

SKILLS

Discussing, following directions, critical thinking, observing, experimentation, and note taking

NATIONAL SCIENCE STANDARD

Science as Inquiry

Content Standard A

Students should develop:

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Life Science

Content Standard C

Students should develop understanding of:

- The characteristics of organisms

OBJECTIVES

Students will understand how insect mouthparts are adapted for a particular food source.

ASSESSMENT

Evaluate students' active participation in class discussions and the appropriateness of their responses. Observe students as they participate in the feeding activity, noting their involvement and appropriate use of materials. Evaluate the accuracy of illustrations and completeness of written observations on the activity sheet.

MATERIALS

- "What's in Your Mouthpart?" handout for each student
- "Feeding Frenzy" activity sheet for each student
- small cups
- box of breakfast cereal
- wooden craft stick for each student
- cookie sheets or cafeteria trays
- water
- plastic wrap
- rubber bands
- sheets of thin paper



SUBJECTS
SCIENCE
LANGUAGE ARTS



TIME
Preparation
40 minutes
Teaching
60 minutes
Evaluation
25 minutes



VOCABULARY
adaptations
food source
proboscis



MORE IDEAS & TECHNOLOGY CONNECTION
Located at the end of each lesson.

- paper plate
- marbles
- raisins
- small bits of sponge
- plain drinking straws
- drinking straws cut diagonally to create a pointed tip
- clothespins
- scissors
- paper towels
- overhead projector (for beginning students)

BACKGROUND

Animals have developed certain adaptations to increase their chances of survival in the wild. An adaptation is a special skill or characteristic that helps an animal survive in its environment. The adaptation may help an animal hunt, hide, or attract a mate. For example, the praying mantis is camouflaged by its green coloring, helping the insect blend into its environment and preventing it from being seen by its prey. This lesson will explore how insect mouthparts are adapted to help the insect obtain food from specific food sources.

LESSON PREPARATION

Before you begin this lesson, fill small cups (one per student) with dry cereal. Set aside, along with one craft stick per student. Prepare the following, on trays or cookie sheets, for each group of five students.

- Tray 1 Food Sources:
One cup of water, uncovered
One cup of water, covered with plastic wrap held in place with a rubber band
Several pieces of paper
One small paper plate with marbles on it
One small paper plate with raisins on it
- Tray 2 Food Collection Containers:
Two empty paper cups for each student in the group
- Tray 3 Insect Mouths (one of each):
A thick piece of sponge with hole cut partially through it and a straw inserted (house fly)
Plain drinking straw (butterfly)
Drinking straw with sharp, pointed tip (mosquito)
Clothespin (damselfly)
Pair of scissors (leafcutter ant)
- Tray 4 Damage Control:
Paper towels

LESSON PRESENTATION

Using a Tool to Eat

Tell students that for the first part of this lesson all they have to do is have a snack. There is just one special rule they must follow: They must eat the cereal using the craft stick as a utensil. They may not pick up the cereal with their hands. Give students one minute to eat their snack in this manner.

Gather students for a discussion. Were they successful gathering food using the tool provided? Why or why not? Would another utensil have made this task easier? Which utensil and why? Point out that different foods require different utensils. Explain that just as some utensils are more suitable for certain foods, animal mouthparts have evolved to deal with different foods. Take a few minutes to discuss the concept of adaptation. What is adaptation? Ask students to relate prior knowledge of how animals, particularly insects, have adapted to survive. Be sure students mention camouflage, body shape, ability to reproduce rapidly, locomotion, and specially shaped appendages to do specific jobs, such as digging. Encourage students to name an insect or another animal with each example and to include what the animal is able to do because of the adaptation.

Continue the discussion of adaptation, focusing on insects. Insect mouthparts act as precision tools and have been adapted to allow them to take in food more easily. For example, hornets and other papermaking wasps have chewing mouthparts. Using their mouths, they scrape off tiny splinters of wood, which they chew into pulp. Similarly, the leafcutter ant has specialized jaws for cutting. It uses its jaws to snip off circular bits of foliage. The leafcutter ant does not eat the leaves it cuts; it takes them back to its nest to raise gardens of fungus on which it feeds. Leafcutter ants use their mouths to eat the fungus that grows in the fungus gardens. Give students the “What’s in Your Mouthpart?” handout. Discuss how each mouthpart helps the insect eat the food source.

The Right Tool for the Job

Explain to students that they will be participating in an activity where they will each pretend to be an insect with a specially adapted mouthpart. Each student will have an opportunity to try to find nourishment from a variety of food sources. Show students the tools they will be using in the lesson: clothespin with sponge, plain drinking straw, etc. Explain that each object represents an insect mouthpart. Ask them to guess the type of insect each tool represents. Ask them to support their guesses with logical reasoning. List all guesses on the chalkboard or overhead projector. If students don’t mention the following insects, add them to the list.

House fly	Sponge-like mouthpart	Drinking straw attached to a piece of sponge
Butterfly	Proboscis	Plain drinking straw
Mosquito	Tube with piercing end	Drinking straw with sharp pointed tip
Damselfly	Sharp jaw to tear	clothespin
Leafcutter Ant	Scissor-like jaw	scissors

FEEDING FRENZY

CONTINUED FROM PREVIOUS PAGE

Insects
Level 2

The Food Items

Show students each “food source,” (listed under tray 1 in lesson preparation section) and discuss each item. Set some parameters for how students can use the tools while they attempt to eat like an insect.

Food Source Representation	Actual Food Source
One cup of water, uncovered	Any uncovered liquid, from a water puddle to a cup of lemonade
Cup of water, covered with plastic wrap	Blood in a capillary under the skin, fruit juice under a peel, nectar inside a flower, liquid inside a plant stem
Paper	Leaves, blades of grass, large pieces that must be broken into smaller pieces
Raisins, marbles	Small insects that a larger insect predator might eat, or small pieces of solid food

Show them the covered cup of water, and discuss which tool could best be used to access this food source. Explain to students that only an insect that can easily pierce the plastic wrap can get nourishment from this food source. Do not allow students to smash the clothespin through the wrap. They will find that the scissors can easily pierce the plastic, but cannot suck up any liquid. Similarly, the sponge could easily suck up the liquid, yet cannot pierce the plastic.

With the leaves food source represented by sheets of paper, explain that the paper must be turned into small pieces, using only the hand holding a tool.

Finally, explain that for the plate of marbles food source, the marbles must be picked up and gathered using only the tools for gathering foods.

Collecting the Food

Now, show the students the two collection cups: one for wet food, the other for dry food. They will need to transfer each food source to the appropriate cup. Demonstrate the proper techniques for using the insect mouthparts:

- With one hand, set the straw (butterfly mouthpart) in the water, then cover the dry end with a finger, holding the water inside the straw. Place the straw over the wet collection cup and remove the finger from the end, releasing the water into the collection cup. Students are not allowed to use their mouths. Use the same technique for the mosquito.
- Whatever they can grasp or pick up with the clothespin or scissors (damselfly or ant) goes into the appropriate collection cup.
- The house fly is a special case. Flies turn solid foods into liquids by vomiting on it. The digestive juices and saliva in the vomit break down solid particles of food. To eat with the sponge, dip it in the liquid, then move it to the wet collection cup and squeeze out the contents.

Assigning the Tool, Time to Eat

Assign one tool to each student in each group of five. Either have groups sit in a circle on the floor, or arrange their desks together so they are in a circle, with their insect tools in hand and collection cups in front of them. Explain that each student, in turn, will have one minute to get as much nourishment as possible into the collection cups. Instruct students to take turns with food sources. One student will try the tool with a food source while the other four observe. After all five students have used a food source, groups will rotate food sources, and so on until all food sources have been used. Students will also rotate tools within each group so they each have a chance to use each tool. You will tell them when to begin feeding and when to stop. After a feeding session, students may need to quickly replenish the food sources before passing the tray to the person on their left. Have students in each group take turns so the others can observe. You will repeat this process, allowing one minute per food source, until each insect has had an opportunity to try each food source.

When the directions are clear to all of the hungry “insects,” begin the feeding frenzy. Be available to help replenish food supplies and calm the frustrated bugs who aren’t successful with a particular food. (It is particularly difficult to suck up a marble with a straw or pick up a marble with a pair of scissors.)

Recording the Activity

After the feeding frenzy is complete, allow some time for students to discuss their successes and failures within their groups and what they learned from the experience. Suggest questions, or post them on the chalkboard or overhead: Which insects were the most successful with what food sources? Why? Were any insects able to get nourishment from more than one food source? Why? Do they think that some insects are adapted to eat a larger variety of foods than others?

Finally, pass out a “Feeding Frenzy” activity sheet to each student. Have students work through it carefully, creating detailed illustrations and making detailed written observations.

MODIFICATIONS

Beginning:

Conduct the feeding experiment as a class. Gather students around a central table and either demonstrate, or have student volunteers demonstrate using each tool (mouthpart) with each food source.

Create a class experience chart, recording observation and information about each tool. Students can use this chart to help complete their activity sheets.

Advanced:

Ask students to record quantities from the feeding simulation. For example, how many raisins or marbles were gathered? How much liquid was collected? Compare these numbers to amounts gathered by others with the same mouthparts. Have students make a table compiling all the data from each group, and get an average number for each type of insect. Make some observations about which insects are food generalists (able to survive on a varied diet) and which are food specialists.

Have students go to science books in the library and read actual information about mouthparts or use the Internet to find insect websites at colleges or universities with accurate information.

MORE IDEAS

Plan an insect snack for the class. Combine yellow and blue powdered drink mix to make incredible green “nectar.” Prepare a large bowl of mixed lettuce and spinach leaves, torn into bite-sized pieces. Also prepare a bowl of bread cubes or croutons. Then gather students and enjoy eating like insects. Provide students with straws for the nectar and encourage them to eat the leaves with their own built-in pincers—thumb and finger, but only one leaf at a time!

TECHNOLOGY CONNECTION

Challenge students to replicate the table below and then fill in the blank column with three foods they could eat using the method listed—and no hands!

Method	Food
Drink	1. 2. 3.
Lick	1. 2. 3.
Chew	1. 2. 3.

ACTIVITY SHEET
FEEDING FRENZY

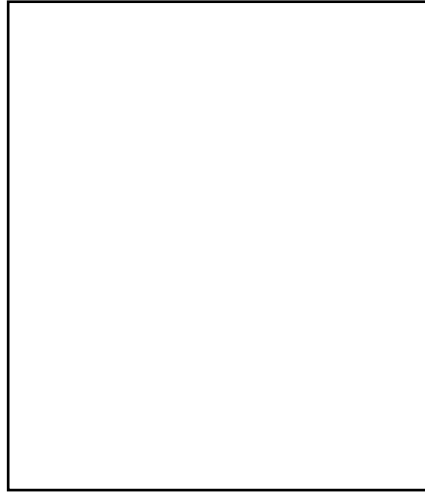
NAME _____

For each food source below, draw a picture of how you tried to get food. In the box marked “observation,” describe whether you were successful. Why or why not?

1. Cup of Water

Tool used:

What kind of insect has
that kind of mouth?



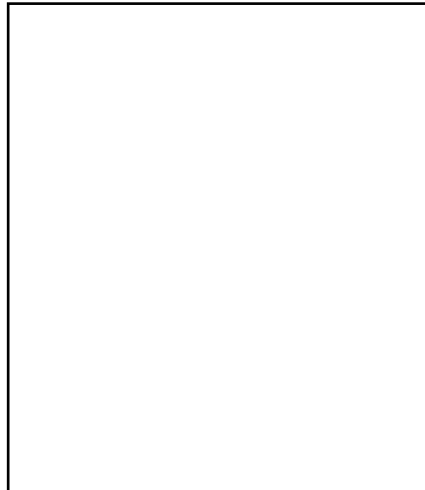
Illustration

Written observation

2. Covered Water

Tool used:

What kind of insect has
that kind of mouth?



Illustration

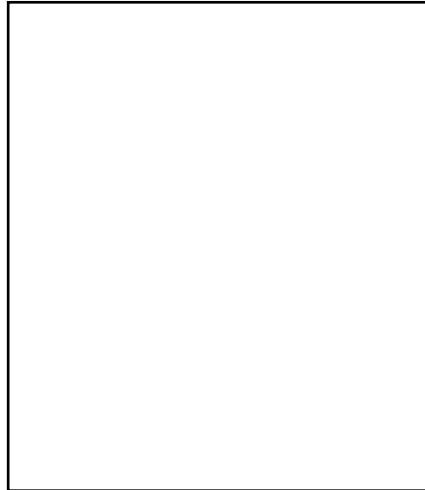
Written observation

ACTIVITY SHEET
EAT LIKE AN INSECT

3. Raisins

Tool used:

What kind of insect has
that kind of mouth?



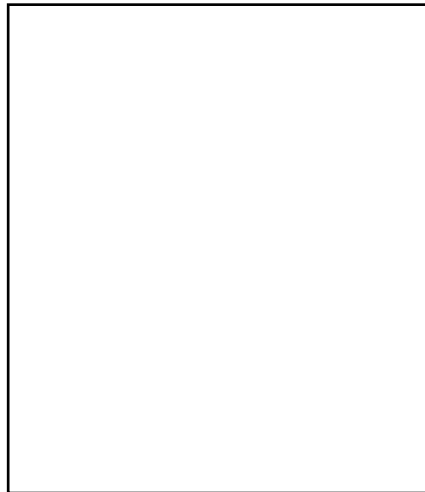
Illustration

Written observation

4. Marbles

Tool used:

What kind of insect has
that kind of mouth?



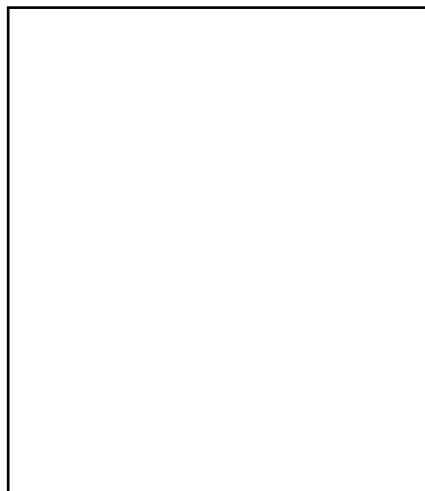
Illustration

Written observation

5. Paper

Tool used:

What kind of insect has
that kind of mouth?



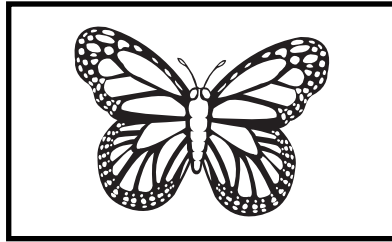
Illustration

Written observation

HANDOUT
WHAT'S IN YOUR MOUTHPART?



proboscis



butterfly



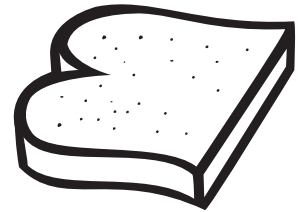
nectar



sponge-like mouthparts
with sucking proboscis



house fly



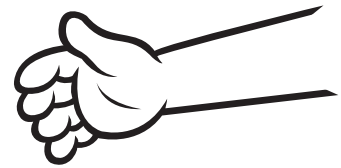
food scraps



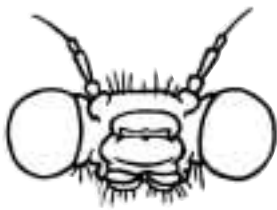
hollow, piercing mouthparts



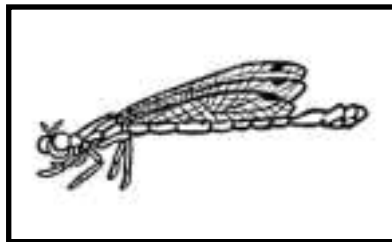
mosquito



blood



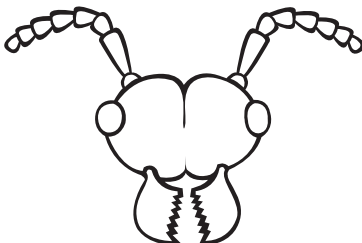
jaws



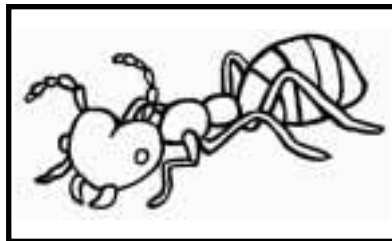
damselfly



mosquito



cutters



leafcutter ant



leaves