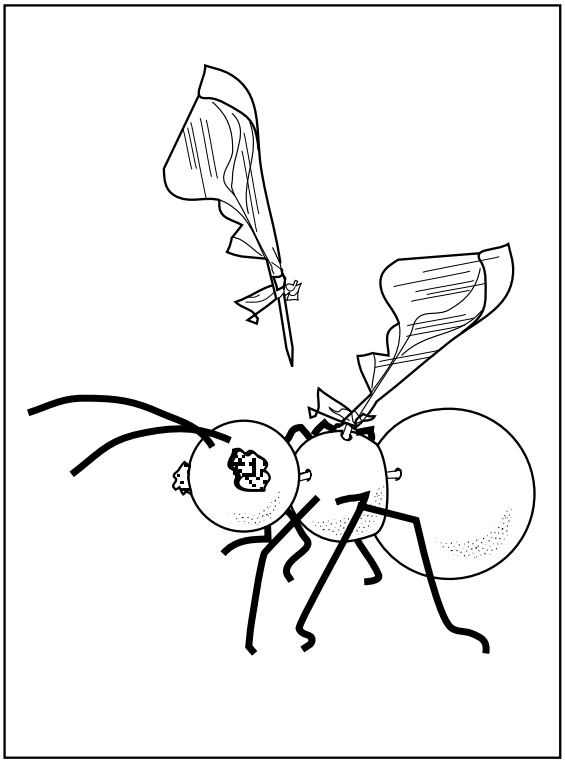


Figure 1-1. An insect model showing all important features.

If you want to make a more realistic insect, carve the thorax and abdomen into shapes similar to those shown in Figure 1-1. However, be aware that letting students carve foam with their scissors will result in a messier classroom. After you practice assembling the insect, dismantle it and set the materials aside for the class demonstration.

3. Hang the Insects Chart where all students can see it as they work. Plan to leave the chart up throughout the module.

4. At a distribution center, place the glue, glitter, tape, and any other materials you want to supply for decorating model insects.

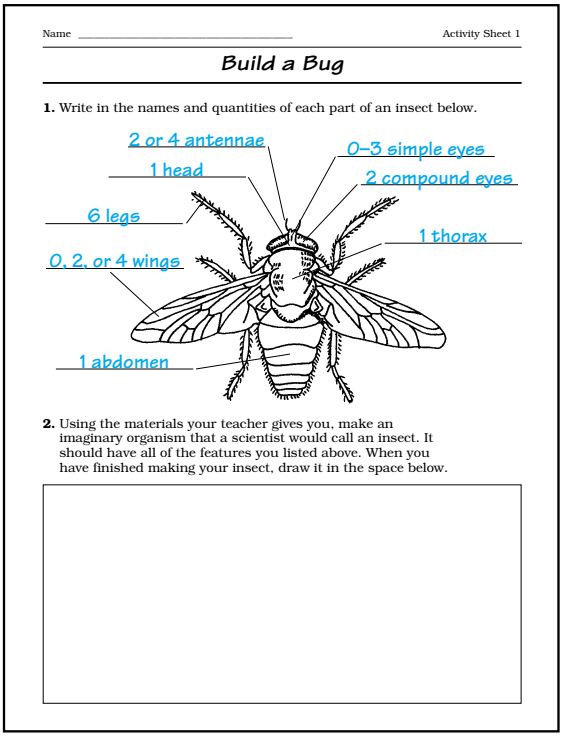
5. Shortly before class, place a cricket in each of two tumblers with lids for each team of four. Leave the remaining crickets in the larger container.

Background Information

Insects are defined as animals without backbones that have three body parts (*head, thorax,* and *abdomen*), and six legs attached to the thorax. Most adult insects have two or four wings attached to the thorax, although some have no wings at all.

Insects have two or four *antennae,* two compound eyes, and two or three simple eyes on their heads. Simple eyes can detect only dark and light. Compound eyes are composed of thousands of separate facets and provide insects with a very unique way of seeing the world. Because the compound eyes are usually large and protruding, insects can see in many directions at once.

Antennae are sensory organs that differ greatly from insect to insect. Besides being used as "feelers," many antennae serve other sensory functions, such as tasting, hearing, and smelling.



Name _____ Activity Sheet 1

Build a Bug

1. Write in the names and quantities of each part of an insect below.

2 or 4 antennae
1 head
6 legs
0, 2, or 4 wings
1 abdomen
0–3 simple eyes
2 compound eyes
1 thorax

2. Using the materials your teacher gives you, make an imaginary organism that a scientist would call an insect. It should have all of the features you listed above. When you have finished making your insect, draw it in the space below.

Teaching Suggestions

Additional Information

Distribute a copy of Activity Sheet 1 to each student and ask, **Does anyone know what an insect is? Are flies insects? How about spiders? Are centipedes insects? How about grasshoppers?**

1

Students will come up with many definitions. Some students may know that a spider is not an insect. Many may think that centipedes are. Accept all answers at this point.

Challenge students to consider their answers as you build an insect and they note its features on their activity sheets. Then begin the demonstration by attaching the foam balls with toothpicks.

2

A large ball should represent the abdomen, or last part, since it is typically the longest part of an insect.

Ask, **How many body parts did I give the insect?**

Students should be able to see the three distinct balls, or body parts.

Explain that all insects have three body parts, although they are not always as easy to see as this.

Unlike mammals and birds, whose heads are usually smaller than their bodies, insects' heads are often quite large in comparison with the rest of their bodies, so using the same size ball for the head and the thorax is realistic.

Write *abdomen*, *head*, and *thorax* on the board. Tell the students that these are the names of the three body parts of insects. Have the students touch their own heads and abdomens. Explain that insects also have a middle body part with an unfamiliar name—*thorax.*

Have students touch their thoraxes—their chests.

Insert six pipe cleaners for legs into the thorax of your model. Ask, **How many legs did I give our insect? To which body part did I attach them?**

3

Explain that all adult insects have six legs, and that the legs are always attached to the thorax.

Ask, **Why did I put three legs on one side of the thorax and three on the other side?**

Students may say that they've never seen an insect with more legs on one side of its body than the other.

Write *bilaterally symmetrical* on the board. Explain to students that insects are bilaterally symmetrical, that is, each longitudinal half is identical to the other.

Point out that *bilateral* means "two sides" and *symmetry* means "equal."

Crumple two pieces of aluminum foil into balls. Use pieces of toothpick to attach them to the sides of the head. Ask the students, **What is different about these eyes and our eyes?**

Students may begin by responding that the eyes are made of aluminum foil, but continue asking until they

comment on the size and placement of the eyes. An insect's eyes are larger in proportion to its head than our eyes are. Also, its eyes sit on the side of its head rather than in the front.

Explain that these eyes that sit on either side of the head are called compound eyes.

Tell students that they will see in a later activity why they are called compound eyes.

Tell students that insects have two different kinds of eyes. With a marker, draw three dots on the top of the model's head.

Explain that these other eyes are small and usually located on the top of an insect's head. They are called simple eyes.

Write the words, *antenna* and *antennae*, on the board. Explain that antenna is the scientific name for the insects' feeler. The plural of antenna is antennae. Insert two toothpicks or pieces of pipe cleaner into the head between the eyes. Tell students that sometimes insects have four, but most have two, antennae. Ask, **What do you think insects use their antennae for?**

Students may think that antennae are used only for touching or smelling. Explain that insects use their antennae to feel, taste, smell, and hear. Some antennae even can sense dark and light.

Add metallic cellophane wings, attaching them to the thorax. Ask, **Which body part did I attach the wings to?**

Explain that most adult insects have either two or four wings, always attached to the thorax.

Ask, **Does my insect need anything else?**

Students also may want to give the insect a nose and a mouth. Explain that insects do not have noses, and that because their mouths vary greatly, you will just make a black spot with your marker for this model.

4

Review the answers students have recorded on the diagram on Activity Sheet 1, or draw a similar diagram on the board and label the characteristics as a class. Then ask again, **Are flies insects? How about spiders? Centipedes? Grasshoppers? If not, why not?**

Students should respond correctly that flies and grasshoppers are insects. Spiders and centipedes have more than six legs so they are not insects.

5

Distribute two tumblers with crickets to each team of four. Ask, **How many of the features of an insect can you locate on a cricket?**

Students should have no problem finding a head, six legs, two antennae, and two compound eyes on the crickets. They may have some trouble detecting where the thorax ends and the abdomen begins because it is defined by a line and not by an indentation in the body. Crickets' wings are folded over their abdomens; if the crickets are immature, they will not have wings. Crickets' simple eyes are difficult to see.

Give students time to examine the crickets closely and to ask questions.

Students may note that some crickets have two spikes protruding from their abdomens while others have three. The third, center spike on female crickets is the ovipositor through which she lays eggs.

Challenge students to build an insect that has all the features of an insect as shown on their activity sheets.

6 Remind students that their insect should be a fantasy insect, and not a copy of the one shown on their activity sheets.

Distribute one large and two medium foam balls, two squares of aluminum foil, one piece of cellophane, and eight toothpicks to each student. To each team of four, distribute 28 pipe cleaners of assorted colors, two pairs of scissors, and a marker.

You may have to remind students to share the pipe cleaners fairly.

Tell students that they can attach the three insect parts with pieces of toothpick. Inform them that tape, glue, glitter, and other materials for decoration are available at the distribution center.

Toothpicks and pipe cleaners should be broken or cut to desired lengths.

As students build their insects, check to see that each exhibits the necessary features (see Figure 1-2).

Particularly watch to see that all legs and any wings are attached to the thorax.

Feature	Number of each
body parts	3
legs	6
antennae	2 or 4
compound eyes	2
simple eyes	2 or 3
wings	0, 2, or 4

Figure 1-2. Table of insect features.

Reinforcement

R Have students identify tell-tale features of insects in pictures found in the Insect Guide and on the Insects Chart. Have them look at pictures of spiders, centipedes, and so on, and challenge them to identify the features that differentiate them from insects.

Cleanup

C Display the model insects and the Insects Chart in the classroom for the remainder of the module. Return crickets to the large container. Sprinkle water as needed to keep one corner of the crickets' soil moist. Replace the apple or potato piece as needed. Collect any other remaining materials and return them to the kit.

Science at Home

Similar model insects can be made using fruits, vegetables, or other edible materials. Have students make "insect snacks"—edible model insects—and bring them to school to be admired and eaten the next day.

Connections

Science Challenge

Have students start an "Insectivora Trivia" book in which they keep track of interesting facts about insects throughout the module. For instance, do they know that mother earwigs actually remain with their eggs and care for their larvae after they hatch? Scientists have found that if they scatter an earwig's eggs, she will gather them back!

Science Extension

Insect antennae are fascinating sense organs that may detect touch, air motion, sound waves, scent, taste or even light. What would it be like to be able to taste, smell, hear, and see, as well as feel, with your arms? Have students research insect antennae and prepare a poster showing the many different forms they take and the different functions they perform. Or have them write a story about the world as sensed through imaginary "antennae arms."

Science and Math

Recall that all insects are bilaterally symmetrical. Have students make a longitudinal half of an insect with pattern blocks. Then ask them to trade places with a partner and complete the partner's insect. If students have trouble, stand a rectangular mirror beside the middle of the insect so that students can see how the other side should look.

What would insects look like if they were symmetrical top to bottom, as well as side to side? Have students make a quarter of a bug with pattern blocks. Partners can finish the funny "bug" by mirroring the pattern in both directions.

Science, Technology, and Society

Insects have inhabited Earth for more than 300 million years. Fossils millions of years old of dragonflies, bees, and earwigs are remarkably similar to those of present-day species.

Many ancient insects have been found trapped in amber, the fossilized resin of pine trees. In the science fiction novel *Jurassic Park*, DNA from dinosaurs' blood was extracted from mosquitoes who bit them before being trapped in amber. The amber supposedly kept the dinosaur DNA intact.

While *Jurassic Park* was fictional, scientists have mapped partial DNA sequences from 40-million-year-old insects trapped in amber. Mapping DNA sequences is a long way from cloning complete insects, much less dinosaurs, however. Still, scientists can learn about evolution, disease, and how our own DNA functions by comparing ancient and modern DNA.

With the class, discuss differences between Hollywood science fiction and real scientific research. Do most scientists fit the "mad scientist" stereotype? Do inventions sometimes escape our control, as in Mary Shelley's *Frankenstein*, or is people's fear of technology generated by watching too many horror shows?