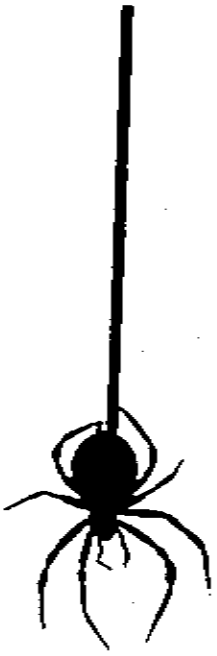


# SPIDERS!

## A GUIDE FOR ELEMENTARY TEACHERS AND STUDENTS

## TO ACCOMPANY THE EXHIBITION SPIDERS!

DR. PETRA SIERWALD
CHERYL WASHER
SUE VOSS

SPIDERS! was organized by the National Museum of Natural History, Smithsonian Institution, and circulated by the Smithsonian Institution Traveling Exhibition Service. The exhibition was made possible through the generous support of MARVEL ENTERTAINMENT GROUP, INC., with additional funding from the Smithsonian Institution Special Exhibition Fund. Education materials were funded by the Smithsonian Institution Women's Committee.

Learning is a creative activity, and an activity which children, who seem to be born observing and questioning the world around them, start with hardly any encouragement. This interest in the natural world can supported by having as accurate an answer as possible. We strongly believe that students of all ages can absorb facts and draw creatively from them. We have therefore included a great deal of scientific information about spiders and some open ended questions so teachers develop their own expertise as a platform for guiding their students to observe, reflect and learn.

Specific information about caring for live spiders, studying preserved specimens, and using microscope slides can be found in the last section of this guide (pp. 68). We encourage you to try them. We have encountered many children, even four and five year olds, who are fascinated by spiders and want to learn more about them.



**ACKNOWLEDGEMENTS**

Special thanks are offered to the exhibition curators, Dr. Jonathan Coddington and Dr. Petra Sierwald, and to the exhibition organizers, Marjory Stoller and Cissy Anklam. The booklet was designed by Mary P. Wiedeman, and it was edited by Nancy Eickel. The authors also wish to thank Mary Dillon Bird, Mary Cahill, Robin Faitoute, Jean Fang, Cynthia Haley, Betsy Hennings, Elizabeth Kennedy Gische, Elizabeth Patton, Virginia Power, Chris Reinecke, Andrea Stevens, Linda Stevens, and Jennifer Thissen.

This kit was adapted from Amazing Spiders!, written by Dr. Petra Sierwald and Caroline Maier for the College of Education, University of Delaware. The sections "Along Came a Spider" (p. 1), "Hairy, Scary, Eeek!" (p. 59), "Defensive Living" (p. 30), and the Bibliography and Teacher Resources (p. 95) were adapted from *Using Live Insects in Elementary Classrooms for Early Lessons in Life* (Tucson: University of Arizona, 1993) and appear courtesy of the Center for Insect Science Education Outreach. Mathematics problems in "The Eights Have It" (p. 28) appear courtesy of Rob Baeur, Arlington County School System, Virginia.

A final note: In this text a spider is referred to by the pronouns "she" and "her" as most spiders we encounter are females.

# *Spiders!*
# A Guide for Elementary Teachers and Students to Accompany the Exhibition *Spiders!*, National Museum of Natural History, Smithsonian Institution
# Grades Prekindergarten – 4

## Correlation to Learning Standards

**Lesson 1: Introduction to Spiders: Along Came a Spider!**

Common Core Standards: English Language Arts, Speaking and Listening Standards K-5; Reading Standards for Informational Text K-5
Next Generation Science Standards: K-LS1-1, 2-LS4-1, 4-LS1-1
Illinois Early Learning and Development Standards: 12.A.ECa, 12.B.ECb

**Lesson 2: Spiders and Other Arthropods: Relatively Speaking: Not Just Another Bug!**

Common Core Standards: English Language Arts, Speaking and Listening Standards K-5; Reading Standards for Informational Text K-5
Next Generation Science Standards: K-LS1-1, 2-LS4-1, 4-LS1-1
Illinois Early Learning and Development Standards: 12.A.ECa, 12.B.ECb

**Lesson 3: Spider Senses: Spiderize!**

Next Generation Science Standards: 4-LS1-1

**Lesson 4: Spider Mathematics: The Eights Have It**

Mathematics: K.CC, K.OA, 1.OA, 2.OA, 3.OA, 4.OA

**Lesson 5: Spider Habitats: Defensive Living**

Common Core Standards: English Language Arts, Speaking and Listening Standards K-5; Reading Standards for Informational Text K-5
Next Generation Science Standards: K-LS1-1, 2-LS4-1, 4-LS1-1
Illinois Early Learning and Development Standards: 12.A.ECa, 12.B.ECb

# *Spiders!*
# A Guide for Elementary Teachers and Students to Accompany the Exhibition *Spiders!*, National Museum of Natural History, Smithsonian Institution
# Grades Prekindergarten – 4

## Correlation to Learning Standards

**Lesson 6: Spider Webs: The Book of Webster**
Next Generation Science Standards: 4-LS1-1

**Lesson 7: Spider Diversity: Spiders, Spiders Everywhere**
Next Generation Science Standards: 4-LS1-1, 4-LS1-2

**Lesson 8: Spider Development: Growing Up**
Next Generation Science Standards: K-LS1-1, 2-LS4-1, 4-LS1-1
Illinois Early Learning and Development Standards: 12.A.ECa, 12.B.ECb

**Lesson 9: Charlotte's Web**
Common Core Standards: English Language Arts, Speaking and Listening Standards K-5; Reading Standards for Informational Text K-5

**Lesson 10: Hairy, Scary, EEEK!**
Common Core Standards: English Language Arts, Speaking and Listening Standards K-5; Reading Standards for Informational Text K-5

# SPIDERS!

## SCARY? HAIRY? EEEEK!

## HOWEVER YOU SEE THEM, REAL-LIFE SPIDERS MAY SURPRISE YOU

All living things face basic problems—locating food, fending off dangers, finding a mate, producing offspring. Spiders manage these feats in ways quite marvelous and quite un-human. We both face the same fundamental challenge—we all have to make a living.

A greater understanding of spiders is the main theme of the Smithsonian Institution, National Museum of Natural History's exhibition **SPIDERS!**. This guide was produced to help further that aim.

The activities which follow will assist teachers and their students in exploring spiders and their world. The organization of this material loosely follows the script of the exhibition SPIDERS! If teachers want to use the guide in preparation for or as a follow-up to visiting the exhibition, a plan of the exhibition is included in the teacher reference section (p. 61) with a list of suitable activities. We hope that teachers will use the guide once the exhibition has left their area or just because spiders are fascinating.

The guide is divided into two parts: student lessons and teacher reference material. Each lesson contains a number of activities related to a primary theme. The activities do not have to be taught in sequence and, indeed, are designed for a two different levels—students in grades 1–3 and 4–6. Each activity is marked with the suggested grade level. We suggest that teachers use these lessons as supplemental materials and pick and choose among the activities.

The reference material includes information about live and preserved specimens, a glossary with information about spiders, and a teacher resource section with an annotated bibliography. Teachers should review these reference materials in preparation for the student activities. Teachers are, of course, also free to use the reference material in any way they see fit. It is not necessary to cover all the material presented in this kit, but we hope that the material will answer many questions.

Any book mentioned in the Lessons is referenced only by title and author. For a more complete citation, see the Bibliography, p. 102.

# TABLE OF CONTENTS

## LESSONS

# TEACHER REFERENCE

# LESSON 1: INTRODUCTION TO SPIDERS: ALONG CAME A SPIDER!

## PRETEND YOU RE A SPIDER. WHAT WOULD YOU LOOK LIKE? HOW WOULD YOU BE DIFFERENT? DO YOU SEE? WALK? HAVE TEETH?

## SUBJECTS: HEALTH, SCIENCE, LANGUAGE ARTS, FINE ARTS

**OVERALL OBJECTIVE:**
By observing spiders, students will recognize and use proper names for body parts of both humans and spiders, and they will compare and contrast parts of the human body and of spiders.

**TIME OF YEAR:**
Late spring or fall (before frost) if spiders are collected outside or purchased from a scientific supply store. Anytime if preserved specimens or microscope slides are used.

**MATERIALS:**
1. Live spiders and the materials to take care of them (see p. 77), or preserved specimens/slides, or copies of the spider illustration (p. 4)

2. Lenses or a microscope

3. Drawing paper and crayons

4. *The Very Busy Spider* by Eric Carle, and other age-appropriate books (see Bibliography, p. 102)

5. Other materials if you plan to do the Additional Activities (p. 7). Those materials are listed specifically under each activity.

**PREPARATION:**

• **Activity 2:** Review material on spider anatomy in reference section (p. 66); look at live spiders or preserved specimens.

• **Activity 2:** Gather remaining materials and books.

• **Activities 2 & 3:** Gather and set up materials for spider containers several days before the lesson begins, following the section on live spiders in the reference section (p. 68). Obtain live spiders as described in the teacher reference section (p. 74). If many spiders are not available (one for every 2-4 students would be best), one spider on display in a large container will also work. If live spiders are not available, use preserved specimens or microscope slides, which are available from commercial science supply stores. Position the container so students can easily observe the spider without disturbing her (only one to a container as spiders are not social animals). Avoid placing the spiders in direct sunlight, near air vents, or in cold drafts.

• **Activities 2 & 3:** Depending on the level of hand coordination of your students, use hand lenses or a large magnifying glass. If you are using preserved specimens, you can work with a microscope as well (see reference section for preserved specimens and microscope [p. 77)].

• **Activity 3:** Prepare a large spider diagram using the illustration (p. 4). Enlarge the diagram by drawing it freehand or by using an overhead projector and tracing the spider onto paper or a blackboard. You may want to create the drawing prior to beginning Activity 1, but leave the labels off so they can be added with your students.

• **Activities 1, 4, 5, 6:** Record discussions, drawings, and stories on paper. Allow wall or bulletin board space for display.

## ACTIVITY 1: THE HUMAN BODY (GRADES 1-4)

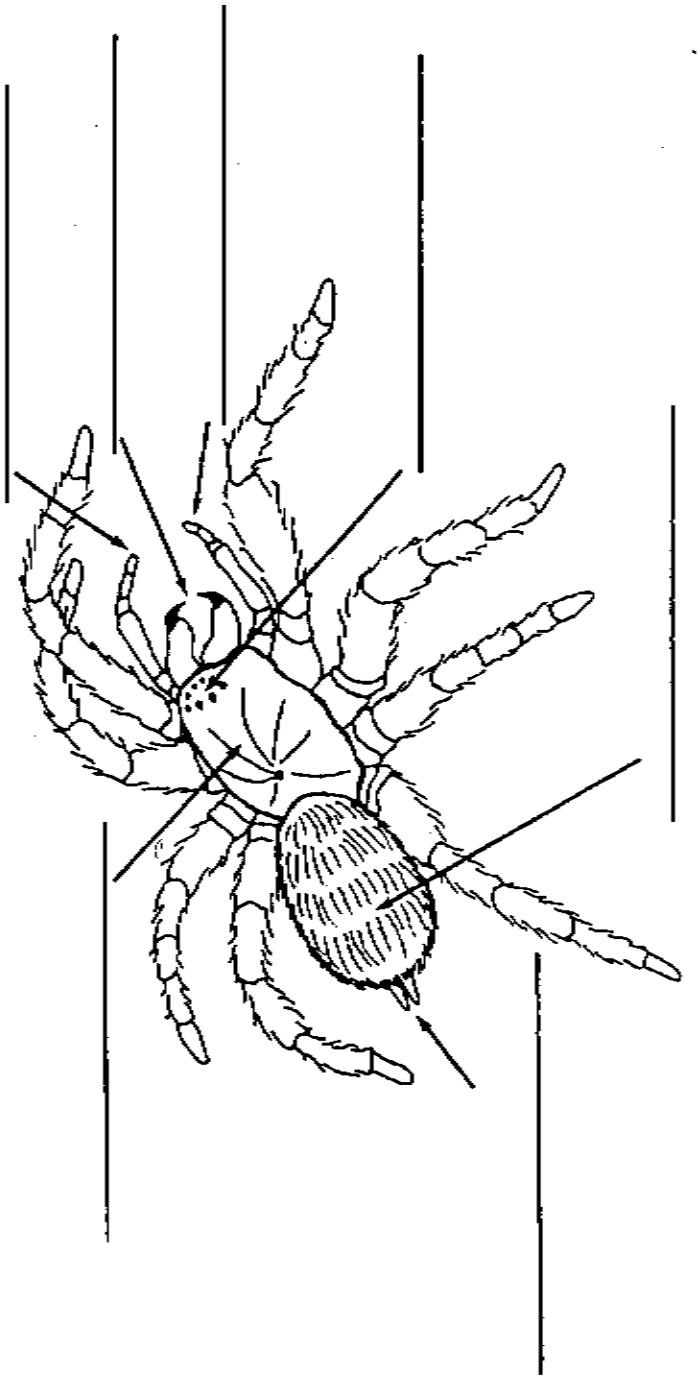
Ask one student to lie down on a piece of paper as large as his/her body. After you trace the outline of the body, ask the students to add the eyes, internal organs, and other features and to name the body arts they know. Label the drawing as the children give their responses. If time permits, play the game "Simon Says," using the directions to touch head, shoulders, chest, neck, elbow, stomach, etc. Observe the students to see if they touch the correct parts.

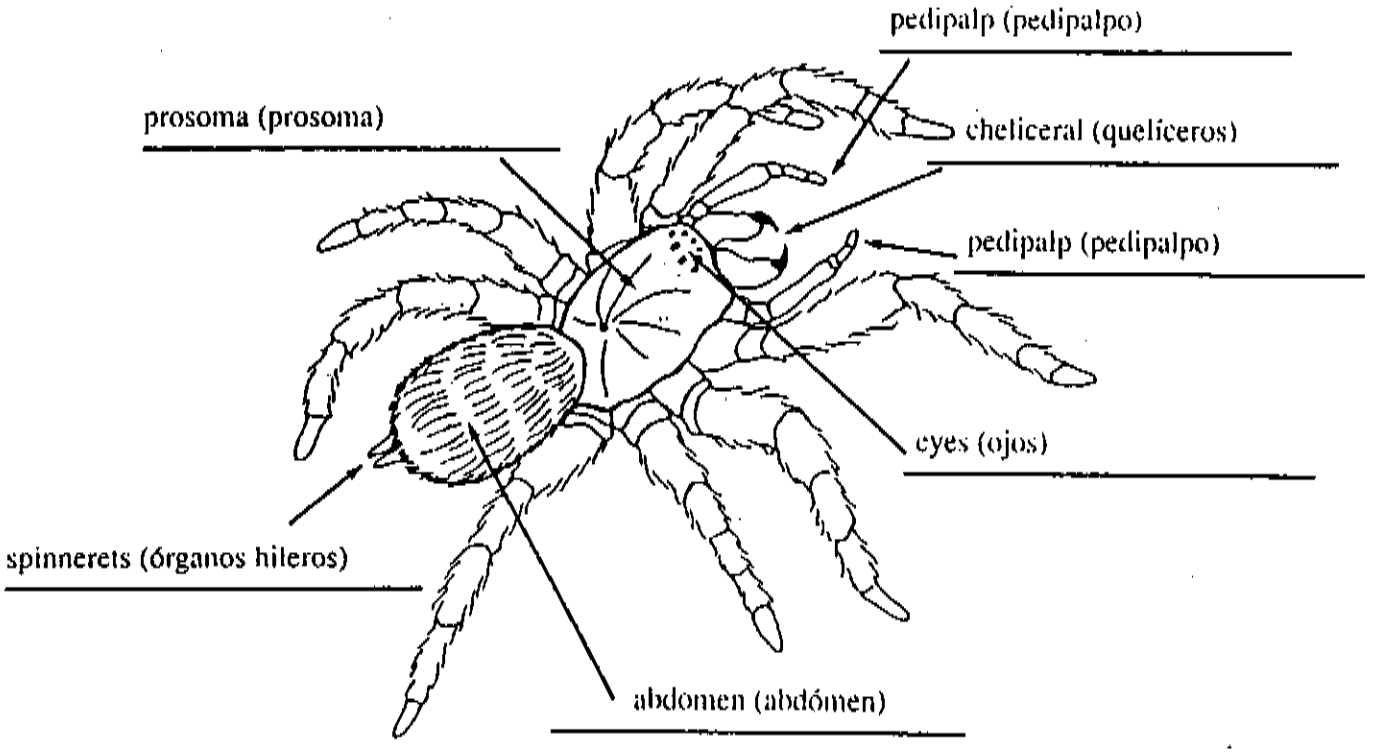
## ACTIVITY 2: THE SPIDER BODY (GRADES 1-4)

Read and discuss *A Very Busy Spider* by Eric Carle. Explain to the students that today they will observe a spider and learn about its body parts. Show them one spider container and explain where she came from (outdoors, resource store). Demonstrate how to observe the spider using the hand lens (start the lens at your eye and then slowly move it towards the spider). Give a small group of students a container with a spider and a lens, or let small groups observe the single container. (Caution the students not to remove the lids). If live spiders are not available, use the preserved specimens or microscope slides. As the students observe the spider, ask questions to help them focus on her: How many legs can you see? Where are they attached? How many body parts can you see? Does a spider have eyes? Does the spider have body sections like a human? If so, how many? Can you find the spinnerets that release the silk made in the silk glands? Ask the students to hypothesize as to the use of the spider body parts: Would it help to have eight legs? What are the advantages to the shape of the spider's body? Following the observation, collect the spiders.

## ACTIVITY 3: NAME THOSE PARTS (GRADES 4-6)

Show the large drawing of the spider to the students (p. 4). Ask them to recall their observations of the spider and help label the drawing. As the students mention the parts, label them both with their words and the anatomically correct name, for example, body and abdomen, head and prosoma, extra legs and pedipalps. Explain: "This is the term spiderologists use. Spiderologists, or arachnologists, are scientists who study spiders." Explain any specialized body part, such as the prosoma and chelicerae (see the glossary, p. 80). Give the spiders to the students for a second observation period. If some of the spiders have died, they can be put into an "observa-scope" or "bugbox" for closer observation (use discretion about which students will handle the dead spiders). Let the extra live spiders, if they are native to your area, go free outside and keep one for class observation.




pedipalp (pedipalpo)
prosoma (prosoma)
cheliceral (queliceros)
pedipalp (pedipalpo)
eyes (ojos)
spinnerets (órganos hileros)
abdomen (abdómen)

## ACTIVITY 4: FROM THE HEAD BONE TO THE PROSOMA (GRADES 1-4)

Study the two large labeled drawings of the child and spider, and compare the human body and the spider body, noting and recording similarities and differences. Discuss the importance of the human body and all of the things we can do. Have the students make suggestions as to what parts of the spider are important and specially designed. Ask them to make dicuss what spiders do with special parts.

## ACTIVITY 5: SIMON SAYS (GRADES 1-4)

Review the large, labeled drawing of the spider with the students. Ask if there are other parts they would like labeled. Then tell the students to pretend they are spiders and play the game "Simon Says," pointing to their bodies but using the names of spider parts.

## ACTIVITY 6: SPIDERS AND US (GRADES 3-6)

Have the students observe the spider. As a class, do a shared writing activity about what the students learned about themselves and spiders. Write the story on paper or on the blackboard, and ask the students to draw spiders and pictures of experiences based on the lesson. Another possibility is to have each student compile a small "book" on spiders, adding pages after each guided activity.

## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Abdomen**—for spiders, the hind body part, containing the intestines, lungs, silk gland and sex organs; for humans, the lower part of the torso, below the ribs, containing the intestines, the liver and the kidneys

**Chelicerae**—the pincer-like mouth parts of spiders, also called jaws; contain the spider's fangs

**Exoskeleton**—a hard protective covering that functions much like a skeleton on the outside of an arthropod's body

**Hypothesis**—a explanation for a question that must be tested using experimentation

**Magnify**—to make something look bigger than it actually is

**Observe**—to look at and pay special attention to what something does, what it looks like, and how it changes

**Pedipalps**—the two "extra" legs of a spider, which appear nearest the jaws; are always shorter than the legs and are used to handle food or for grooming

**Predict**—to guess what you believe will happen

**Prosoma**—the name for the upper body part of the spider to which a spider's legs are attached; also called the cephalothorax (Latin: cephalo=head & thorax=chest)

## ADDITIONAL ACTIVITIES

### BUILD A SPIDER (GRADES 1-4)

If you want the students to label the body parts of a spider themselves, hand out copies of the sheet "Build a Spider."

Have the students cut out all the parts and paste them in place on a sheet of construction paper. They can label the parts according to the sample spider. Encourage them to color the spider. Since some children will want to make a web for their spider, review the section "The Book of WEBsters (p. 35) and check in the reference section as well (p 61).

### BUILD A FUNNEL-WEB SPIDER

BY DR. PETRA SIERWALD

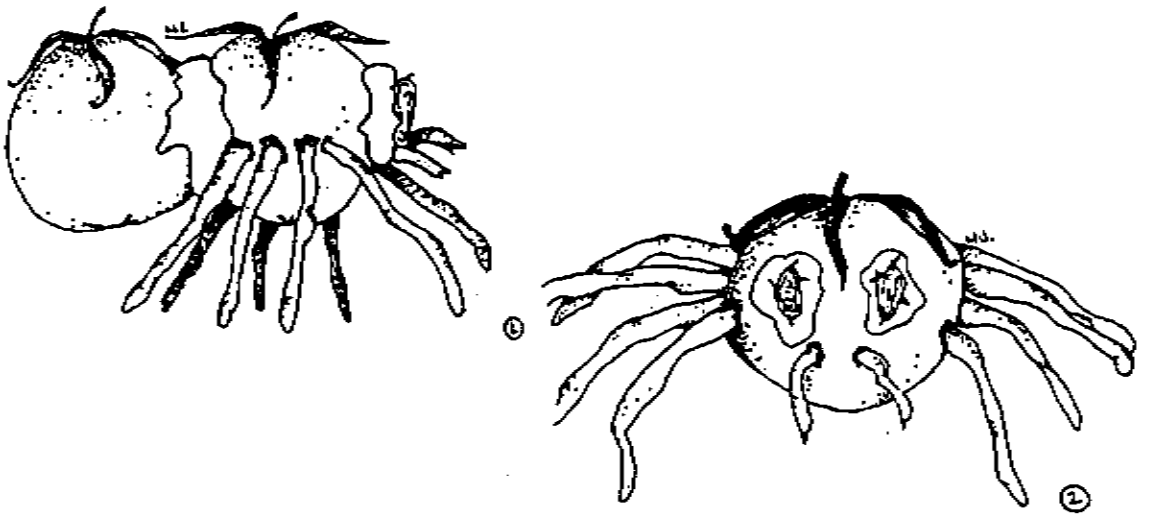
## SPIDER SNACKS (GRADES 1-4)

Here's a delicious way to review the parts of a spider.

Materials needed include cherry tomatoes, chow mein noodles, cream cheese or peanut butter, and raisins. Rinse and dry the tomatoes so that the cream cheese or peanut butter "glue" will adhere better. Set out the materials, then review the parts of a spider. How many body parts does a spider have? How many legs? To which body part are the legs attached? How many eyes? Which parts help a spider catch and eat its food?

Make a spider by sticking two cherry tomatoes together with the "glue" or use a chow mein noodle as a "nail." Add eight chow mein noodle legs to the prosoma, with two shorter noodles serving as pedipalps. Use the "glue" to add raisin eyes to the face. Admire your creation, then eat it.

For a variation at Halloween time, use two black gumdrops for the body parts, black shoe string licorice for the legs and pedipalps, and cinnamon red-hot candies for eyes. Hold the body parts together with chocolate icing. The "spider" can perch on top of a cupcake or sugar cookie.

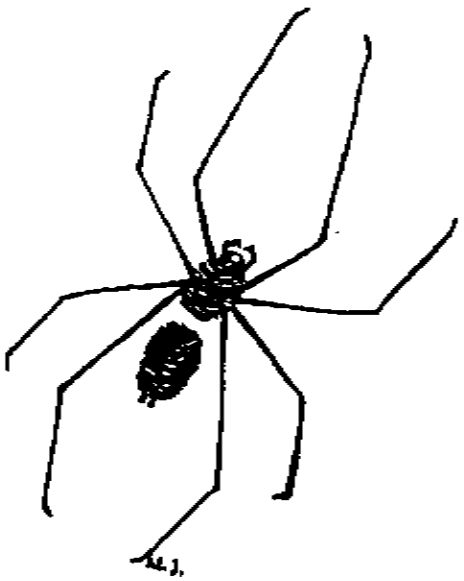


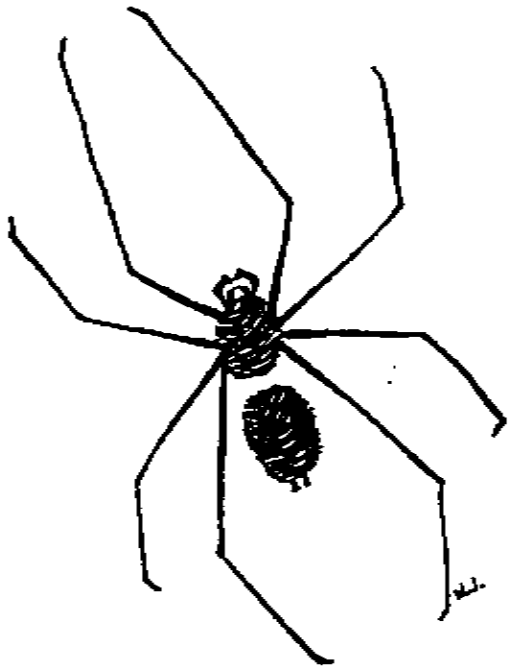
## THUMBPRINT SPIDERS (GRADES 1-4)

This craft activity for reviewing the parts of a spider is especially good for younger children.

Materials include paper, chocolate syrup or washable ink pads, and drawing materials. Review the parts of a spider: How many body parts does a spider have? How many legs? To which body part are the legs attached? How many eyes does a spider have? Which parts help a spider catch and eat its food?

Show the students how to make a thumbprint picture. Press your thumb or fingertip into an ink pad or onto a paper plate holding a small amount of chocolate syrup, and then press it onto the paper, leaving a print. Make two prints next to each other to form the prosoma and abdomen. Once the print is dry, use a pencil or marker to draw on legs, eyes, pedipalps, chelicerae, and spinnerets.

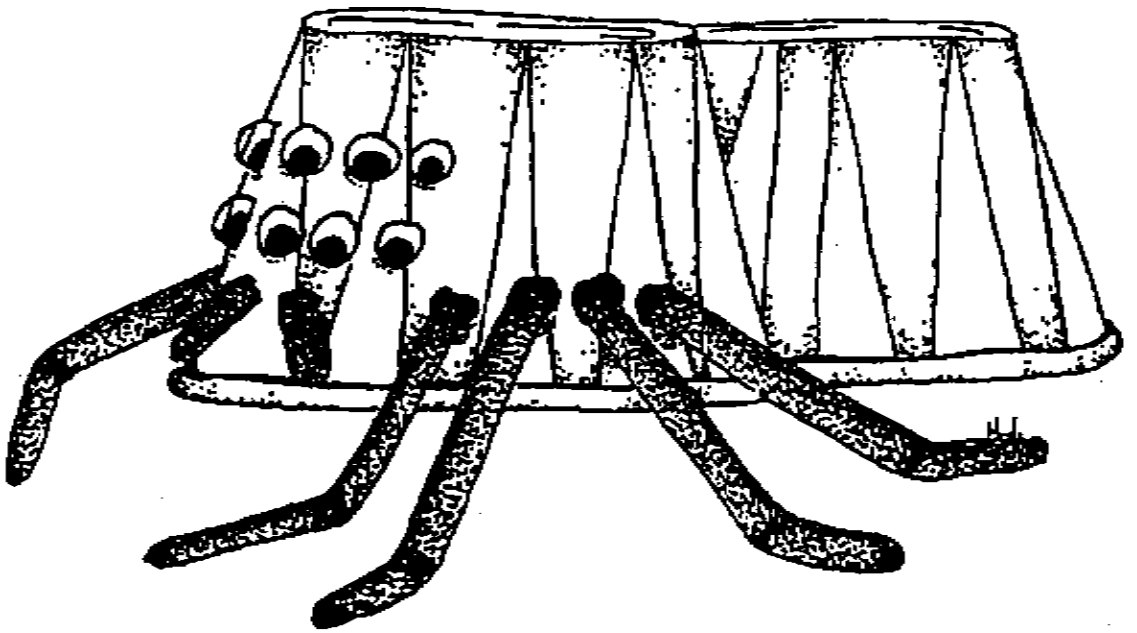




## 3-D SPIDER (GRADES 1-4)

For this non-edible craft activity for reviewing the parts of a spider, you will need paper cupcake cups, souffle cups or egg cartons, pipe cleaners, wiggle eyes, tape, glue, pencil, and scissors. Review the parts of a spider: How many body parts does a spider have? How many legs? To which body part are the legs attached? How many eyes does a spider have? Which parts help a spider catch and eat its food?

Tape together two cups representing the spider's prosoma and abdomen. Glue eight wiggle eyes on the prosoma. Using a pencil, carefully poke eight holes along the bottom edge of the prosoma, four on each side. Cut four pipe cleaners in half for the eight legs. Push the pipe cleaners in the holes to become the spider's legs (Teachers may want to do this before hand with wire cutters). Repeat for the pedipalps.



## SPIDER POKEY (GRADES 1-3)

To dance the Spider Pokey, sing the tune to the Hokey Pokey, except have the "spiders" put in their:

Pedipalps—Arms

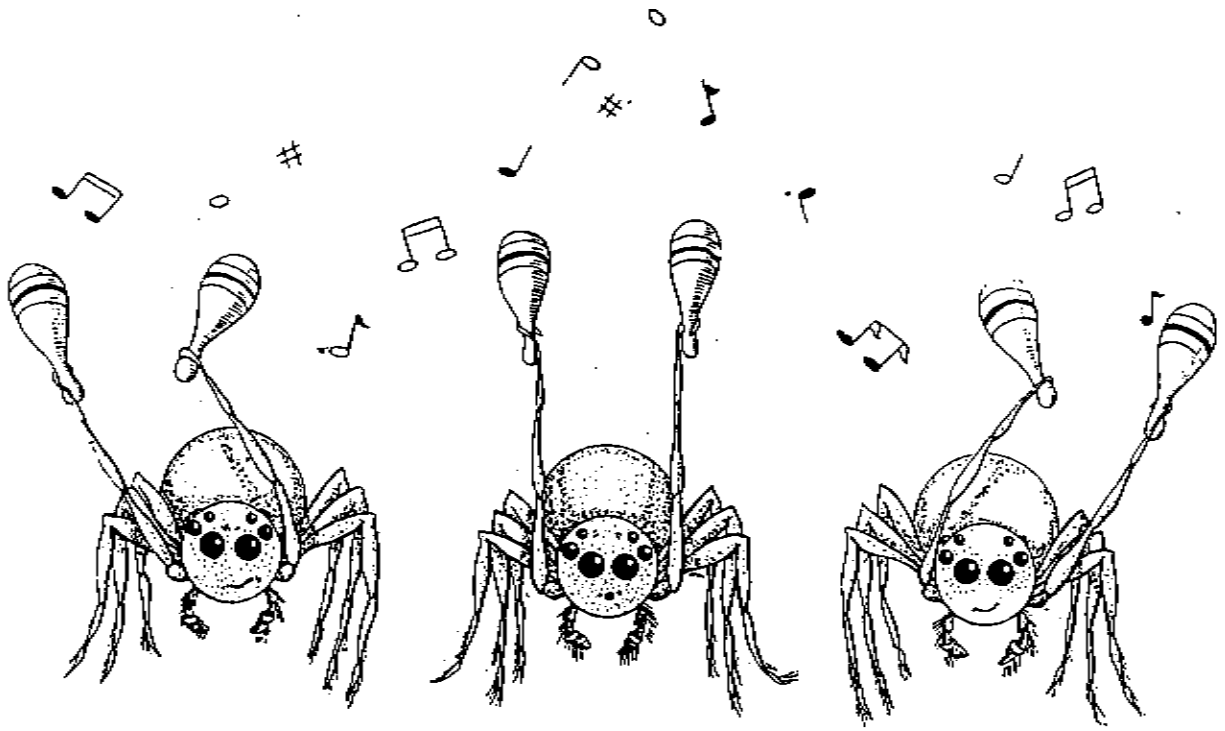
Chelicerae—Teeth

Eight eyes—Eyes

Eight legs—Legs

Prosoma—Head and Chest

Whole Spider Body—Body



# LESSON 2: SPIDERS AND OTHER ARTHROPODS: RELATIVELY SPEAKING: NOT JUST ANOTHER BUG!

Spiders are related to insects, but it's easy to tell them apart. A spider has two main body parts and eight legs. Insects, like flys, ants and beetles, have three main body parts and only six legs.

Instead of backbones, both spiders and insects have exoskeletons (their outer hard covering is an external skeleton that protects them like a medieval knight's armor), and both have segmented bodies. Their jointed legs and appendages put them into a group of animals called arthropods, which means "jointed feet."

Arthropods include insects, crustaceans, isopods, and, of course, arachnids. The spider's closest arthropod cousins are other arachnids: scorpions, ticks and mites, crabs and daddy-longlegs. Only spiders have abdominal spinnerets (organs that spin silk).

## SUBJECTS: SCIENCE, LANGUAGE ARTS

### OVERALL OBJECTIVE:

To introduce arthropods and to point out the distinguishing features of each group of arthropods, especially spiders and insects

### TIME OF YEAR:

Late spring or fall (before the first frost) if spiders are collected outside or are ordered from a scientific supply store; anytime if you use preserved specimens or microscope slides, which are available from commercial science supply stores, or photographs. Crickets are best obtained from scientific supply stores or pet stores that sell reptiles.

### MATERIALS:

1. Live spiders and crickets, with the materials to take care of them, or preserved specimens/slides, or illustrations of spiders and crickets

2. Lenses or a microscope

3. *A Very Quiet Cricket* by Eric Carle, and other books found in the bibliography or other supporting materials, especially for older children

4. Paper and drawing materials

**PREPARATION:**

• **Activity 1:** Gather materials for cricket and spider containers and set them up several days before the lesson begins, following the section on live animals in the teacher reference section (p. 74). Obtain live spiders as described in the teacher reference section (p. 74). For keeping live crickets, some pet stores sell "cricket club" containers. Plastic cups with lids can also be used. Position the containers, avoiding direct sunlight, air vents, or cold drafts, so that students can easily observe the animals.

• **Activity 1:** Depending on the level of hand coordination of your students, use hand lenses or a large magnifying glass. If you are using preserved specimens, you can use a microscope as well (see reference section for preserved specimens and microscope, p. 77)

• **Activity 1:** Reproduce the drawing (p. 14) of a cricket.

• **Activity 2:** Reproduce the chart (p. 16) of the families of Arthropoda.

• **Activity 2:** Reproduce one "Find the Hidden Spider" sheet (p. 21) for each student.

• **Activity 3:** Reproduce the script and signs (pp. 17-20). These signs include the cellar spider, tick, scorpion, daddy-longlegs, ant, and crab. Make signs for "Applause" and the numbers 1 through 6. Gather props, such as a silly hat and a pretend microphone, for the game show.

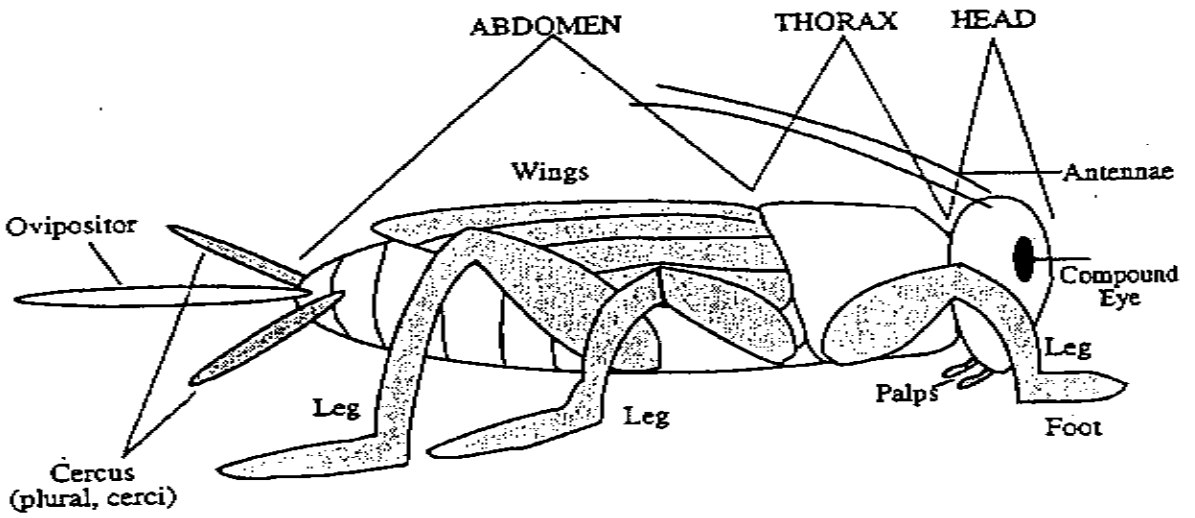
• **Activity 4:** Collect slides or magazine pictures for "What is a Spider?"

• **Activities 1, 2, 4:** Record discussions, drawings, and stories on paper. Allow wall or bulletin board space for display.

## ACTIVITY 1: CRICKET AND SPIDER (GRADES 1-4)

Read and discuss *A Very Quiet Cricket* by Eric Carle. Explain that a cricket is a typical insect. If necessary, review the spider's body parts from Lesson 1, referring to books or to the large, labelled drawing a spider provided in that section. Explain to the students that they will observe a spider and a cricket, and will learn how the two differ. Show them the containers with the live spider and cricket, and explain where they came from (outdoors or store). (If live animals are not available, used preserved specimens or microscope slides. If these are not available, use the drawings of a spider, p. 4 and a cricket, p. 5). After you caution the students not to remove the lids, give them the opportunity to examine the animals with a hand lens. As the students look at the animals, ask them questions to help them focus: How many legs does a cricket have? (6) How many does a spider have? (8) How are the legs attached differently? (among other possibilies, the cricket's legs attach to a different body part than the spider) How does the cricket move? (it jumps.) The spider? (it runs, although some spiders, such as the jumping spider, jump.) How do the body parts differ? (in number, in shape) What is different about their heads? (how they are attached to the other body parts, the number of eyes)

After you collect the animals, show the drawing of the cricket to the students. Ask them to recall their observations of the cricket and help you label the drawing. If possible, hang the cricket drawing next to the spider drawing and point out differences. Explain any specialized body part of the cricket, such as antennae, thorax, etc. Continue to label parts of the cricket using the drawing provided. Have the class discuss how the animals differ and how those differences help each one survive.




## ACTIVITY 2: FIND THE HIDDEN SPIDER (GRADES 4-6)

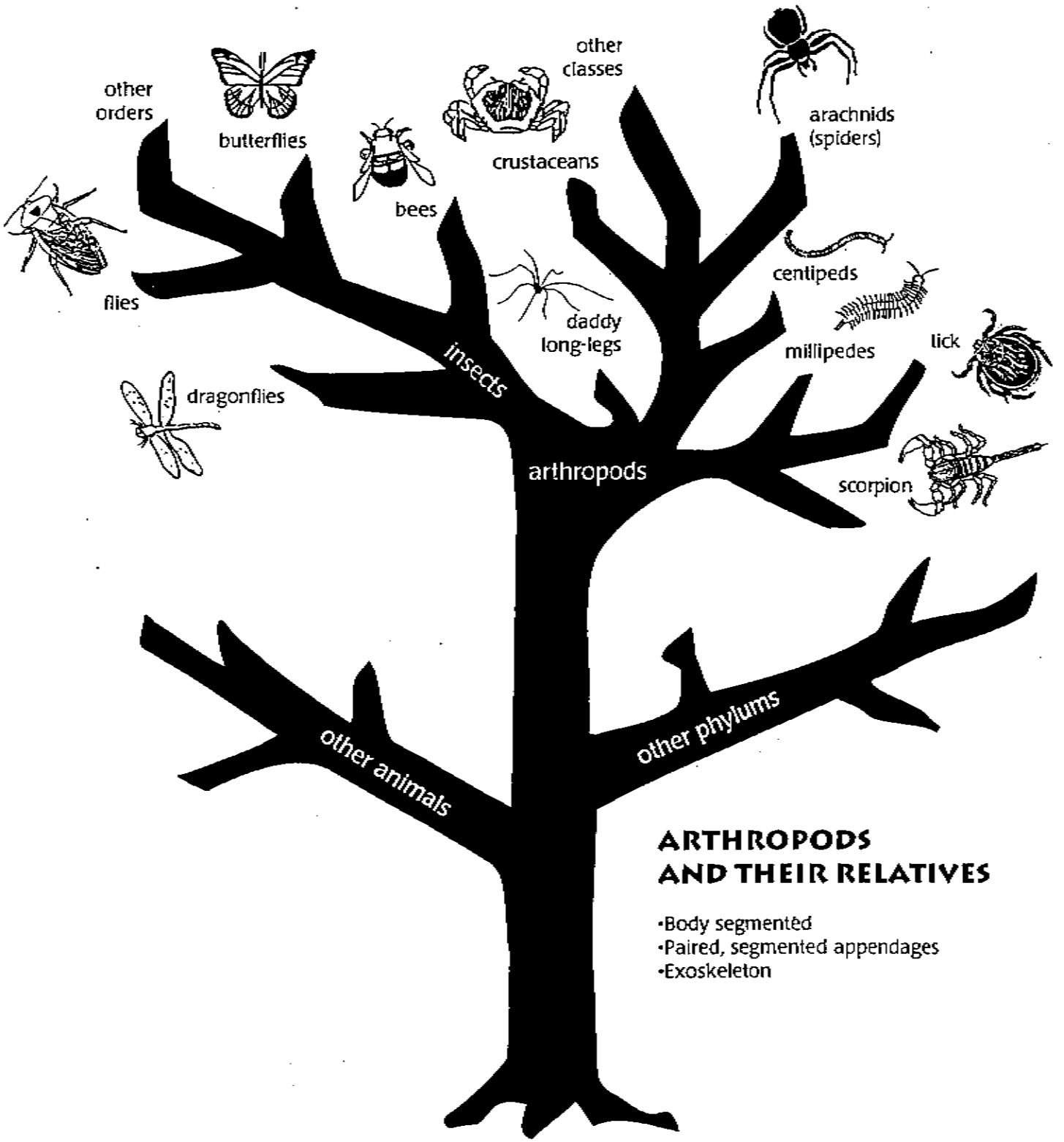
Use clues to find the spiders on the animal sheet (p. 21).

First, review the parts of a spider and a cricket. How many body segments does a spider have? (2) A cricket? (3) How many legs does each have? (spider 8, cricket 6) To which segment are the legs attached? (prosoma, abdomen) To which segment are the eyes attached? (prosoma, head) Which parts help a spider catch and eat its prey? (pedipalps) Where are these parts located? (on the prosoma) Where are the spinnerets located? (abdomen) What do they do? (spin spider silk)

Second, introduce the class to the chart of the Phylum Arthropoda. Point out the various families on the chart (p. 16) and the major characteristics of Arthropods: (exoskeleton, paired appendages, segmented appendages, segmented body). Using the chart and its illustrations as a guide, ask the class to point out differences between each class, such as: Do they all have one pair of antennae? (yes) Does each arthropod have the same number of legs? (no, insects have 6, spiders have 8) Do any arthropods have a tail? (yes, the scorpion and the lobster) Do all arthropods have the same number of body segments? (no, some have 2, 3, many) Do any arthropods have wings? (yes, some insects do, such as flies)

Now the class is ready to look at the animal sheet. Divide the class into pairs. Give each team a pencil and a copy of the sheet "Find the Hidden Spider". Many arthropods, both real and fantasy, are pictured on the sheet. Challenge the teams to find and circle the spiders. They'll need to remember all the characteristics of a spider to select the correct ones.

When the teams are finished, discuss each animal on the sheet. Is it a spider or not? Why or why not? Is it an arthropod? Why or why not?




Animal Kingdom

## ARTHROPODS AND THEIR RELATIVES

- Body segmented
- Paired, segmented appendages
- Exoskeleton

# CHART OF THE PHYLUM ARTHROPODA

## ACTIVITY 3: WILL THE REAL SPIDER PLEASE STAND UP! (GRADES 4-6)

By pretending to hold a game show, you can teach your students about the main characteristics of spiders and other arthropods. With you as the host, six students play the part of game show contestants who are arthropods. The rest of the group acts as the audience, listening to the host's clues and trying to identify which contestants are spiders.

First, have all of the students look at the chart (p. 16) of the classes of arthropods. Discuss the specific characteristics of each class (see Glossary for details, p. 80), such as insects have 6 legs and three body parts, crustaceans have special "legs" to help them move in the water, scorpions have pincers and tails, etc.

Then, give each of the six contestants a "costume" (picture sign) and the contestant number sign that matches the one written on the back of the picture. Two of the contestants, numbers 1 and 6, will have a big picture of a magnifying lens as well. Look on the reverse of each lens picture to see to which contestant it belongs. Choose one student to hold the "applause" sign and lift it when the correct answer is given. Clear a space in front of the room for the "stage." If you really want a big production, put a sign on the left that says "IMPOSTERS" and another sign that says "SPIDERS HERE." Put on a goofy hat to help you become the game show host, have your script nearby, and ham it up.

### *WILL THE REAL SPIDER PLEASE STAND UP?* game show script

Hello and welcome to ***WILL THE REAL SPIDER PLEASE STAND UP,*** the game show for the wild at heart. Today, you'll hunt for one of the most famous animals of all time, the spider. We've assembled six of the most creepy, crawly creatures that ever lived on earth.

Let's meet our contestants. (Raise the "applause" sign. Allow the contestants to parade out on stage while the audience claps.) All of the contestants are arthropods. What do they all have in common?

I will provide the clues. Your challenge is to use those clues to identify which of these six contestants are spiders and which are mere arthropod impostors. Choose carefully. If you guess right, you'll win a free, all-expenses-paid trip to the murky, dusty, filthy corner of the garage, where you'll dine on fly juice with a cellar spider and enjoy a swing on her web.

**Ready? Here are the clues:**

**Clue number 1:** Spiders live primarily on land, just like humans or elephants. Some may go into the water for short periods, but spiders don't have special legs to move in the water.

Does clue number 1 help you find any spider impostors? (Yes! Contestant number 5 is a spider impostor.) Has anyone seen this animal before? Why do you think that it is not a spider? What makes it like a spider? (It's a crab. A crab has 2 pairs of antennae and 5 pairs of leg-like appendages. One set of those appendages, the ones at the back, are designed to help the crab swim. Crabs are arthropods and have hard exoskeletons.) Allright, Crab, go to the "Imposter" corner! (Crab either leaves the stage or goes under the "IMPOSTER" sign.)

**Clue number 2:** Spiders move around on eight well-developed legs. Even with eight legs, they are so well coordinated that they can move gracefully around their web or run quickly across the ground.

Does this clue help you know if any of our contestants is not a spider? (You're right. Contestant number 3 is not a spider.) Why is Contestant number 3 not a spider (It has six legs.) Has anyone seen this animal before? (It is an ant.) What made the ant think it could pass as a spider? (It has an exoskeleton and segmented body parts.) Contestant number 3, you have to leave and stand with the Crab! (Ant leaves the stage or goes under the "IMPOSTER" sign.)

**Clue number 3:** Spiders' bodies have two parts. The first part, called the prosoma, is like our head in that it contains the spider's eyes and mouth. The second body part is called the abdomen. The fluid that becomes the silk for making webs is produced in the spider's abdomen.

Does clue number 3 help you eliminate any non-spiders? (Yes! Contestant number 4!) Why do you think this contestant is not a spider? (It has only one body part) Is anyone familar with this animal? (It's a daddy-longlegs, or a harvestman. Even though it looks like a spider, it isn't.) Why did it think it could be a spider? (Daddy-longlegs have eight legs and no antennae just like a spider.) You don't fool us, Daddy-longlegs, you're not a spider! Stand with the other imposters! (Harvestman leaves the stage or goes to the "IMPOSTER" sign.)

**Clue number 4:** Some animals have special arm-like structures called pedipalps. The structures are like our arms in that they are used to handle food and for cleaning. Spiders have plain pedipalps that end in a stub. Spiders never have large pincers at the end of their pedipalps, although they do have small claws on their stubs.

Look carefully at the contestants. Remember, if the pedipalp ends in a pincer, the animal is not a spider.

Which one do you think has pincers? (Contestant number 2 has pincers at the end of its pedipalps.) Is it an impostor? (Yes!) Can anyone guess what this animal is? (It is a scorpion.) Why did the scorpion think it looked like a spider? (It had a hard exoskeleton, pedipalps and 2 body segments) Well, we know better! Scorpion, go off to the side. (Scorpion leaves the stage or stands under the "IMPOSTER" sign.)

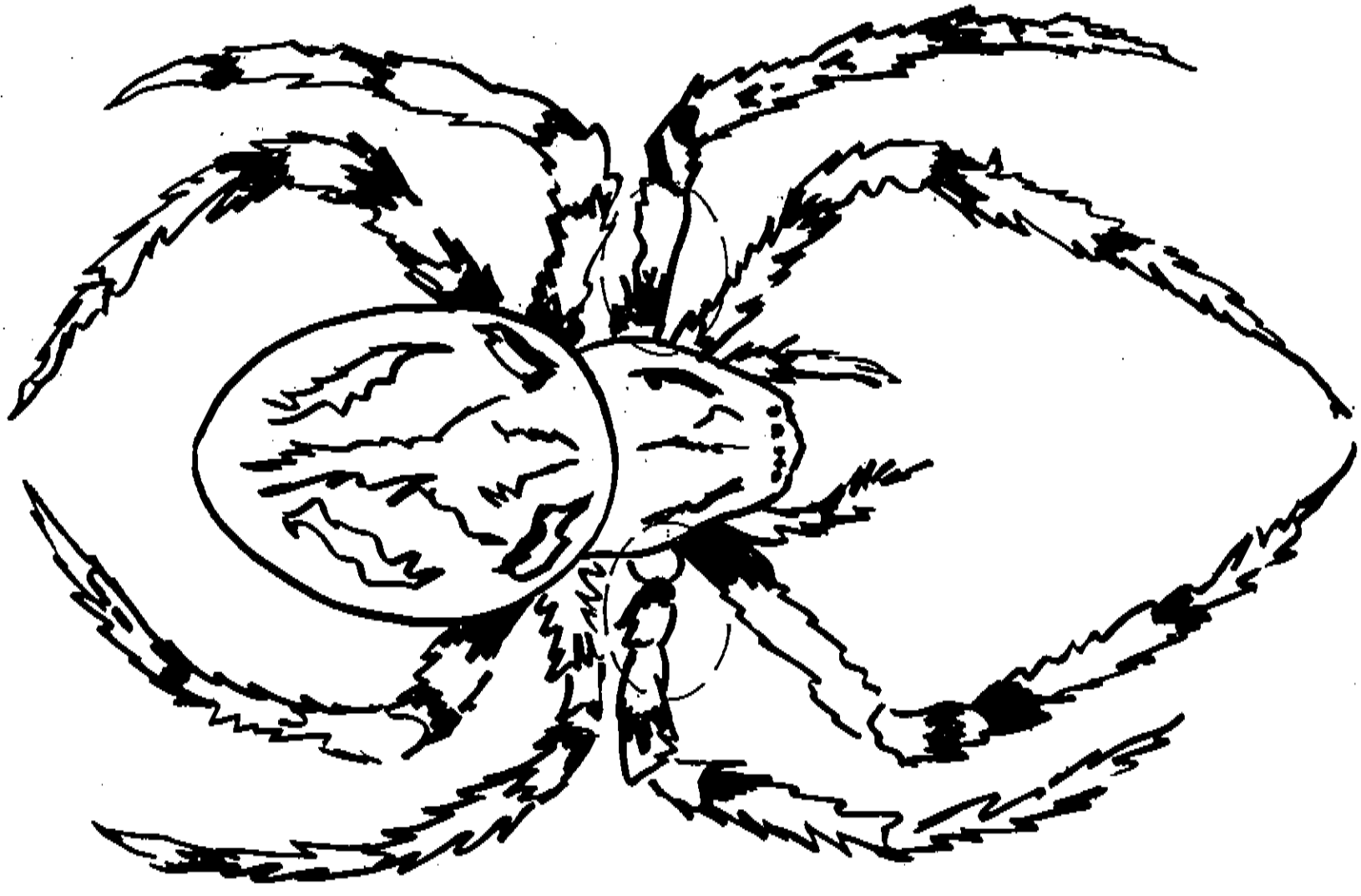
Now we are down to two contestants. One, or maybe both, are spiders. Are you ready for the last clue? While it is a bit technical, clue number 5 is also very important. Spiders have special mouth parts, or jaws, called chelicerae, that look like fangs. Chelicerae can move like a lobster's pincers. Poison comes out of them, and spiders use their chelicerae to kill their prey.

Examine the mouths of our two contestants carefully. Obviously we need a magnifying lens. Contestants, hold up your magnifying lenses.

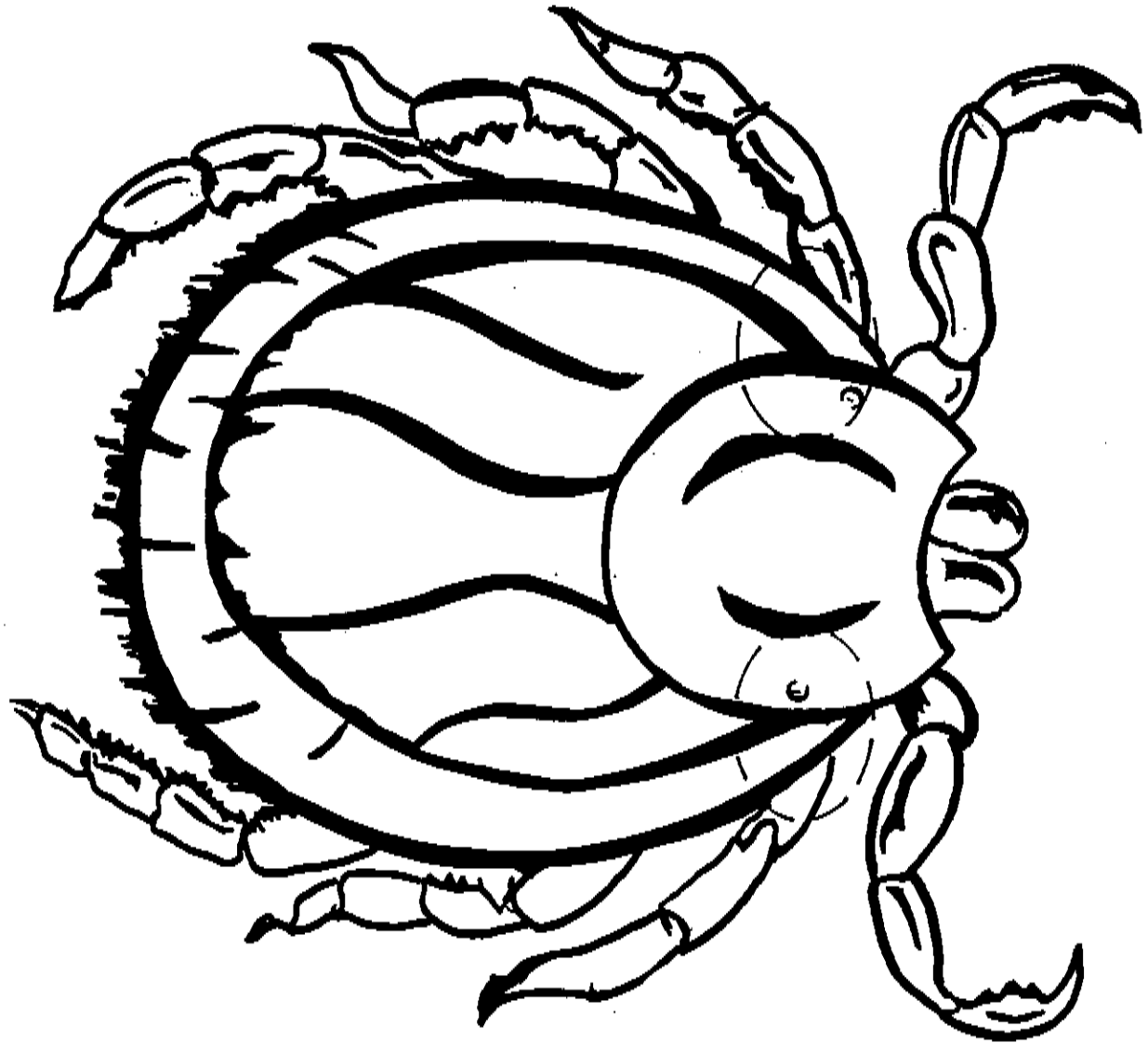
The contestant with the two fang-like chelicerae is a spider. The contestant without is an impostor. Which contestant is not a spider? (You're right! Contestant number 1 does not have chelicerae.) Is anyone familiar with what is Contestant number 1? (It is not a spider at all, but a tick.) A tick is an arthropod, but not a spider. It uses its special mouth to burrow into skin. Tick, you're not a spider! Go stand with the other imposters. (Tick leaves the stage or stands under the "IMPOSTER" sign.)

So, we have only one Contestant left. Is she a spider? (Yes!) Why is she a spider? (She doesn't live in the water, she doesn't have antenae, she has eight legs, a two-part body, pedipalps without pincers and chelicerae.) Contestant number 6 is a beautiful cellar spider. Little cellar spiders like in the corners of basements and garages, especially ones that haven't been cleaned in a long time. Dusty, dirty corners have lots of insects that cellar spiders like to eat. They spend their days eating, repairing their webs to catch insects, and just relaxing in their webs.

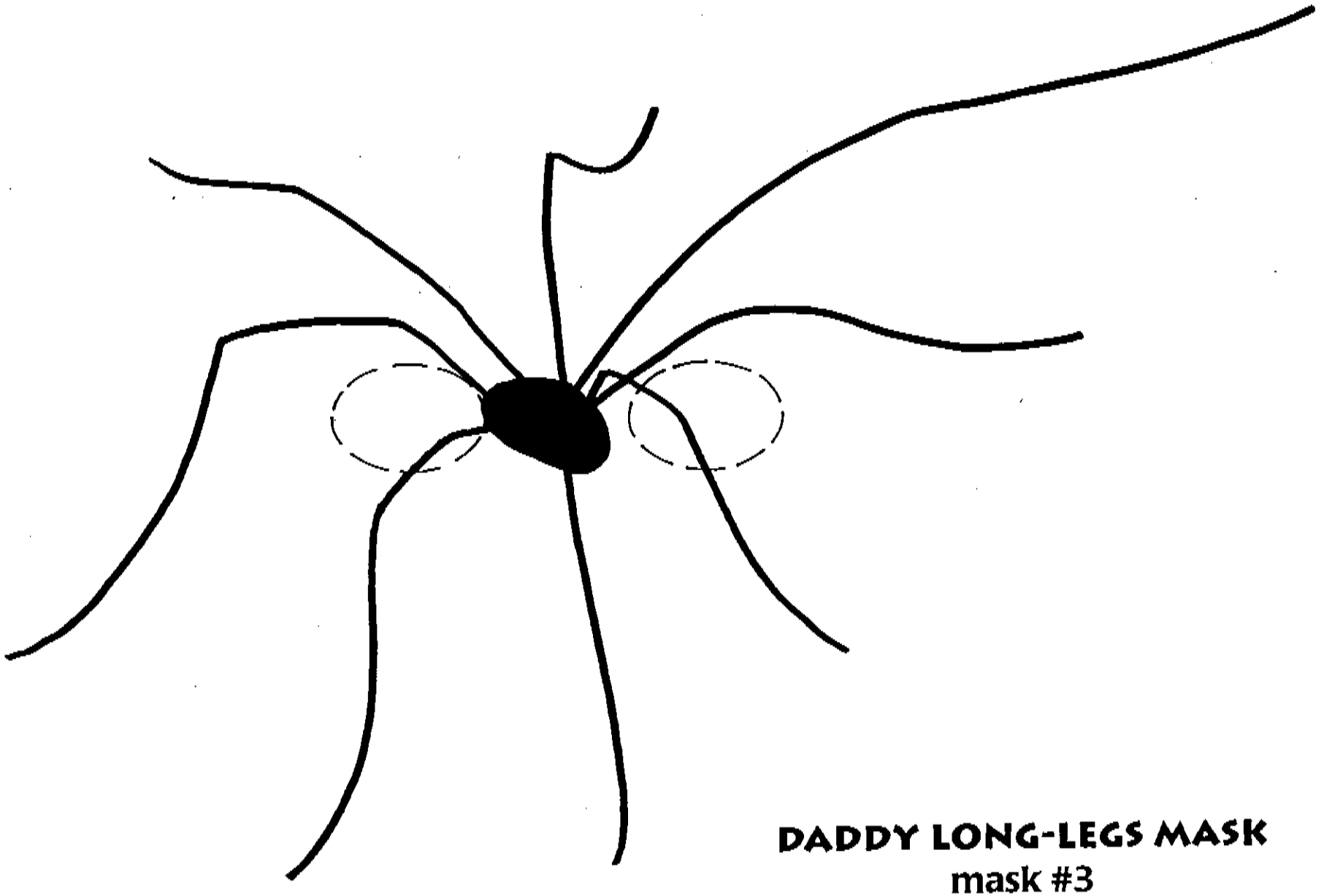
You've won! You all did a great job. See you in the garage!!



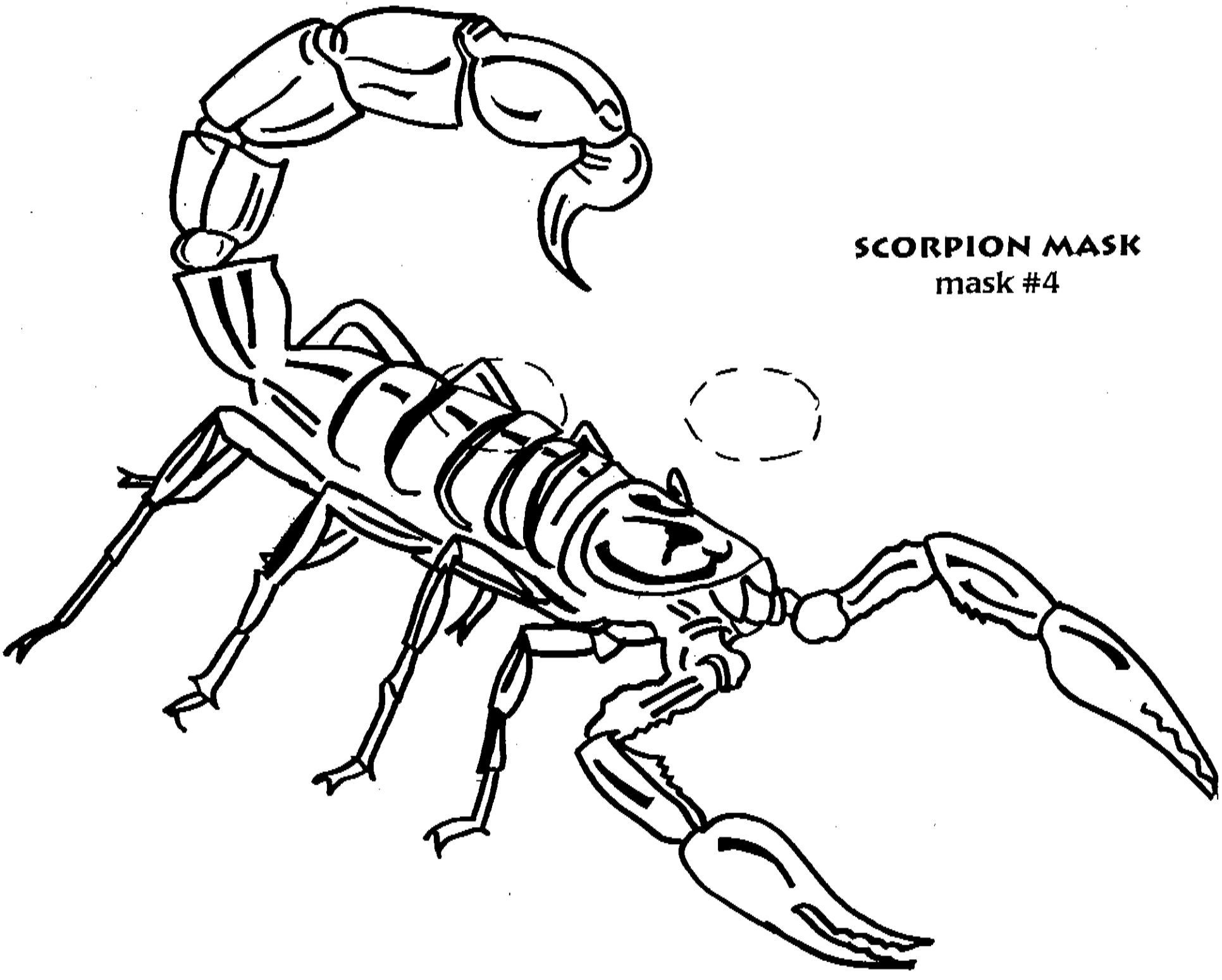
**SPIDER MASK**
mask #1



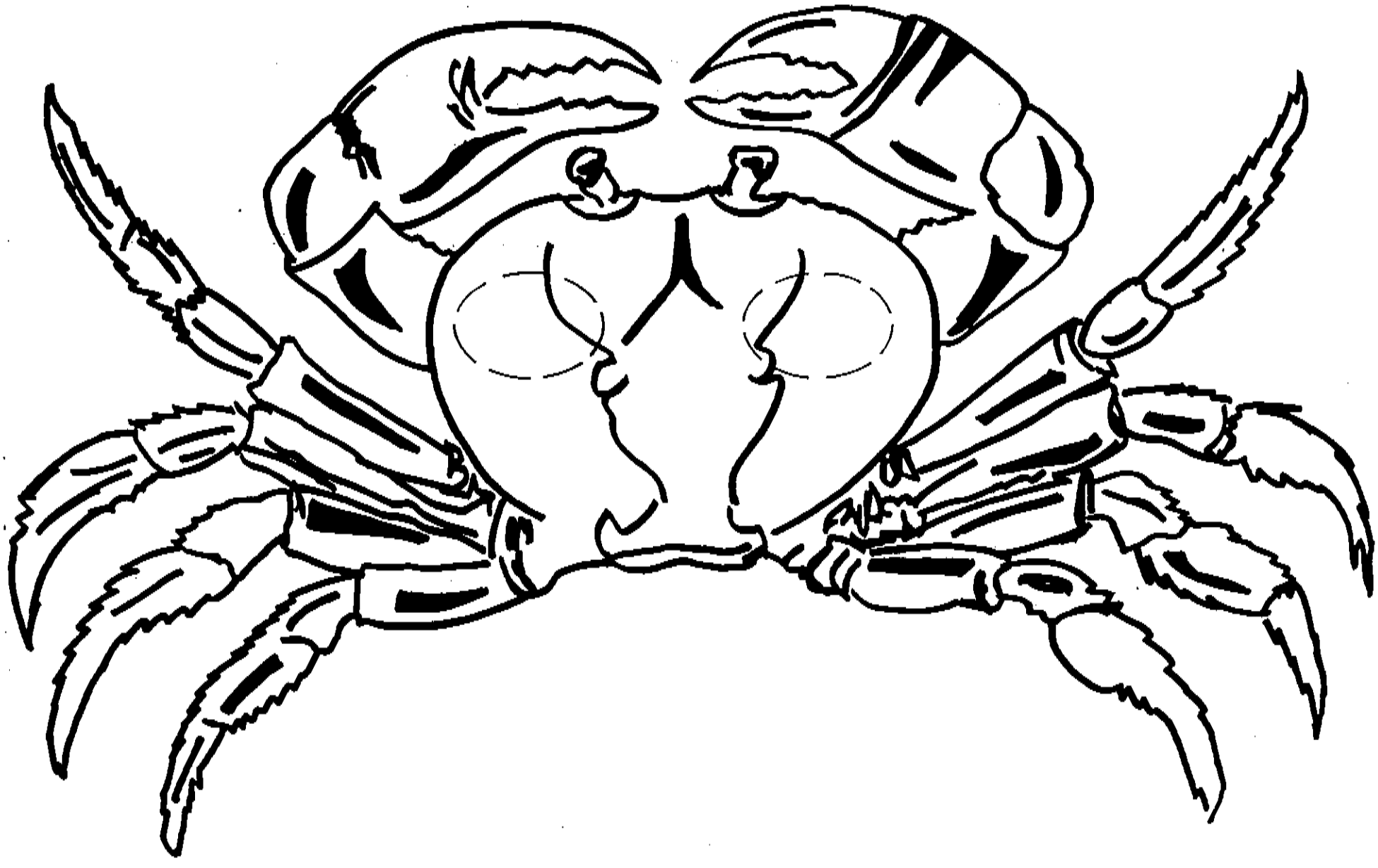
**TICK MASK**
mask #2



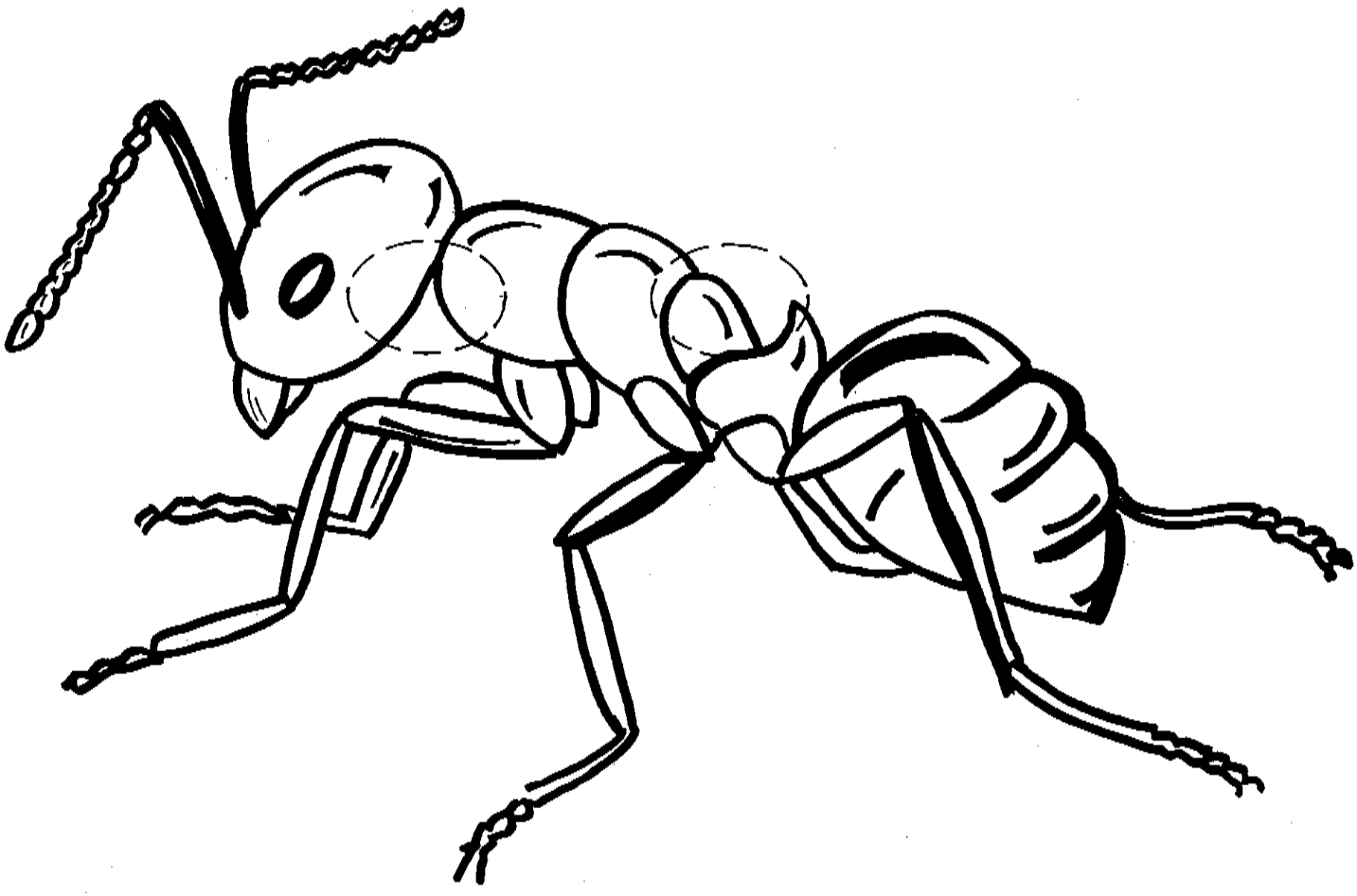
**DADDY LONG-LEGS MASK**
mask #3



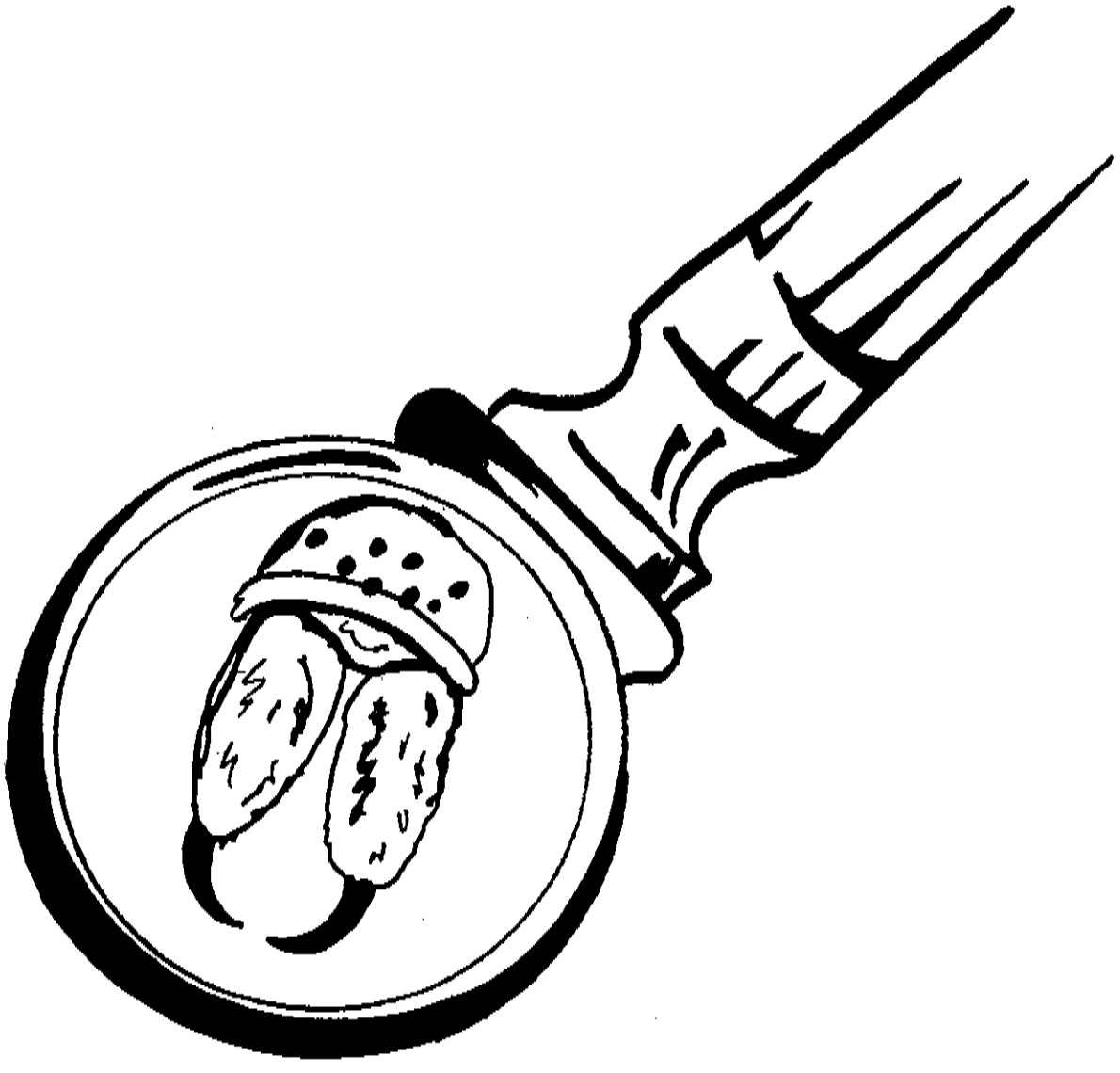
**SCORPION MASK**
mask #4



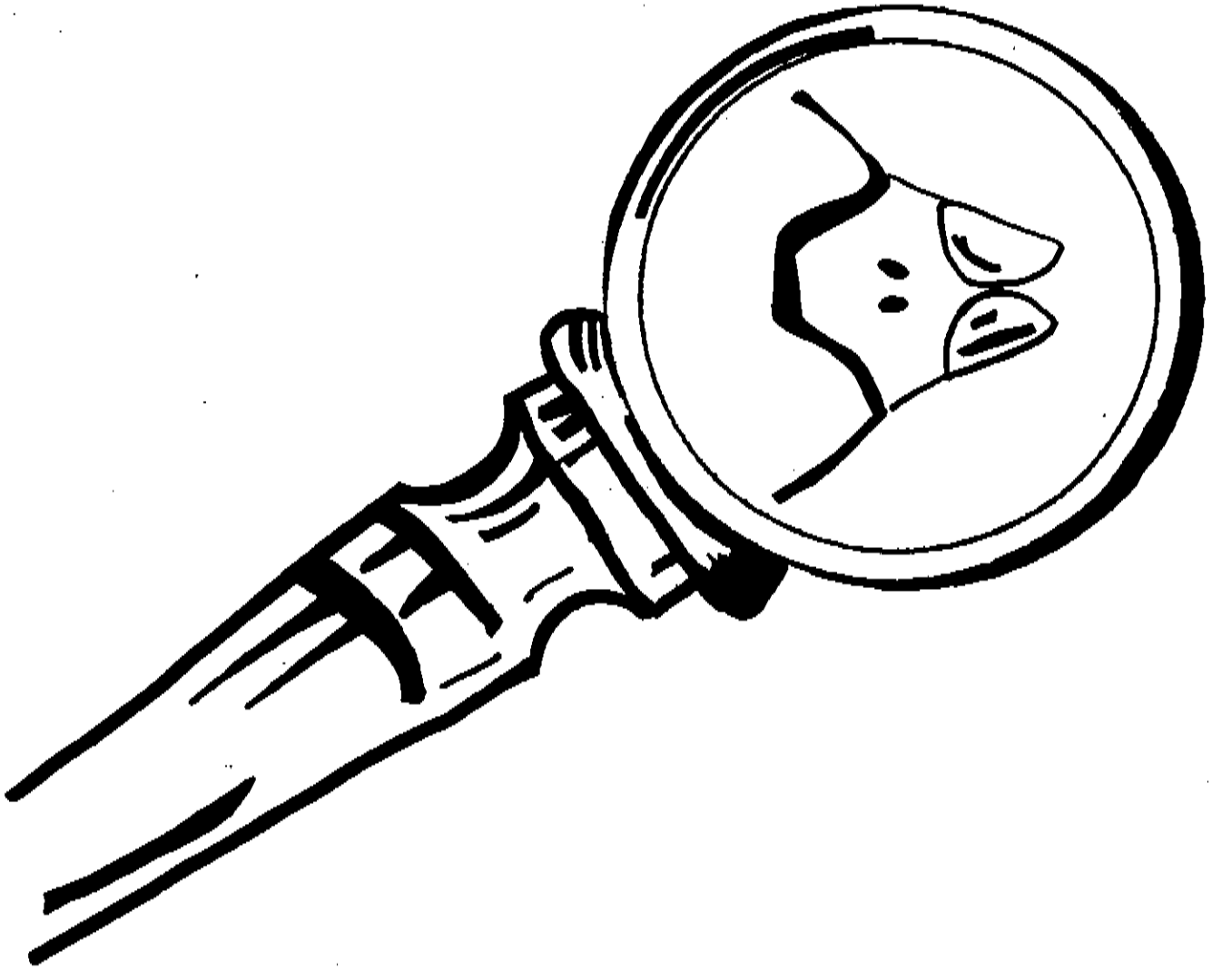
**CRAB MASK**
mask #5



**ANT MASK**
mask #6



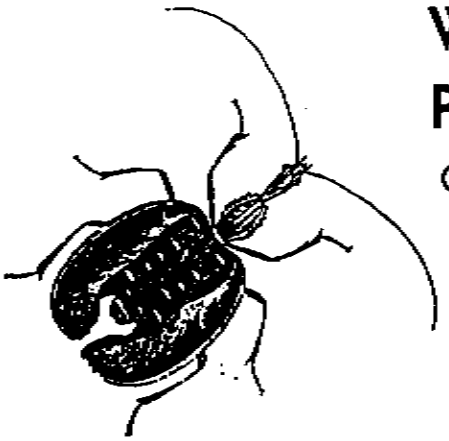
MAGNIFYING GLASS FOR MASK #1



MAGNIFYING GLASS FOR MASK #2

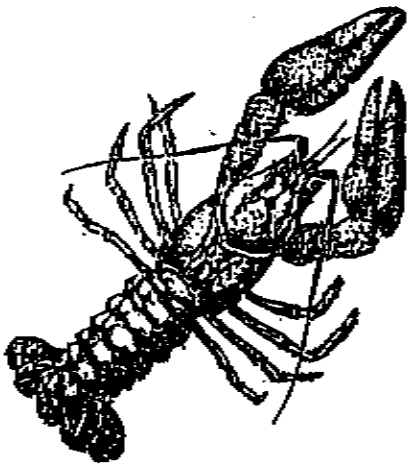
# Will the Real Spider Please Stand Up?

Circle the animals that are real spiders













## ACTIVITY 4: WHAT IS A SPIDER? (GRADES 1-4)

Review with your students the primary characteristics of spiders and insects. Show slides or pictures from magazines of spiders and other animals, including a mammal, a bird, and an insect. Have the students discuss what makes each animal unique. Record these observations and, if possible, display the pictures in the classroom.

## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Abdomen**—for spiders, the hind body part, containing the intestines, lungs, silk gland and sex organs; for humans, the lower part of the torso, below the ribs, containing the intestines, the liver and the kidneys

**Arthropod**—animals that have jointed legs and an exoskeleton (a skeleton on the outside of their bodies); includes insects, spiders, ticks, centipedes, millipedes, crayfish, lobsters, mites, and scorpions

**Antenna (antennae)**—a pair of appendages on the head of an insect used as sensory organs

**Compound eyes**—an insect's special eyes that are made of hundreds of tiny lenses

**Crustaceans**—one large group among arthropods, such as crabs and shrimp

**Daddy-longlegs**—relatives of the spider with body in one piece; conspicuous ones often have very long, thin legs; more than 200 species live in North America; also called harvestman

**Exoskeleton**—a hard, protective covering, serving the purpose of a skeleton, on the outside of an insect's body

**Fangs**—end segments of chelicerae, which connect to the spider's poison glands

**Pincers**—the jointed or articulated claw of certain arthropods, such as crabs or lobsters

**Prey**—an animal that is hunted and eaten by another animal

**Species**—a single kind of plant or animal

**Tick**—an arthropod and spider relative that sucks blood from other animals

# LESSON 3: SPIDER SENSES: SPIDERIZE!

How animals live in the natural world is based on characteristics that have evolved over generations. As a human, you are a very visual, vocal animal with a highly functioning brain, but you have a relatively poor sense of smell and mediocre hearing. A spider has eight eyes, but blurry vision. A spider's "skin" is hard, so she can't rely on touch to feel what's around her. Small slits in her exoskeleton and the hairs that poke through it keep her in touch with her surroundings. Through the use of these slits and hairs, a spider feels and identifies what is happening around her. Differences in the frequency and strength of vibrations give her instant clues about changing conditions in her surroundings.

## SUBJECTS: SCIENCE, HEALTH

**OVERALL OBJECTIVE:**
To learn how spiders sense the outside world with their eight eyes and legs.

**MATERIALS:**
1. Objects to identify for Activity 1: The Five Senses, such as chalk, an eraser, a banana, an orange, a book.

2. A blindfold and string or yarn for Activity 3: *Feeling for Food*

3. Wiggle eyes or Copies of pp. 25-26 with eyes for Activity 3

4. Drawing materials, blackboard and/or bulletin board space

**PREPARATION:**
• **Activity 1:** Record discussions, drawings, and stories on paper. Allow wall or bulletin board space for display.

• **Activities 2 & 3:** Review material on spider anatomy.

## ACTIVITY 1: THE FIVE SENSES (GRADES 1-4)

Ask the students to name their five senses and discuss how each is used. Record and post the answers for classroom discussion. Sample questions could include: Which organs are associated with each sense? Do they see "out of the corner" of their eyes? How do they know when someone is coming up behind them? When their dinner is ready, do they see it or smell it first? Which of their senses is the clearest? Which one do they use the least? Have the class identify certain items, such as chalk, an eraser, a pencil, a piece of fruit, by touch alone. Discuss and record how they knew what the object was.

## ACTIVITY 2: THE EYES HAVE IT (GRADES 3-6)

How many eyes do most spiders have? Eight, of course!

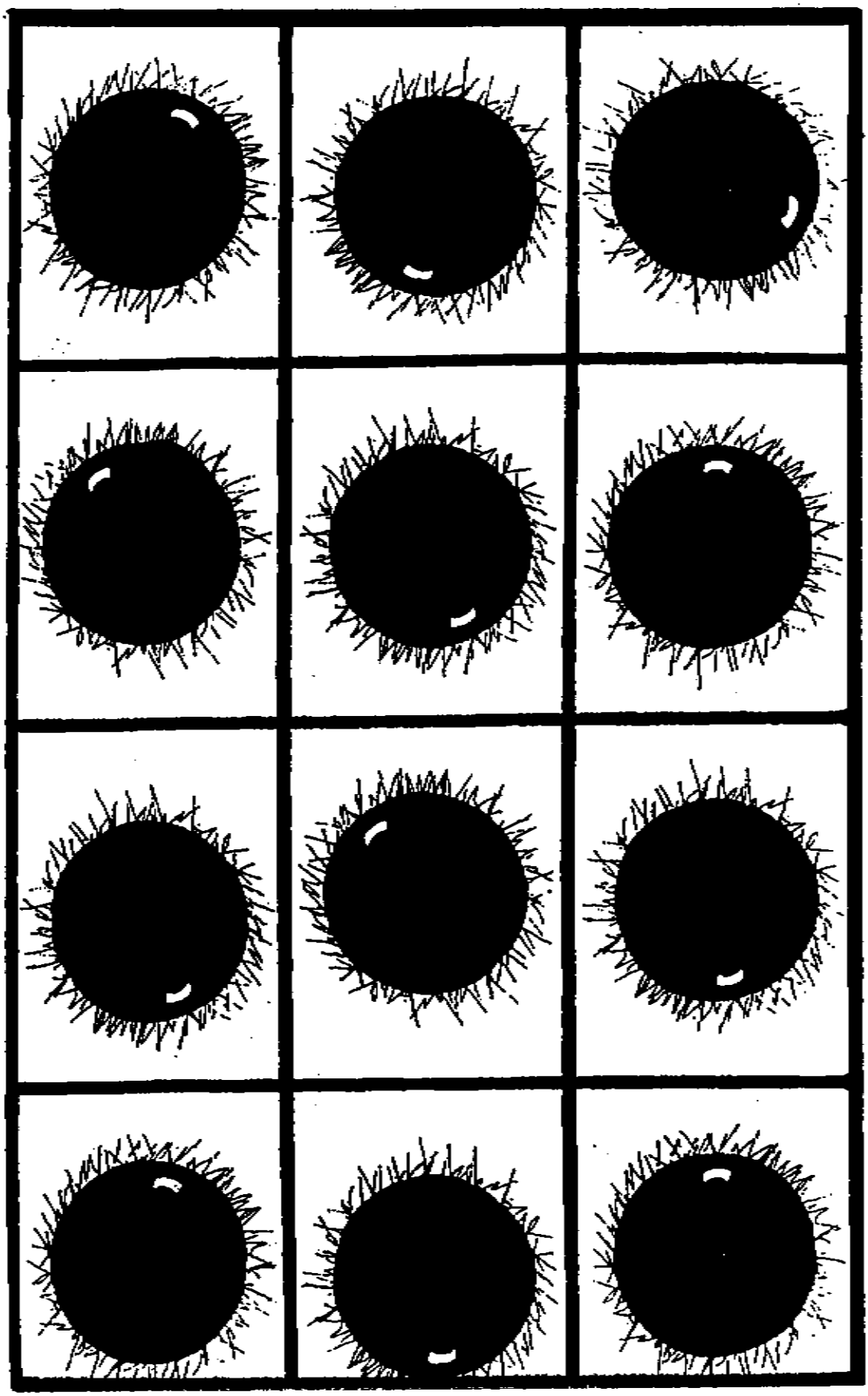
Divide the class into teams of three to four students. One student in each group will be transformed into a spider. Since your human spider already has two eyes, challenge the students to attach six more eyes to turn their teammate into an efficient, well-designed "spider." They can put the six eyes anywhere they want on their "spider's" body. Where will they put the eyes?

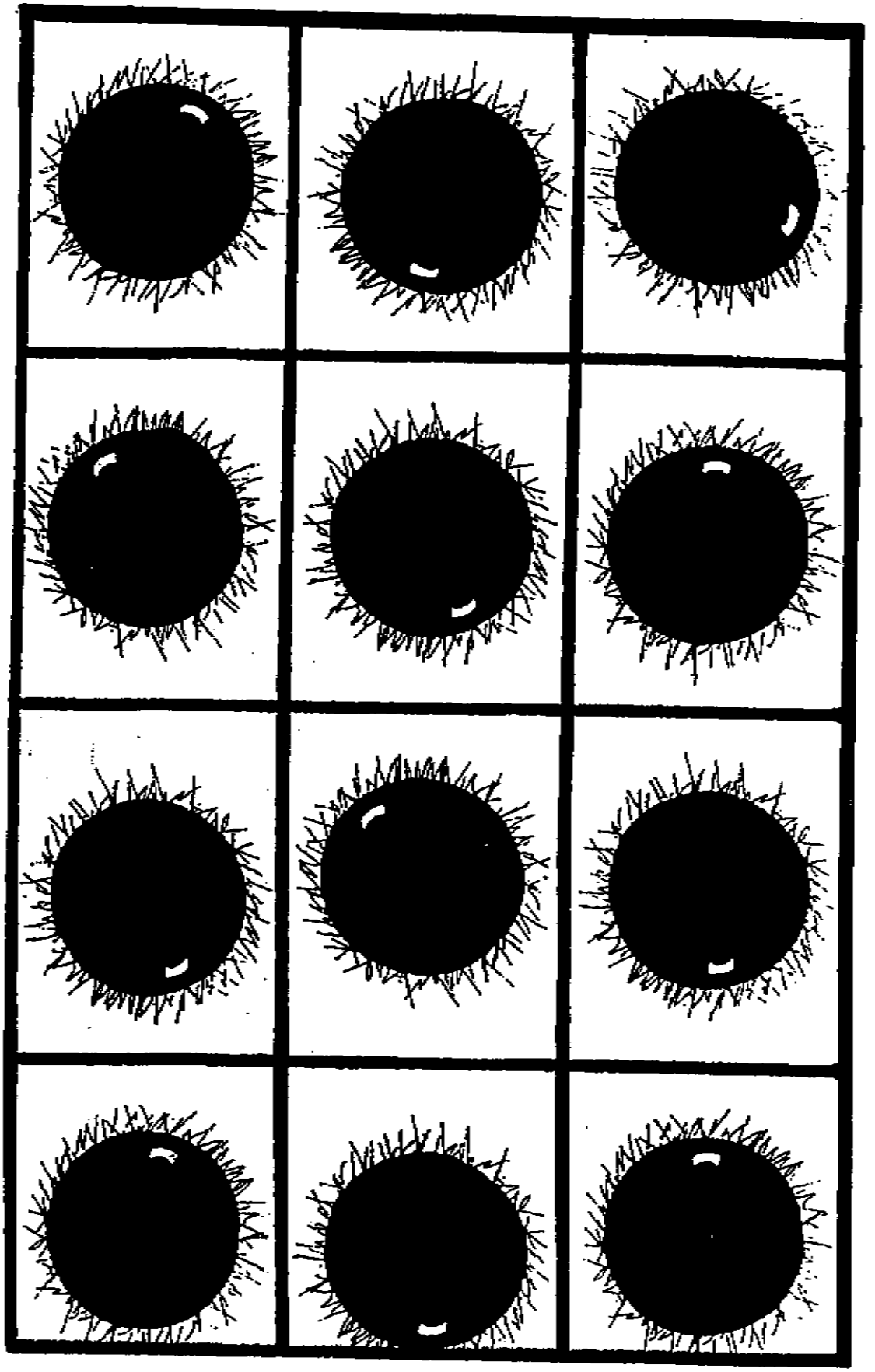
Give each group a roll of tape and six spider eyes. Show the students how to use the tape to secure an eye temporarily onto a person. One by one, allow each team to present their "spider" and explain the placement of the eyes. Record their thoughts on paper or the blackboard.

Explain that a real spider's eight eyes are placed all over its head pointing in many different directions. The eyes are small, cannot focus, and lack color vision, but their placement around the head region enables the spider to see in many directions at once. Without moving, spiders can see in front, behind, above, below, and to either side. Although these eyes scan a large area, they primarily detect movements, much like our own peripheral vision. They are used mostly to avoid predators.

What senses to we use the most to know when something is coming from far away? How do we know when something is coming up behind us? Do we sense like spiders? Do we use our eyes? Our ears?

As usual with biology, there is always an exception. Jumping spiders, which have the best vision of all spiders, have two especially large eyes that both face forward, much like our own two eyes. These large eyes focus on prey and the environment —scientists have even seen jumping spiders watching crickets on TV!





## ACTIVITY 3: FEELING FOR FOOD (GRADES 1-4)

Since spiders' eyes don't work well, how then do they know when an insect is in her web? What other senses does she have to use? Think about spider anatomy. Does a spider have ears? A nose? A tongue? Well, we didn't see any. And, in fact, her sense organs aren't hidden, like ears on a bird. She just doesn't have a nose or ears or a tongue. So how does she sense? She feels with her eight feet!!! Each foot has specialized hairs which sense vibrations in her web and act as noses, ears and tongues. Let's try to find dinner like a spider.

Divide the class into teams of six. Give each team a "spider web" made of twelve long strands of string or yarn tied together at one end. Show the teams how to set up their web, putting the center knot on the floor and spreading the strands of yarn out like the spokes of a wheel. One child in each group should be the "spider." The spider sits, blindfolded, in the center of the web. Each of the remaining students becomes an "insect" stuck in the spider web as each holds the end of a string taut to, but not touching, the floor. One "insect" plucks a string to make it move and vibrate. The "spider" uses her hands to feel all the strands, searching for the one that moves. She feels her way along the strand until she finds the insect and tags him. Give each student a chance to be the spider and the insect.

Real spiders find insects trapped in their webs the same way—not so much by vision as by touch. Spiders even have special hairs on their legs to help them better feel movements in the air. Compare spider senses with human senses.

# LESSON 4: SPIDER MATHEMATICS: THE EIGHTS HAVE IT

## TWO, FOUR, SIX, EIGHT, WHO DO WE APPRECIATE? SPIDERS, THAT'S WHO!

### SUBJECT: MATHEMATICS

**OVERALL OBJECTIVE:**
To use spiders as an enjoyable introduction to mathematics problems.

**MATERIALS:**
1. Copies of Spiderific Brain Teasers for each student (p. 29)
2. Dominoes, dice (a set for each group of 3-4 students)
3. Drawing materials, blackboard

## ACTIVITY 1: SPIDER MATH

The magic number for spiders is eight—eight legs and eight eyes. Without the number 8, spiders couldn't function. Most of human mathematics is based on the number 10, but we can also count like spiders!

### SPIDER MULTIPLICATION (GRADES 1-3)

Have the students draw a circle 10" in diameter either on paper or on the blackboard. Each student then draws eight spiders in the circle, making sure each one has eight legs and eight eyes. One circle with eight spiders represents the multiplication sentence 1 x 8, two circles of eight represents 2 x 8, etc. For even higher mathematics, ask the students to calculate how many legs are in each circle? How many eyes in 2 circles?

### SPIDER DIVISION (GRADES 1-3)

Fill a piece of paper or the blackboard with drawings of spiders. Each student counts all the spiders and writes down that number. After each one circles groups of eight spiders, count the total number of groups of eight. Any spiders not circled represent the remainder.

## SPIDER LEGS (GRADES 1-3)

In this game of probability, give each student a chance to roll the dice, keeping count of the number of rolls. Whenever a combination of eight ("Spider Legs") appears, make a tally mark. How many rolls does it take to roll 8 eight times?

## SPIDEROMINOES (GRADES 2-4)

Line the dominoes face down along the edge of the table. This is the "web." Each student picks eight dominoes from the web. The player with the highest double places that domino in the center. Instead of matching numbers, the next student plays a combination that equals eight (6/2, 5/3, 4/4, 1/blank). When a blank comes into play, the player assigns the number it represents. If a student does not have a match, he/she should draw a domino from the "web" and let the next player take a turn. The first player to use all of his/her dominoes wins the game.

## SPIDER BRAIN TEASERS (GRADES 2-4)

Mother Spider was knitting clothing for her babies. Each baby needs a piece of clothing for each of its body parts. Mother Spider knitted sixteen pieces of clothing. How many babies does the Mother Spider have? (2)

Mother Spider took her children to the shoe store to buy each one new shoes. She bought 48 pairs of shoes. How many children does Mother Spider have? (Each spider needs four pairs of shoes. She has twelve children.)

Seven little spiders were swinging on a web. Two spiders ballooned away. How many spiders were left? (5)

The spiders and insects had a leg contest. The judges looked at 1000 legs. Sixty insects took part in the contest. How many spiders participated? (Hint: insects have six legs.) (80 spiders)

The eye doctor had a busy day examining spider eyes. During the day, he looked at 352 eyes. How many spiders came in for an eye exam that day? (44)

I passed a spider web one day
And forty eyes were looking my way.
Can you guess, now can you see,
How many spiders were looking at me? (5)

There were eight spiders walking down the street.
Hear the patter of their little feet.
Tell me now, do you know,
How many legs help them go? (64)

Five spiders were in the garden, and each of them ate twelve insects. How many insects did they eat in all? (60)

# LESSON 5: SPIDER HABITATS: DEFENSIVE LIVING

## SPIDERS WOULD RATHER DODGE THAN FIGHT

A spider's first line of defense is to stay out of harm's way. Biting is almost always a last resort. When threatened, many spiders simply drop to the ground and play dead or head for the nearest hideout. Sometimes they blend in with their surroundings to escape attack. Spiders are generally small and not colorful, so they can hide while in plain view. Many spiders match their surroundings in color and pattern. Some even change color to blend in with nearby flowers.

## SUBJECTS: HEALTH, SCIENCE, LANGUAGE ARTS

**OVERALL OBJECTIVE:**
To predict, observe, and explain how insects, spiders, and humans stay safe and protect themselves

**TIME OF YEAR:**
Late spring or fall (before the first frost) if using actual observation; otherwise, anytime

**MATERIALS:**
1. Drawing materials and paper; different colors of construction paper

2. *Find the Hidden Insect* by Joanna Cole and Jerome Wexler, *Nature Hide and Seek Jungles* by John Wood, *How to Hide a Butterfly* by Ruth Heller, *The Spider* by Margaret Lane or *Who's Hiding Here?* by Yoshi

3. A live orb-weaver (if possible)

**PREPARATION:**
• **Activties 1 & 2:** Record class discussions on paper. Allow bulletin board or other wall space for display.

• **Activity 2:** Set up a display of live spiders in the classroom, as described in Lesson 3: *Spider Senses: Spiderize!* (p. 23). Review material on spider anatomy in the reference section. Look at live spiders, preserved specimens, or microscope slides.

• **Activity 2:** If you choose to observe live spiders, check in your classroom and outside the school for spiders. Identify places where students might find them, such as in corners, bushes, trees, and potted plants. (Check for local dangers, such as poison ivy, etc. before taking the students out on tour.) You may need to ask your custodial service not to clear away spider webs inside the classroom for a few days.

• **Activity 2:** Depending on the level of hand coordination of your students, use hand lenses or large magnifying glasses. If you are using preserved specimens, you can use a microscope as well (see Teacher Reference section for preserved specimens and microscope (p. 77)).

• **Activity 2:** Students will probably ask for assistance with identifying spiders. Species identification is very difficult unless you are a specialist with a microscope. Also, it is better if the spider is not handled unnecessarily. Students should observe spiders without moving them or destroying their webs.

It is possible to identify general families using Herbert Levi's *Spiders and Their Kin*, available in paperback as a Golden pocket guide. Otherwise, gross identification is fine, such as an orb weaver or a cobweb spider (check Teacher Reference section (p. 64) and *Spiders and Their Kin*). You will probably find only spiders that spin webs, as other types are very mobile. Remember, it is easier to identify the web than the spider.

• **Activity 3:** Make cards out of different colors of construction paper. Fold the paper into quarters and cut along the fold lines.

• **Activity 4:** Make copies of the crab spider illustration.

## ACTIVITY 1: HIDE AND SEEK, (GRADES 1-3)

Read and show pictures from *Find the Hidden Insect* by Joanna Cole and Jerome Wexler; *Nature Hide and Seek Jungles* by John Wood, *How to Hide a Butterfly* by Ruth Heller, *The Spider* by Margaret Lane or *Who's Hiding Here?* by Yoshi. Discuss what the spiders and insects in the books did to protect themselves and from what are the animals protecting themselves (being eaten by predators, heat, cold). Talk about other ways a spider or an insect can protect itself. Record answers.

## ACTIVITY 2: WHERE IN THE WEB?, (GRADES 1-3)

Have the students observe spider webs in the classroom. Look for the spider in the web. If possible, go outside as well to look for spiders and see where they and their webs are located. Even though the students may not find the spider, have them think about how the spider hides herself in the web. From what does she need to protect herself and why. Have the students draw spiders hiding themselves in webs, bushes, corners, etc.

## ACTIVITY 3: SPIDER, ARE YOU THERE?, (GRADES 3-5

Do you have to hide while you eat your lunch? Some spiders must be good at hiding in order to eat well or to protect themselves from being eaten. Set up an "arachnid trail" by choosing a short outside path (about thirty to forty feet). Along the trail place twenty cards made of construction paper, some in bright colors that stand out, others whose colors match the surrounding area. Each card should be out in the open, not hidden behind anything. Place some cards high, some low.

Have the class pretend to be "frogs" (a frequent eater of spiders) and walk along the trail in a single file with spaces in between them. Have them spot as many "spiders" as they can, counting each as they find it. Encourage them to do this silently, with no pointing allowed. When they reach the end of the trail, have each student whisper to you how many spiders he/she saw. If no one found all the spiders, have the class search again until all of the spiders are located. End the game by walking along the trail together, finding and collecting the spiders one at a time.

Questions for the class to discuss include: Why were some spiders easy to see and others more difficult? Which spider would the "frog" have noticed first?

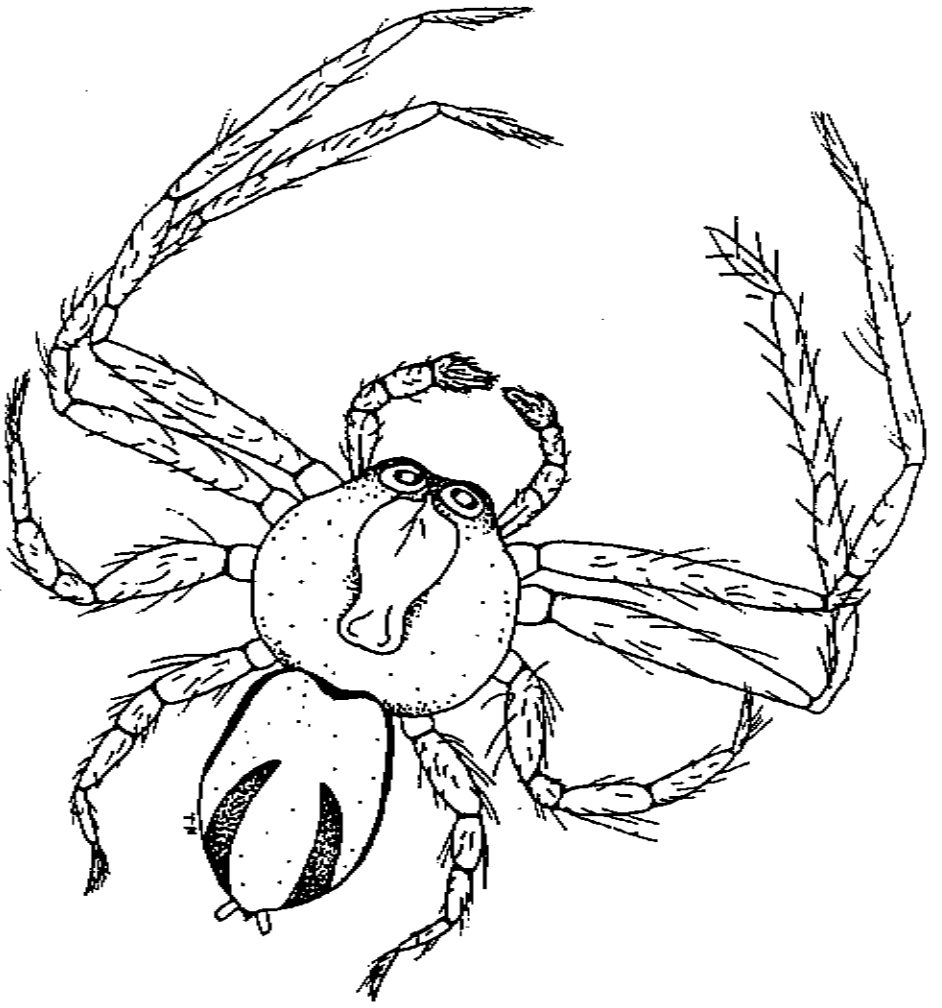
## ACTIVITY 4: CAMOUFLAGE THE SPIDER, (GRADES 2-4)

The different colors of crab spiders allow them to blend in with a variety of flowers. They can also change color slowly to match new flowers.

Before the activity begins, choose two activity sites, either indoors or outdoors. Divide the group into two teams and indicate to each its activity site. Give a copy of the crab spider picture to each student. After everyone has colored one and cut it out, hide the crab spiders throughout the activity area.

Send each team to the other's activity area and challenge them to find all the spiders. As each spider is found, carefully remove it from its "hiding place."

After two minutes, gather the whole group together. Discuss the characteristics of the "captured" spiders (bright colors, distinctive markings). If any spiders are still left in the activity area, allow their owners to point them out to the group. Discuss why each was especially difficult to see (color blended with background; drab, solid color; well hidden).



## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Camouflage**–to hide or conceal by altering the appearance

**Enemies**–spider enemies are toads, snakes, birds, and shrews.

**Predator**–an animal that hunts and eats other animals

**Prey**–an animal that is hunted and eaten by another animal

**Safe (safety)**–free from danger

**Self-protection**–to keep yourself free from danger

# LESSON 6: SPIDER WEBS: THE BOOK OF WEBSTER

Webs are one of the most beautiful things in the world, and web building stands out among the amazing things spiders do. How do spiders build their webs?

## SUBJECTS: SCIENCE, FINE ARTS

**OVERALL OBJECTIVE:**
To understand spider web construction and the different types of webs that spiders build; to realize that not all spiders build webs

**TIME OF YEAR:**
Late spring or fall (before the first frost) if observing actual spider webs; otherwise, anytime

**MATERIALS:**
1. Waxed paper, white glue, kite string, adhesive tape

2. Paper plates and string

3. Drawing materials

4. Dream catcher materials—willow hoops for each student, string, beads and feathers

**PREPARATION:**
• **Activity 1:** Make copies of spider web drawings (p. 37) and the poem "Wonderful Webs" (p. 36) for each student

• **Activity 2:** Identify a place outside to observe webs

• **Activity 3:** Make copies of the "Orb Under Construction" (p. 39) for each student or the Dreamcatcher instruction sheet (p. 42).

## ACTIVITY 1: WONDERFUL WEBS, (GRADES 1-3)

Webs come in all shapes and sizes, from seemingly jumbled structures to an endless spiral radiating outwards. Although the webs built by different species of spiders vary in size and shape, they are all used to trap insects for the spider's dinner.

Before beginning, give each student a set of spider web drawings. As you recite "Wonderful Webs" for the first time, encourage the class to identify each web as it is described in the poem. Which picture shows a flat, round orb web with a spiral? Which one looks like a patchwork quilt of lines and designs? During the second time you recite the poem, have the students hold up the appropriate drawing to match each verse.

### "Wonderful Webs"

Many spiders build webs of sticky threads, of sticky threads
Many spiders build webs of sticky threads, of sticky threads
Webs trap insects, ants, and bees
That's what spiders eat, you see
Many spiders build webs of sticky threads.

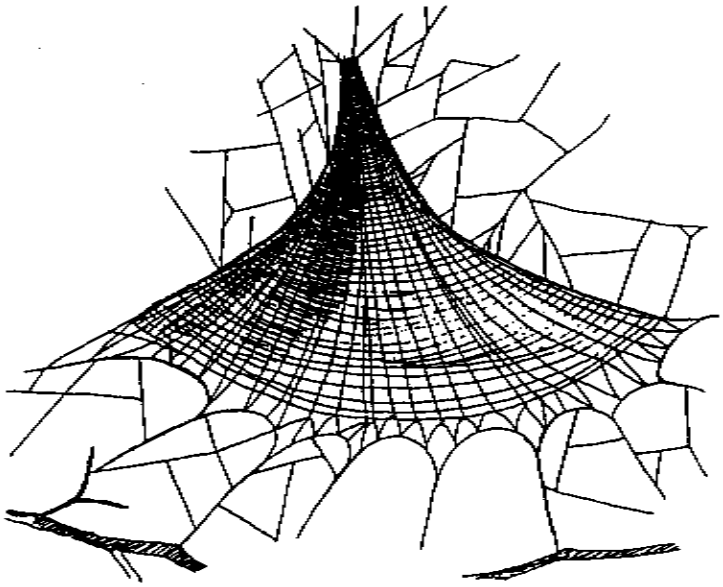
A sheet web is very flat, so flat
A sheet web is very flat, so flat
The strands are woven like a sheet
The spider hangs beneath
A sheet web is very flat.

A cob web is a terrible mess, what a mess
A cob web is a terrible mess, what a mess
Although it doesn't look so swell
It traps insects really well
A cob web is a terrible mess.

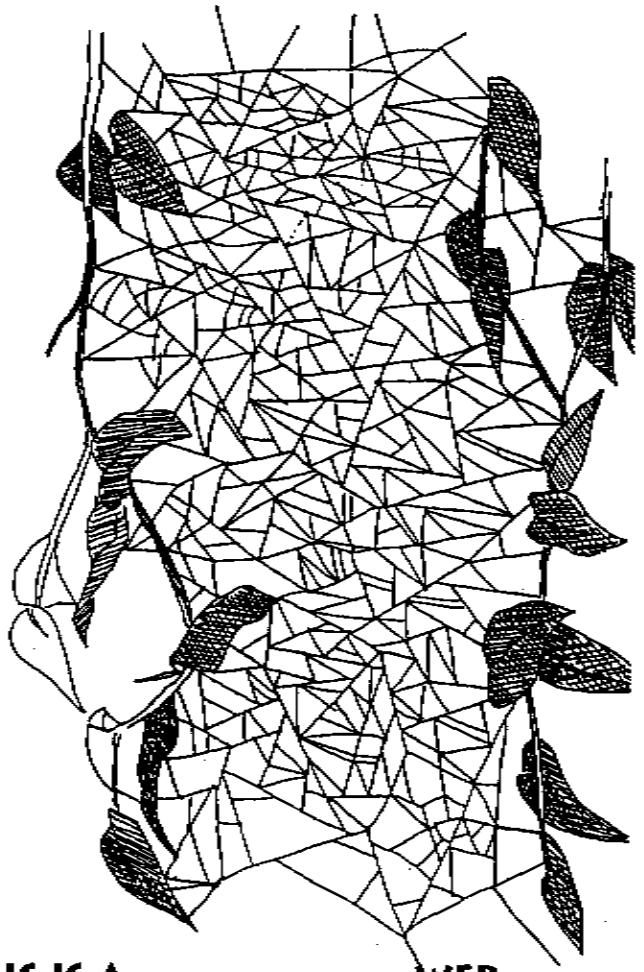
A funnel web is shaped just like a cup, a paper cup
A funnel web is shaped just like a cup, a paper cup
The spider hides deep inside all day
And then jumps out to catch her prey
A funnel web is shaped just like a cup.

Many spiders build webs of sticky threads, of sticky threads
Many spiders build webs of sticky threads, of sticky threads
Webs trap insects, ants, and bees
That's what spiders eat, you see
Many spiders build webs of sticky threads.

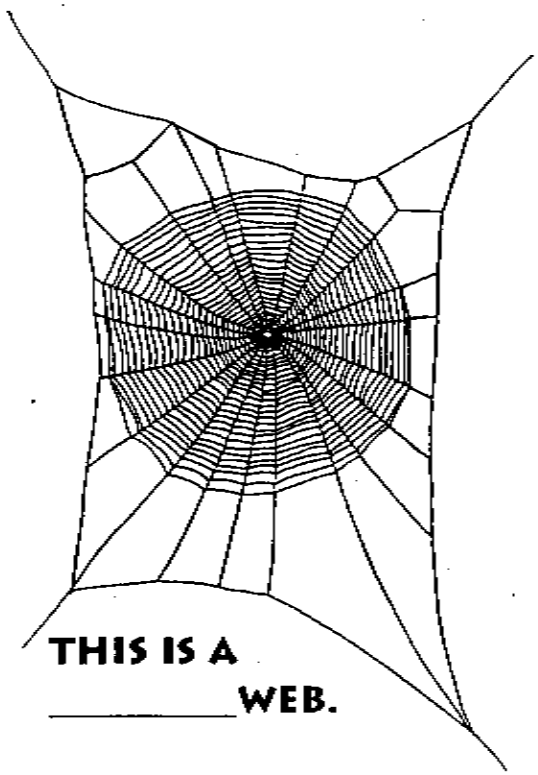
After the poem, ask each student to write in the webs on their drawings.



THIS IS A _____WEB.



THIS IS A _____WEB.



THIS IS A
_____WEB.

THIS IS A
_____WEB.

## ACTIVITY 2: BEHOLD THE ORB, (GRADES 4-6)

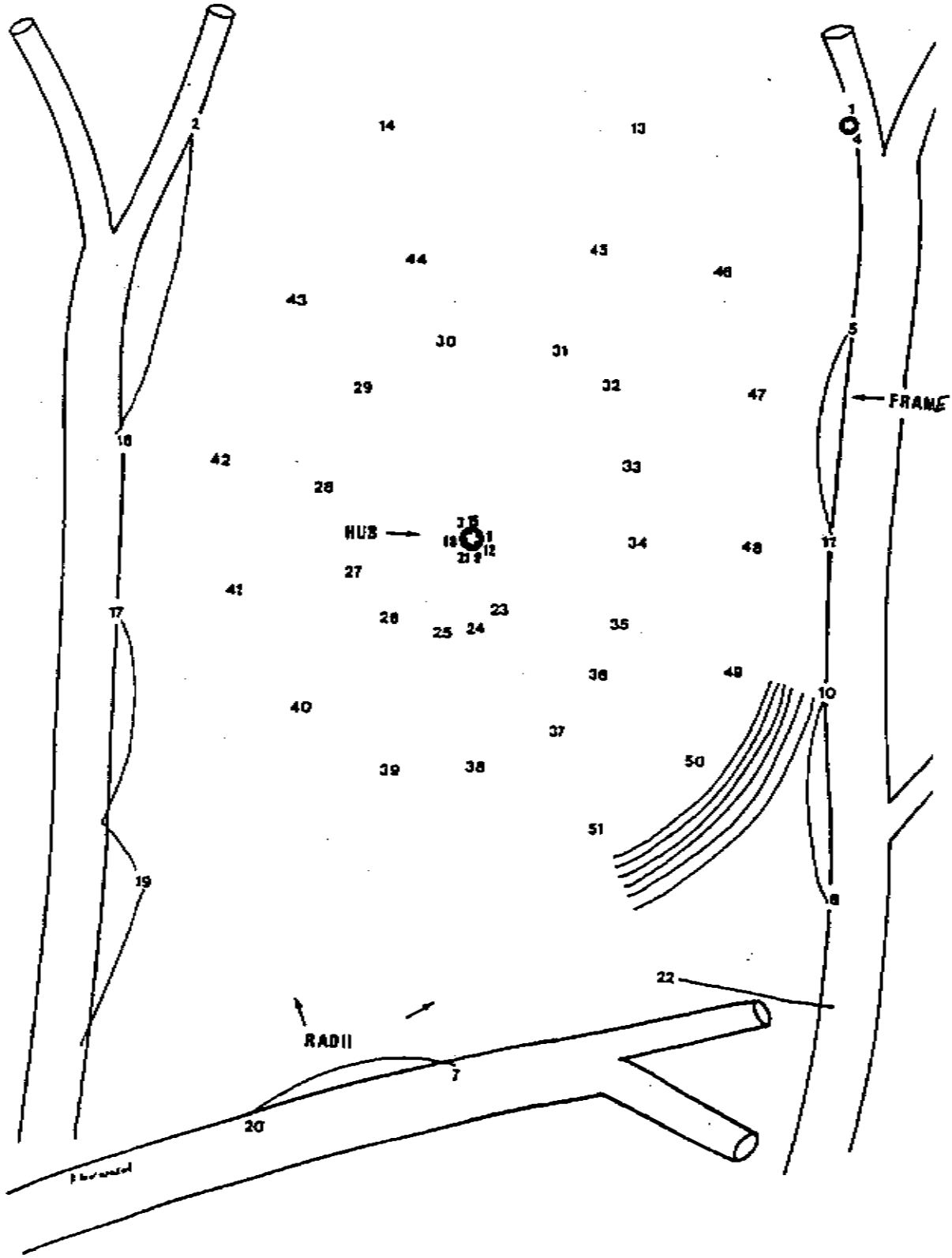
Spider silk starts as a liquid protein, made by glands located in the spider's abdomen. Each send the liquid to a spigot, a tiny tube on a small appendage called a spinneret. Most spiders have three pairs of spinnerets, and a few kinds of spiders spin up to eight kinds of silk.

To begin spinning silk, a spider attaches a thread from her abdomen to a surface, or pulls the silk out from a silk spigot using one of its hind legs. As the spigots release silk, the liquid becomes a solid thread—not because it dries, but because tension reorients the protein molecules.

Find an orb web outside and examine it. What shape is the web? (an oval in a rectangle) What is it made of? (spider silk) Where are the main structural threads attached? (at the corners of the web and to trees, bushes, flowers, weeds, fences, walls, etc.) How did the spider make this web? Where did she begin? Where did she go from there? (structural threads were secured first, then a spiral was laid starting from the outside edge) How does the web catch food? (insects are caught in the sticky threads) Are any insects stuck in the web right now? Is there evidence that the spider recently caught something? Can you find the web's owner?

Some spiders like to sit in the middle of their web. Others often hide under a leaf, sitting on a single thread that radiates from the main part of the web. How does the web help the spider? (web vibrates when it is disturbed by food or a predator; spider avoids enemies by coming out of hiding place only when food is caught in the web) If you are lucky enough to see the spider moving in her web, watch carefully. How does she move along the threads? Does she move across all the threads, or does she avoid some?

# BUILD AN ORB WEB



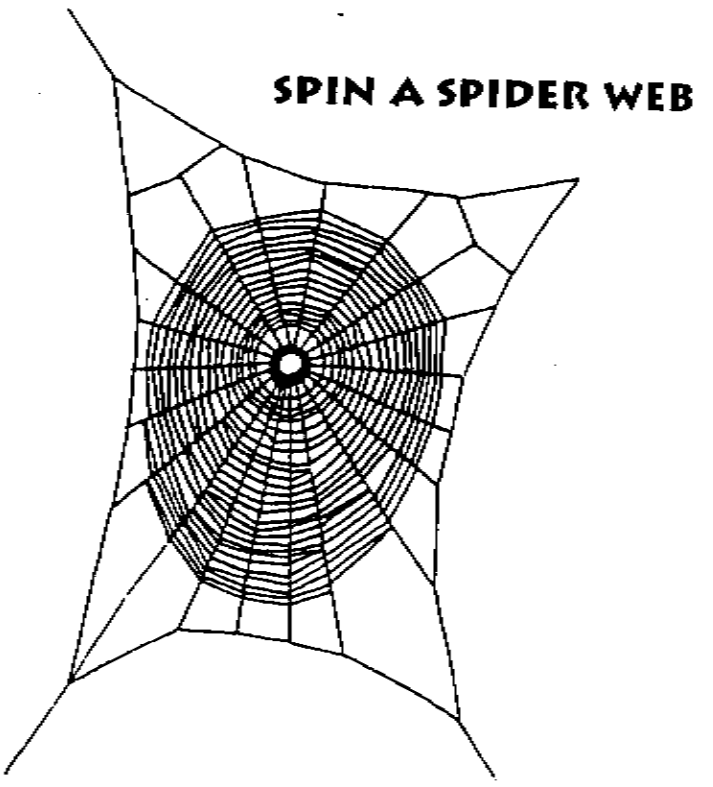
## ACTIVITY 3: ORB UNDER CONSTRUCTION, 1-3

The spider begins an orb web by building a bridge between two solid objects. Usually, the spider sits, abdomen in the air, and allows the wind to pull out a strand of silk. After the strand is attached to another object, a bridge is started. The spider often walks back and forth along this strand, making it strong by reinforcing it with more silk.

The spider then makes the spokes of the web, attaching each to a nearby object. The spokes will make the web stable, even when a breeze blows.

After the spokes are secure, the spider begins to lay down the spiral. First, she makes a temporary spiral from unsticky threads. Once the temporary spiral is in place, the spider constructs a sticky spiral that will trap insects. The silk threads of the sticky spiral carry little droplets of a glue-like substance. The spider begins laying down the sticky spiral on the outside edge of the web, working inward. As she works, she removes and eats the silk of the temporary spiral and securely attaches the sticky spiral to the spokes.

Build your own orb web by connecting the dots on the Orb Web page (p. 39). Connect the dots 1-51 to see how the spider makes her temporary spiral.



## ACTIVITY 4: SPIN A SPIDER WEB, (GRADES 4-6)

Give each student a copy of the web picture (p. 40) and the materials to spin a web.

Tape a piece of waxed paper on the table to serve as a guide and squeeze a small amount of glue on it for the students to use. You can also place small containers of glue around the table for sharing and easy access.

Tape a piece of waxed paper in front of each student on which he/she can make a web. Then give each student one yard of kite string. Start the web by laying several pieces of kite string (6" or longer) across each other, like spokes of a wheel. Make the string sticky by dipping it in the glue. Begin the spiral by working outward from the center of the spokes, laying down the sticky string in a spiral.

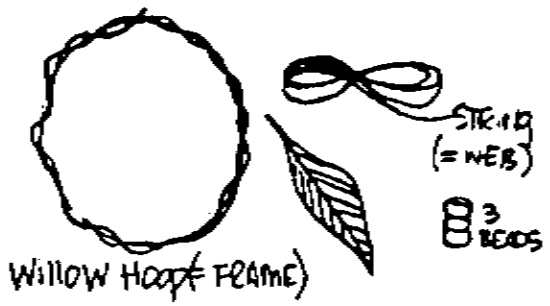
Allow the web to dry overnight, then carefully peel the web off the waxed paper.

Another way to have your students build spider webs is to have them construct dream catchers. According to one Native American legend, the web of the dream catcher traps the bad dreams while the good dreams go through the center hole and down the string and feather to the sleeper below. Hung above the bed, it is a comfort and give assurance that only pleasant dreams will come (see drawing of how to make dream catchers, p. 42).

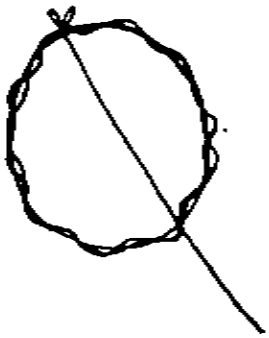
Each student gets a willow frame and a length of string. As they hold their frames in one hand, they tie tie the string to one side of the frame and then pull it to the other side. To hold the string in place on the frame, the students loop the string around the frame one time and gently tug on it to make sure that the string is tight across the frame.

Using this method, design a "web." Stop when there is about 1 foot left of the string (the "tail"). Choose a bead to string onto the "tail and push it through until it is in the middle of the web. Tie the tail to the frame by making a loop around the frame. Insert the extra string into the loop and pull tightly to make a knot. Once the "tail" is secured to the hoop, decorate it by stringing beads onto the "tail." Finally, attach a feather to the bottom so that good dreams can fall down at night.

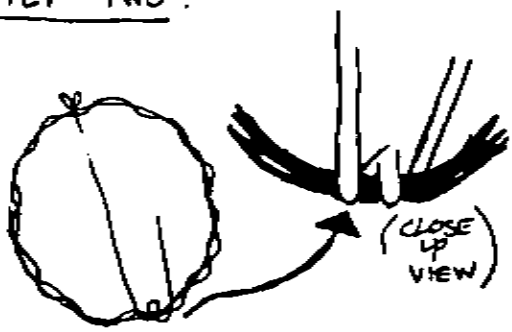
## DREAMCATCHER MATERIALS



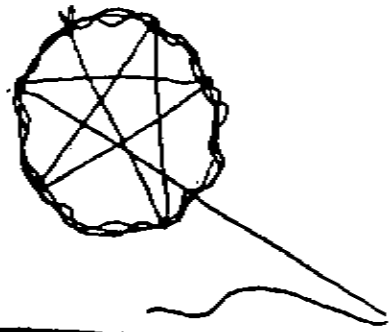

## STEP ONE:



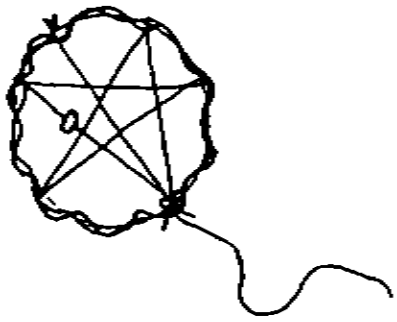
## STEP TWO:




## STEPS THREE AND FOUR AND FIVE:



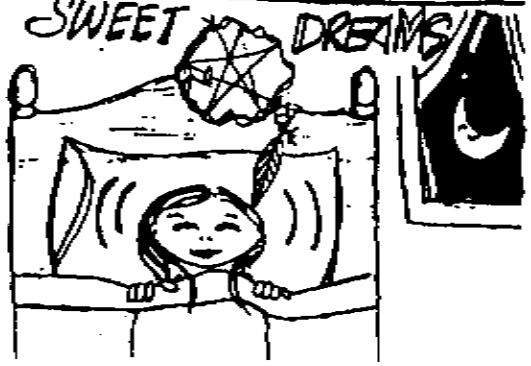
## STEPS SIX AND SEVEN AND EIGHT:



## STEP NINE:

## STEP TEN:

Now your dream catcher is complete - Remember to hang over your bed and you'll have...



## ACTIVITY 5: POUNCING ON PREY, 1-6

Not all spiders use large webs to hunt. Some spiders, such as wolf spiders, stalk their prey and spend a great deal of time running around in search of something to eat. Jumping spiders actually leap on their prey. Other species patiently lie in wait, ambushing their next meal when it comes too close. Crab spiders wait on flowers with their legs outstretched. When an unwary insect comes too close, it's dinner time!

Divide your class into two teams, the "insect" prey and the hunting "spiders." Give each of the insects a paper plate to which a nine-foot length of string is attached in the middle. (Poke a small hole in the plate, pull the string through, and tie the string's end in a knot. The students might enjoy decorating their paper plate insects, adding six legs made of construction paper.) Show the insects how to make the plates move quickly by holding the end of the string and running.

Take both teams outside, where each of the spiders can hunt until it catches an insect's paper plate. Follow the two strategies that spiders use: search actively for insects, or set up an ambush and wait quietly. Remember, spiders hunt alone! Once a spider grabs an insect's plate, she should take it to the sidelines to "eat" it while the remaining spiders finish hunting.

Once all the insects have become a delicious meal or after about 5 minutes, reverse the roles of the two teams and play again.

After the game is over, discuss the hunting strategies the "spiders" used. Did some actively chase their prey the entire time? Did some hide and then pounce when prey came too close? Which method was most effective? You may also want to discuss how "insects" avoided the spiders. Did they hide? Did some run faster?

## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Lampshade**—a type of spider web that looks just like a lampshade; usually found on the underside of rock ledges

**Recycling**—many orb web spiders eat their web after it has been damaged or destroyed over time

**Sheet web**—a type of spider web that looks like a bed sheet and usually hangs horizontal to the ground

**Spinneret**—located at the end of a spider's abdomen; carries the spigots for the silk glands.

**Spigot**—the openings of the silk ducts of the spider's silk glands; differ according to type of silk gland

# LESSON 7: SPIDER DIVERSITY: SPIDERS, SPIDERS EVERYWHERE

You are always within three feet of a spider. Spiders live nearly everywhere on land, including caves, mountain tops, seashores, and deserts; some even live in fresh water. They come in many different shapes and sizes: they can be as tiny as the dot of the letter "i" or as big as a dinner plate. A tarantula can measure over ten inches with its legs stretched out.

## SUBJECTS: SCIENCE

**OVERALL OBJECTIVE:**
To learn about diversity and scientific method

**TIME OF YEAR:**
Late spring and early fall (before the first frost); Activity 1 can be done at anytime

**MATERIALS:**
1. Paper and drawing materials
2. Live spiders
3. Materials for spider habitat

**PREPARATION:**
• **Activity 1:** Make copies of the spider data sheet, pp. 47-48, for each student.

• **Activity 2:** Set up an environment for a live spider in the classroom, as described on p. 74. Review material in the Teacher Reference section (p. 77) on looking at live spiders and preserved specimens, and using microscopes.

• **Activity 3:** Make copies of the spider illustration, p. 50, for each student (if desired).

• **Activities 1, 2 & 3:** Record discussions, drawings, and stories on paper. Allow wall or bulletin board space for display.

## ACTIVITY 1: SPIDER SEARCH, (GRADES 4-6)

Like all scientists, arachnologists collect and record data that they then analyze and share with colleagues and the general public. Let the class search for spiders at home and in the classroom and record what they find.

Take your class on an extended outdoor walk around the school grounds in search of spiders. Emphasize that they are visitors and discuss basic rules about respect for animals and the environment. Give the students the Spider Search Data Sheet (pp. 47-48) and challenge the students to search carefully. It is best for the spider that she not be picked up or handled. You may wish to have the students search in pairs.

You may also ask the students to check their homes, garages, and basements to locate as many spiders as possible. It might be a good idea to ask the students to plan where they wish to search: in the backyard bushes, near a fence, in a basement corner, on a houseplant, etc. It is also important to caution the students not to poke their hands into drawers or boxes, especially in the garage or basement. Some spiders poisonous to humans, (like the brown recluse) lurk in those types of places. The best rule of thumb is to just look and not move anything. The students should record their observations on the Spider Search Data Sheet. Webs with no spiders should still count.

Afterwards, discuss the students' findings. Ask the students to describe where they found the spiders and whether it was easy or difficult to locate them. Helpful questions include: How many spiders do you think you would find? What did you find more of–spiders without webs, spiders in webs, or webs with no spiders?

Where are the spiders' webs? To what are the webs attached? What shape are the webs? Describe the web, is it regular and round or irregular? Is is an orb web? Is it high or low from the ground (measure it)? Do you see the spider? Where is she? Is there anything in the web other than the spider? Is the web complete or does it have broken threads?

How big do you think the biggest spider would be? How small do you think the smallest spider would be? What color were most of the spiders? Why were they not easy to see?

Ask your students to suggest explanations about their findings and analyse them. For example, are spiders more likely to be found in the bushes or near the playground? In the basement or in the kitchen? Why do you think spiders prefer one section of the schoolyard or the house to another? Did the color or size of the spider make it difficult for you to find it? Why was one spider big and another small? How do the students think each spider they found fits into its environment?

Tally the students' answers to see who found the most spiders, whose house has the fewest, who found the biggest spider or the largest web, etc.

## ACTIVITY 2: KEEPING A LIVE SPIDER, (GRADES 4-6)

Discuss and record on paper the materials needed to design and maintain a spider habitat. Based upon this chart and the students' observations of spiders in the wild, what kinds of things does a spider need from its environment to survive and be healthy?

Keeping in mind the spider's habitat needs, create an artificial home with water and food sources. Collect a spider and introduce it into its new home. Have students record for one week their observations of the spider's daily activities.

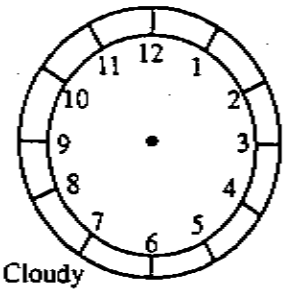
At the end of the week, review the observations and discuss the results. What was necessary for the spider to survive? Did the class provide a good home for the spider? What is absolutely necessary for people to survive? What do people need that the spider did not need? Carefully return the spider to its natural home.

# RECORD SHEET

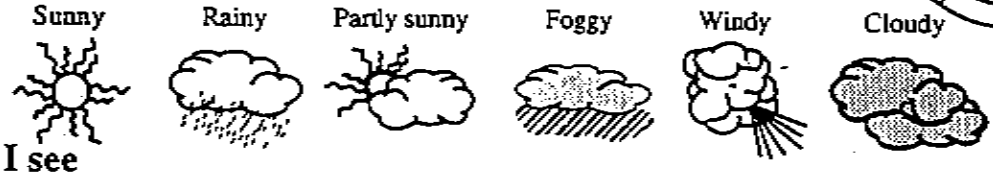
Name _____ Time: _____

Date _____

Place _____




Weather




**What I see**

_____

_____

_____

_____

_____

**What it is doing**

_____

_____

_____

_____

_____

Tell what else you found out. _____

_____

_____

JOURNAL PAGE
for making journal book

## ACTIVITY 3: DESIGN A SPIDER, (GRADES 4-6)

Spiders can be found almost everywhere on earth . . . even in your house and classroom. Scientists have identified more than 34,000 kinds of spiders. There might be as many as 170,000 kinds of spiders in the world, and there may be a many as 64,000 spiders in a small, grassy meadow. Most of these amazing creatures are, of course, harmless to humans and quite beneficial.

Spiders live in almost every kind of environment. One spider, the European water spider (Argyroneta) can dive and swim freely under water. Fishing spiders can climb down logs or rocks and hide underwater. These spiders have physical characteristics which help them be successful near water: both types can take an air supply with them to breathe while submerged; Fishing spiders can stay under water for about thirty-five minutes and have long front legs which help them catch insects. Other spiders, such as the lampshade spider, spin webs on the underside of rocky overhangs in the mountains, where the lampshade spider lives.

Ask the class to think about what would be a good place for a spider to live, taking into consideration the spider's need for air, water, live food (usually insects), and a place safe from predators. Once they have thought about good spider homes, let them design a spider well suited to that habitat. If they have already done Activities 1 & 2, the students would have considered these questions.

It might be helpful to have the students color copies of the spider illustration (p. 50) to visualize size, color patterns, and shape. They should also draw the environment where their spider would live, like a garden or a garage or a rainforest. You may want to introduce your class to the principles of scientific nomenclature and have them select names related to their spiders' physical characteristics or habitats. If you really want to have the students' nomenclature follow scientific principles, consult Roland Wilbur Brown's *Composition of Scientific Words*, rev. ed., Washington, DC: Smithsonian Press, 1956.

## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Desert**–a region with little plant or animal life due to environmental extremes, especially little rainfall and hot temperatures

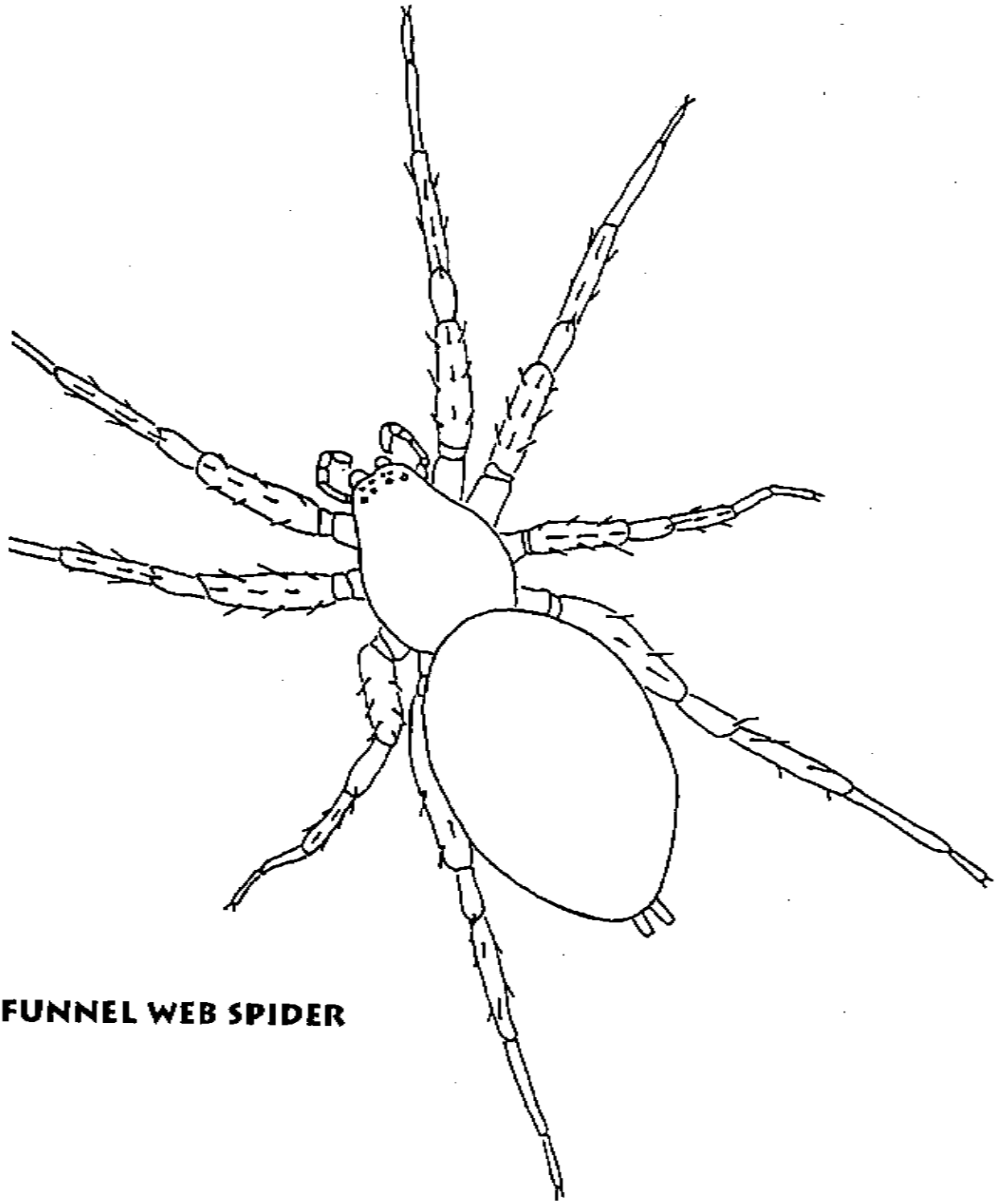
**Diversity**–having a great variety of types of plant and animal life

**Environment**–the combination of conditions and surroundings that affect and influence the lives of plants and animals

**Hypothesis**–a tentative explanation for a question that can be tested by experimentation

**Predator**–an animal that hunts and eats other animals

**Survive**–to stay alive



FUNNEL WEB SPIDER

# LESSON 8: SPIDER DEVELOPMENT: GROWING UP

Imagine you are a spider as you listen to this story.

## SUBJECTS: SCIENCE, LANGUAGE ARTS

**OVERALL OBJECTIVE:**
To learn about the life cycle of a spider

**TIME OF YEAR:**
Early fall (before the first frost) for Activity 3; otherwise, anytime

**MATERIALS:**
1. Soft, instrumental music (optional)
2. Milkweed seeds or "parachutes" made of string and paper or cloth
3. A coat or sweater

**PREPARATION:**
- **Activity 1:** Have the students bring in old coats or blankets. Arrange a space for the students to sit on the floor and react as they listen to the story.
- **Activity 2:** Bring in milkweed seeds or "parachutes" made of string and paper or cloth.
- **Activity 3:** Check outside for spider egg sacs.
- **Activity 4:** Tie together the coats or sweaters.

## ACTIVITY 1: PORTRAIT OF A YOUNG SPIDER, (GRADES 1-3)

Have you ever seen a spider egg sac or a young spider? How are spiders born? Do spider mothers take care of their children? Can very young spiders catch their own food? Ask the children their ideas about what it would be like to grow up as a spider. If appropriate, have them compare their lives with their perceptions of a young spider's life.

Turn down the lights in the classroom. Perhaps play some instrumental music quietly in the background. Encourage the children to get comfortable in an open area on the floor. Ask them to imagine that they are spiders while you read them the following guided story about one spider growing up. Feel free to tailor the story's length and detail to the attention span of your students.

### GROWING UP

You are about to become a tiny spider. Please find a place where you can be protected, but where you can easily hear my voice. Curl up as small as you can and be very quiet. Close your eyes.

It is winter now. The days are short and the nights are very cold. But you can't see the daylight or feel the bitter wind because you are snug in your egg sac. Last fall, your mother made the egg sac from her silk and hung it from a fence post in a meadow. She laid her eggs inside. You've been here ever since. Things are crowded inside the sac that you share with several hundred of your brothers and sisters, but it's comfortable, too.

A furious storm comes down from the north. The wind whips around your egg sac and driving rains beats down on you. But inside your egg sac, you are safe and dry.

Winter turns into spring. The sun is brighter and warmer. The frozen streams are thawing and the snow begins to melt. The grass turns green and rabbits come out to feed. Droplets of water from a spring rain splash gently on your egg sac.

Inside the sac, you feel the urge to stretch and move . . . stretch all your legs out. (Students can mimic movements.) Suddenly, you are out of your egg sac and standing tall, soaking in the sunlight. You are a spiderling. Even though you are tiny, you look just like your mother spider.

You climb up on a tall bush. A gentle breeze blows and you let out a line of silken thread from your spinnerets. The breeze blows playfully on the thread and you feel its pull. You let out more thread. A stronger breeze comes and picks up the threads. Suddenly, you're carried on the breeze, attached to your waving threads. Up and up you go until the trees and houses below shrink away from sight.

The breeze become more gentle, and you begin to drop slowly down. A stronger gust tosses you up again, but as it fades, you descend again. Slowly and gently you fall, until you are moving over a field of tall grasses. You stretch out some of your legs and grab onto a blade of grass. It's been a long journey and an exciting day. You crawl under a nearby leaf and sleep for a while.

When you awaken, it is dark, except for the stars shining above. Everything is quiet except for the hoot of a distant owl. It is night. You crawl up to the top of a blade of grass and let out a line of thread, and it blows on the breeze. You let out more silk, and the line gets longer until it touches and sticks to another blade of grass not far away. You run along your thread, laying down more lines. Connecting each line to nearby blades of grass, you work until you have completed a framework of threads. Then, very carefully and starting from the middle of your framework, you walk in a spiral laying down a sticky thread behind you as you go. Without anyone having to teach you, you have made a sturdy web. You crawl back under your leaf to rest.

You are safe under your leaf. By touching a single thread, you can feel the movements of your web. Through your strand, you can feel the web blowing gently in the breeze. Suddenly . . . thump! . . . something large hits your web. You awaken with a start. Something in your web struggles, making your web bend and twist, and sending strong tugs on the line you touch.

Slowly and cautiously, you crawl out from under the leaf. Balancing carefully, you move across your shaking web towards the struggling creature which will be your first dinner. You life as a spider has really begun.

This is a story about one spider growing up. Many spiders have similar stories. The mother spider in this story left her egg sac in a safe spot. Other spiders carry their egg sacs with them. Some mother spiders allow their spiderlings to ride on their abdomen for the first few days. Some even feed their newly hatched children. Some spiderlings don't balloon to a new home, but set out on foot instead. Not all spiders catch their food in webs. Some spiders chase down or pounce on their prey instead. No matter how they hunt, all spiders can take care of themselves as soon as they are born.

## ACTIVITY 2: BALLOONING, (GRADES 1-3)

Make a spider to balloon away in the wind.

Spiders send out long strands of silken thread that are caught by the wind. They travel through the air, often very high up, hanging from the threads. This is called ballooning (see p. 56).

Give each student a milkweed seed as a pretend spiderling (the seed is the "spiderling" and the white silk is the "balloon"). If milkweed seeds are not available, make "parachutes" of paper or cloth and string.

Hold the "spider" up to the wind and wait until the wind fills the parachute. Let go. Follow your ballooning spider if you can. How far up does it go? Where does it land?

Why is ballooning helpful for spiderlings? (Spiders like to live alone. Ballooning helps them get away from each other. By being far apart, spiders have plenty of room for food and plenty of branches from which to build webs.)

## ACTIVITY 3: SEARCHING FOR SACS, (GRADES 4-6)

All mother spiders make sturdy sacs out of silk in which they lay their eggs (see the teacher reference section on spider lifestyles p. 63). Spider egg sacs are found in webs both outdoors and inside, and they resemble small dust balls or cotton balls.

Have your students look carefully for spider egg sacs on the school grounds. Remember, early fall is the best time to find egg sacs. Where would be good places for mother spiders to hide their egg sacs? Look inside crevices, behind shutters, and under stairs. You can always find egg sacs in cob webs in garages and sheds.

When you find an egg sac, examine it carefully without touching or disturbing it. Does it look hard or soft? What do you think it might be made of? How do you think it protects the spiderlings? Is it like a chicken egg? What color is it? Does it blend in with it's surroundings? What if it were bright red? Can you see through it? If so, are the spiderlings still inside? Or, has the sac burst, with the spiders already hatched? If the spiderlings are still inside, visit the egg sac every day to see what happens.

## ACTIVITY 4: THE MOLTING GAME, (GRADES 1-4)

Before a spiderling becomes an adult, she usually molts four to twelve times. Spiders must molt when they grow because they live inside a hard exoskeleton. Although the exoskeleton provides wonderful protection, it cannot stretch and expand as the spider grows. Inside her exoskeleton, a growing spider becomes cramped, just as you would if you always had to wear a coat that was much too small.

When the spider grows too big for her exoskeleton, it is time to molt. First the sides of the covering crack. The spider begins the difficult process of pulling each of her legs out of the old "coat." Little spines on her legs help keep them from slipping back into her old skin. Finally, the spider steps all the way out and stretches. Newly molted spiders often drink lots of water and move each of their legs frequently until their new exoskeleton hardens in a few hours. Molting spiders are vulnerable to predators and will often hide in a safe area during this time.

In this game, most students become spiders who molt as fast as they can. A few students will be the predators who try to tag the spiders before they molt. There should be fewer predators than teams of spiders. Spiders have eight legs, so a pair of students kneeling side-by-side on their hands and knees become one spider. The spider wears an old exoskeleton, so each pair of students needs to put on an exoskeleton costume. The game works best if the costume is made of four coats or sweaters tied together to form one large exoskeleton.

Have the predator students stand in a circle in the center of the playground. Mark off several areas as "safe" havens; there should be more "safe" havens than there are teams of "spider" students. The "spider" students stand outside the inner circle and outside the "safe" havens.

To mimic spider behavior, the "spider" students start molting as quickly as possible, pulling their eight legs out of the old exoskeleton as quickly as possible. Once the "spider" students have molted, they can run to a "safe" haven. The "predators" leave the inner circle once the "spiders" start molting and try to catch the "spiders" before they reach a "safe" area. The winners are the spiders who complete their molt; they get to grow up!

## QUICK REFERENCE FOR WORDS WITH SPECIAL MEANINGS: (FOR UNDERSTANDING ONLY)

**Ballooning**–aerial dispersal by small spiders and spiderlings of many species, during which they release silk strands from spinnerets and use uplifting air currents to transport themselves over great distances

**Egg sac**–spider silk container produced by the female to protect her eggs; also called a cocoon

**Exoskeleton**–a hard protective skeletal structure or skin layer covering the outside of an arthropod's body

**Molt**–to shed the hard exoskeleton in order to grow; once they become adults, spiders do not molt again

**Spiderling**–a very young spider that has just hatched from the egg sac

# LESSON 9: CHARLOTTE'S WEB, (GRADES 1-6)

"But it's the way I'm made. A spider has to pick up a living somehow or other, and I happen to be a trapper. I just naturally build a web and trap flies and other insects."

Many children are familiar with the book *Charlotte's Web* by E.B. White, which has also been made into an animated movie. Here is a list of spider characteristics that can be discussed in connection with the book/movie. An annotated version, edited by Peter F. Neumeyer and currently in print, contains a great deal of interesting information about Charlotte and spiders, and about White himself.

Note: Charlotte is an Araneus cavaticus, a type of orb-weaver.

After the students have read *Charlotte's Web*, either independently or as a class, discuss the following questions.

•1. What type of web did Charlotte make? (orb web)

•2. Describe Charlotte's life. (Charlotte lived one summer. In the fall, she made an egg sac and died.)

•3. Compare Charlotte's body features with those of actual spiders. (She had two eyes, rather than the typical eight eyes, antennae, and a separated head.)

•4. How did Charlotte's babies travel after they hatched? (ballooning)

•5. Why did Charlotte build her web in the door frame of Wilbur's barn?

—Door frames provide a structure for spiders to build an orb web. Fences and corners often carry many spider webs. Since appropriate web sites are in short supply, spiders compete for web sites. Some people want spiders to build webs nearby. Orange growers in California and Florida, for example, may set up wooden frames in their groves to attract spiders as biological insect control.

—Wilbur's food and his droppings actually attract flies and other insects, upon which Charlotte can prey. Thus, Charlotte chose a very good web site. (Spiders often relocate to other web sites when their food supply becomes scarce.)

•6. What did Charlotte catch for food? (a fly)

•7. What other foods might Charlotte eat? (crickets, moths, beetles)

•8. How did she catch it? (The fly flew into her web and was stuck.)

•9. What did Charlotte do with the fly? (She wrapped it in silk to eat later.)

•10. Charlotte discussed her eating habits with Wilbur. Did Charlotte give a correct explanation of her eating habits? (No. Charlotte said she drinks the blood of the fly. Spiders actually turn the entire inside of an insect to thick liquid, like a milkshake. Perhaps the author did not know how spiders really eat.)

•11. Wilbur and Charlotte were friends. Indeed, Charlotte saved Wilbur's life, and Wilbur saved the lives of Charlotte's children. Did Wilbur change his mind about being friends with Charlotte after she told him how she lived and ate? (no) Are our attitudes towards spiders similar to Wilbur's? (Class discussion)