

Who Eats What? Mouthparts and Meals

Essential Question:

What do insects eat?

Background Information

The ecological roles that animals play in their ecosystems or habitats are, for the most part, determined by what and how they eat.

Contrary to some people's opinions, no species of insect eats everything. Collectively, however, they eat a wide variety of foods, and very few plants have been successful in fending off all insects. Some insects eat only live animals (carnivores, insectivores), others (scavengers) feed on dead animals or animal waste (e.g., feces). Some feed only on parts of animals, primarily fluids such as blood. Many eat plants (herbivores)– but their preferences may be flowers, seeds, stems, roots, leaves, wood or they may choose dead or rotting plant parts. Some insects eat fungi or microorganisms; some (omnivores) eat all kinds of things.

Within these ranges, some insects are generalists and these may, if leaf-eaters, for example, nibble leaves from a variety of plants. Other insects are specialists. These would only eat leaves from one – or maybe a few closely related – species of plants. As you might guess, each group or even species of insect has its own unique diet.

What insects eat affects our perceptions of them. We dislike those who eat our crops, woolen clothes, or blood! Alternatively, we tend to like the pest-eating predators or nectar-drinking pollinators (unless, of course, we are stung by a bee).

Like people, insects have one big limitation: they are limited to foods that their mouthparts and digestive systems can manage. The mouthparts of insects vary with what they eat. In general insects have a front lip (labrum), jaws (mandibles), and lesser jaws (maxilla) with pincer points for holding food and organs for tasting and smelling. Insects also have a tongue-like hypopharynx. Behind it is the salivary gland.

Basically, insects have two kinds of mouthparts: those for biting and chewing and those for sucking. There are innumerable variations. The mouthparts pictured belong to the following insects:

• CHEWING: BEETLE

Notice the sharp jaws (mandibles) of this predatory insect. Grasshoppers, wasps, beetles and ants are examples of insects with chewing mouthparts similar to people. They grasp food in

Location: Classroom/Outdoors

Objectives: *Learners will:*

- 1) describe how insects eat different kinds of food.
- 2) give examples of how insect mouthparts differ between species and limit diets.

Skills: communication, observation, listening, analysis

Supplies:

- Insect Mouthparts Worksheet
- Illustrations of insects and invertebrates mouthparts
- GEN Eco-service ID cards of insects and invertebrates for mouthpart identification.
- pencils and paper
- pliers
- Relay Race (per team) or Demo
 - pipettes
 - party blowers
 - sponge
 - turkey baster
 - four cups
 - stomach container
 - tray
 - water with food colors: red, orange, yellow
 - nuts

Subjects: science

Time: 30 min-1 hour

strong jaws. The jaws move sideways like hand shears or pliers to cut, tear, and chew food. Animal-eaters may also have spines on their jaws or front legs.

- **PIERCING-SUCKING: STINKBUG**

Insects that must pierce tissue to get to the fluids (blood in animals; sap in plants) need to have ‘sucking tubes’ that can pierce. The mosquito’s mouth looks like a long, piercing, sucking tube. Stylets in it move up and down into the victim.

- **SPONGING: HOUSEFLY**

This housefly uses a sponging technique. In the modified lip (labium), saliva secretions are pumped onto the food source. This wets and partially liquefies the food so it can be sponged up into the mouth.

- **SIPHONING: BUTTERFLY**

A butterfly has a long proboscis (tube), which uncoils to suck up nectar from a flower.

Getting Ready:

Decide if you want to do the Insect Mouthparts Demonstration or Relay Race. The Relay Race will require more supplies than the Insect Mouthpart Demonstration. Copy the Insect Mouthparts Worksheet for each student.

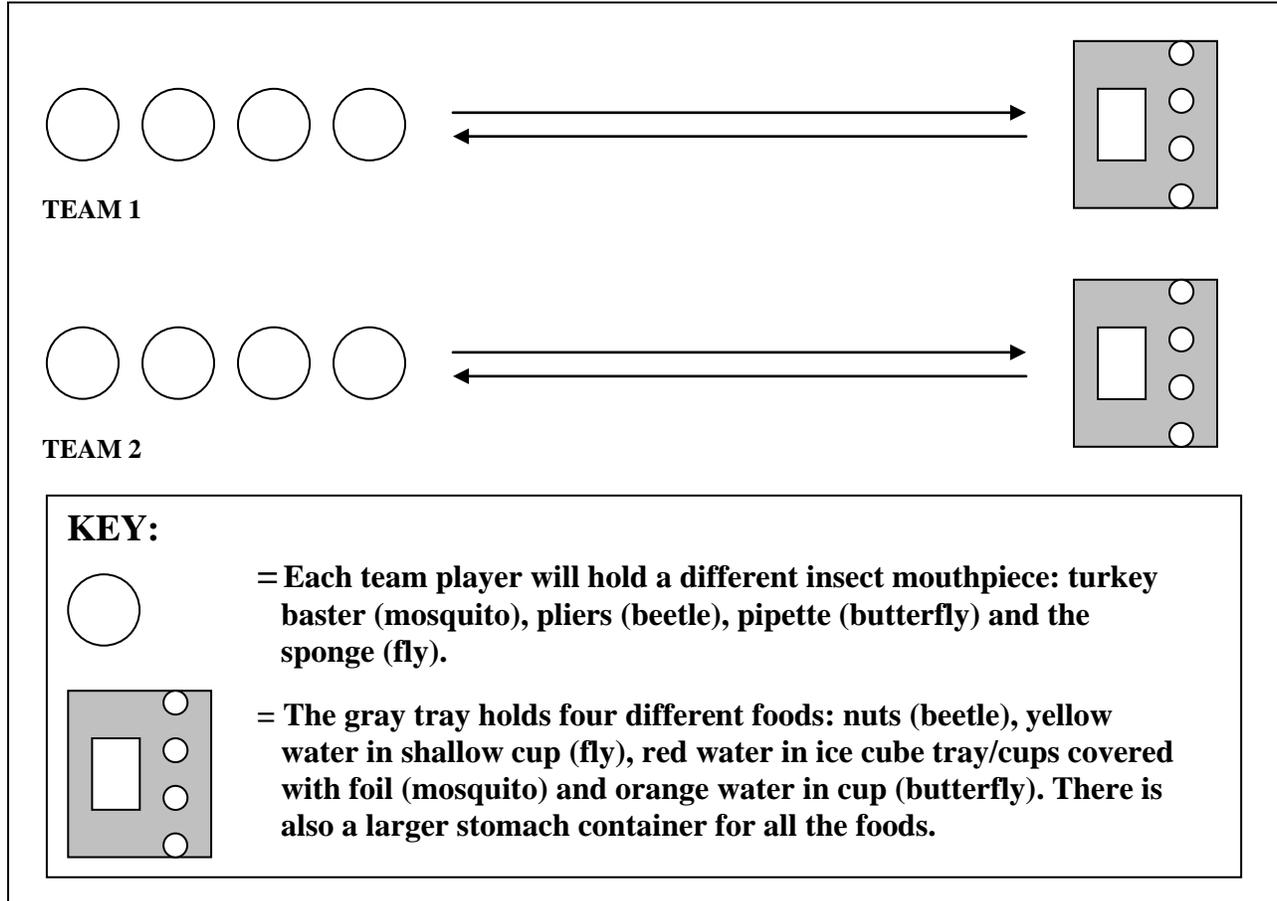
Procedure:

1. Ask students if they think insects are important? Why or why not?
2. Ask: What are some good things about insects? What are some bad things about insects?
3. Explain the importance of what insects (and all animals) eat to their roles in ecosystems and to our perceptions of whether they are helpful or harmful to people. (*See general Teacher Background.*) For example, we like butterflies that drink nectar, but not mosquitoes who go after our blood). So, to be knowledgeable about any insect or other animal, it is important to discover what it eats.
4. Ask students if they have ever seen insects eating? What were they eating? [List student responses on the board.] [All plant parts; blood; body liquids; wastes, live and dead animals; cooked food; etc.] If students give an incorrect response, lead students in realizing that insects do not eat that.
5. Ask: Do all insects eat the same things? Use questions to encourage discussion (Do butterflies eat blood? Do flies eat leaves? Do grasshoppers eat nectar?) Explain that many insects do not eat the same things and none eat every thing. Point out how some insects are generalists and some specialists For example, monarch butterflies can drink nectar from many different flowers. This is a generalized feeding behavior, so we could say that monarch butterflies are generalists. The monarch caterpillar, however, can only eat leaves from the milkweed plant. This is a specialized feeding behavior, so the monarch caterpillar is a specialist.
6. **Insect Mouthparts Demonstration:** An easy and effective way to show the students how different insect mouthparts work is to give them a quick demonstration. Show students the various devices and how they can be compared to insect mouthparts.

Device	Function	Insect
pliers	tearing and chewing food	beetle
party blower and pipette (or straw)	to show the way it wraps up and the pipette or straw for the sucking part	butterfly
turkey baster or pipette in a glass of water (use food coloring to make it easier for students to observe)	pierces the skin and draws up the liquid (blood)	mosquito
sponge (pour some water in a tray and soak it up with a sponge)	soaks of liquids	fly
pliers (hold pliers sideways and move them back and forth)	tear and chew plants	grasshopper

7. **Insect Mouthparts Relay Race:** See **Figure 1 Insect Mouthparts Relay Race** for the set-up. The students race up to the tray with their mouthpiece, transfer the correct food into their stomach container, then race back to the back of the line and hand their mouthpiece to the next person in line who doesn't yet have one. You can make the student do movements for their insect too.

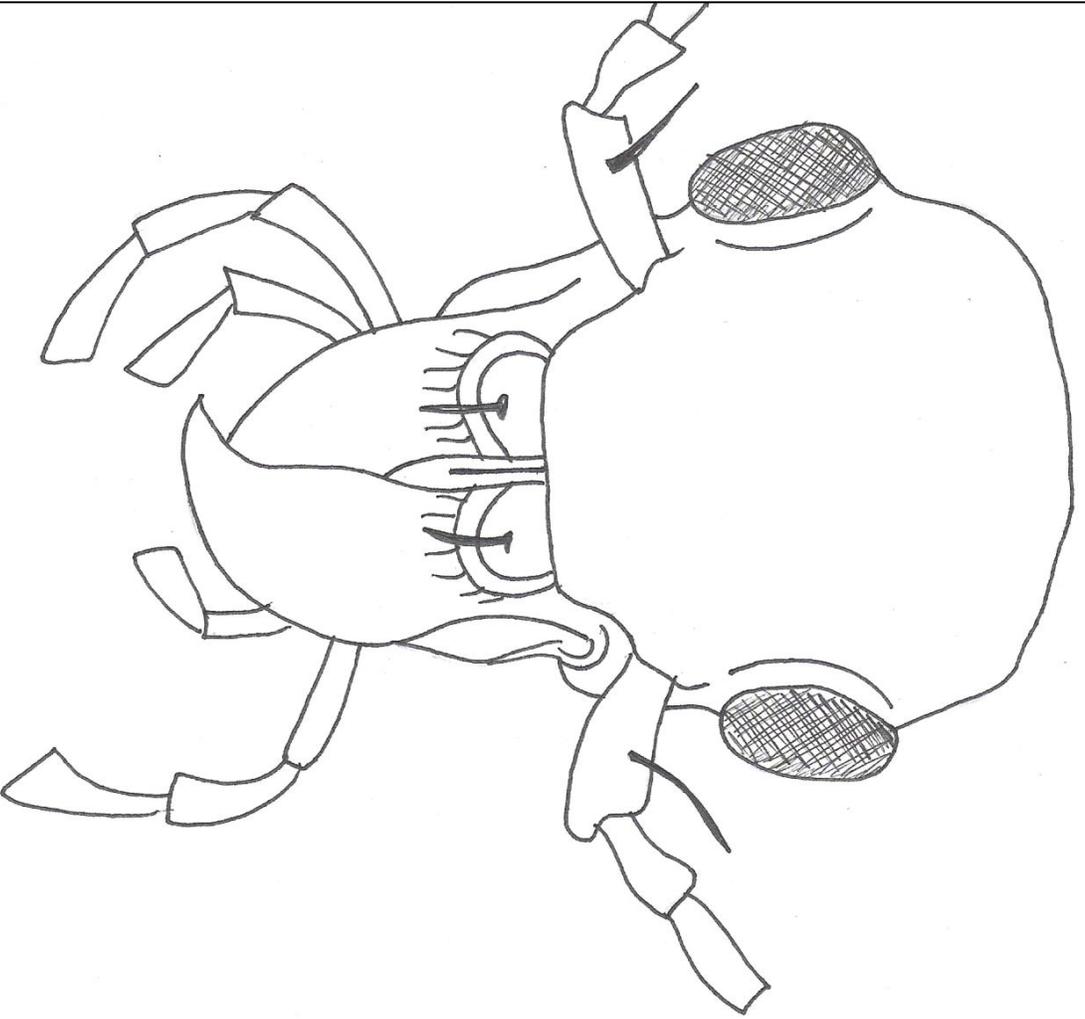
Figure 1: Insect Mouthparts Relay Race:



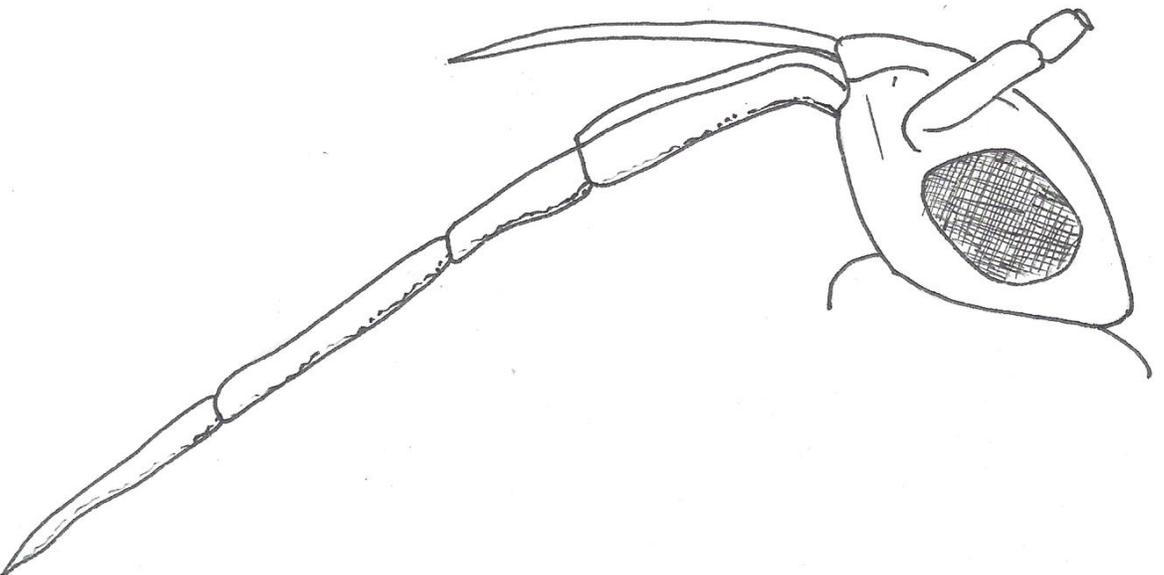
- 8. Creating Mouthparts:** Explain that one reason that insects eat different things is that, unlike people, they have different mouthparts. Distribute the Insect Mouthparts Worksheet with six identical insect heads. Now, ask learners to draw mouths on their heads for each insect as you describe what it eats. Some insect mouthpart description examples:
1. An insect that sips nectar from a deep flower. (A long straw-like mouthpart)
 2. An insect that sucks blood. (A straw-like mouthpart with a piercing tip)
 3. An insect that eats larvae and other insects. (Sharp cutting, tearing jaws)
 4. An insect that eats grasses or leaves. (Sharp, cutting jaws)
 5. An insect that laps blood. (A sharp cutting edge and lapping device like a sponge)
 6. An insect that sucks sap from leaves. (A straw-like mouthpart with a piercing tip)
 7. Design an insect mouthpart and explain what it eats.

Discussion/Assessment:

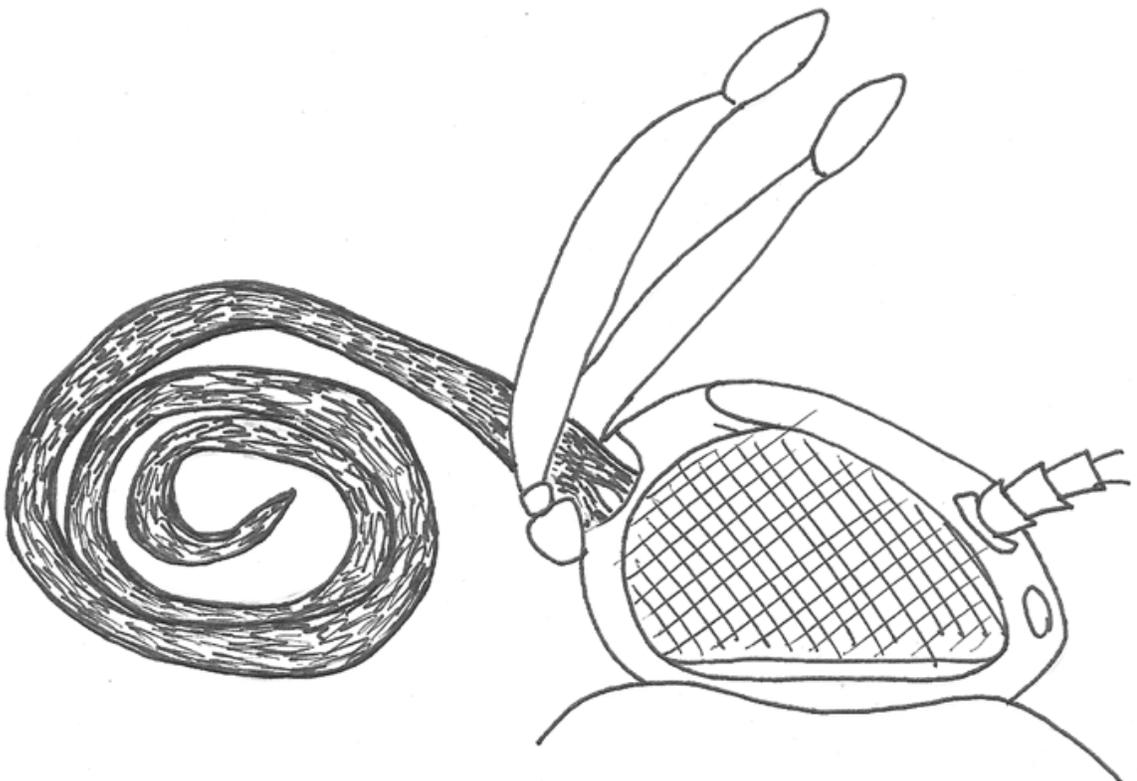
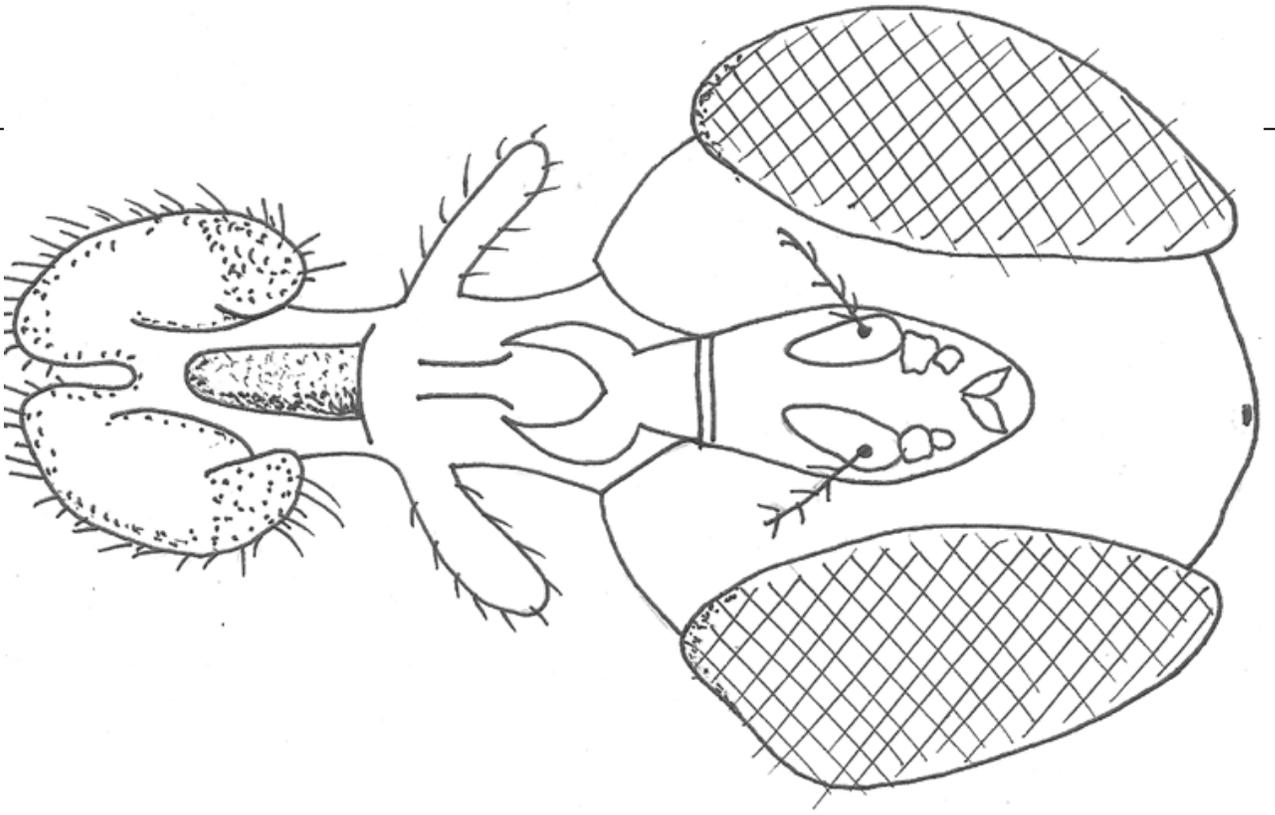
Distribute the GEN Eco-services ID cards of invertebrates to students, giving one to each student or pair of students. Ask them to look at the information on the back to discover what kind of food that invertebrate eats. They should then look at the picture to see if they can determine what kind of mouthparts the invertebrates have. Do they have mouthparts to puncture and suck in liquids? To bite and chew? To sponge? Or do any have mouthparts that work in other ways. Consider what kind of mouthparts humans have.



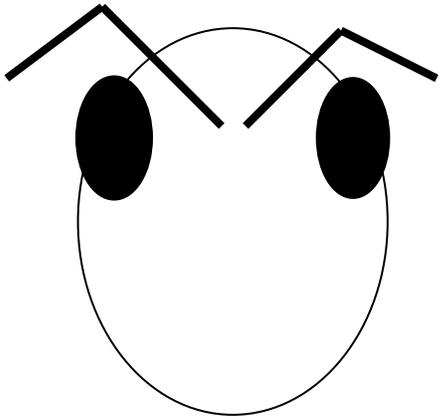
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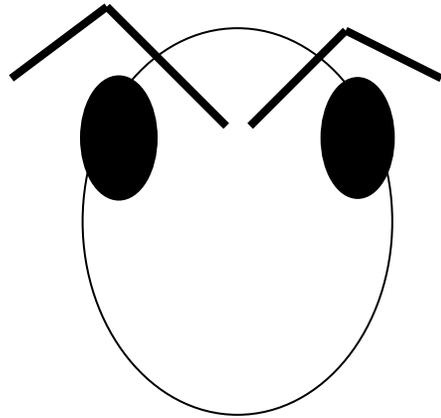
**PIERCING-SUCKING:
STINKBUG**



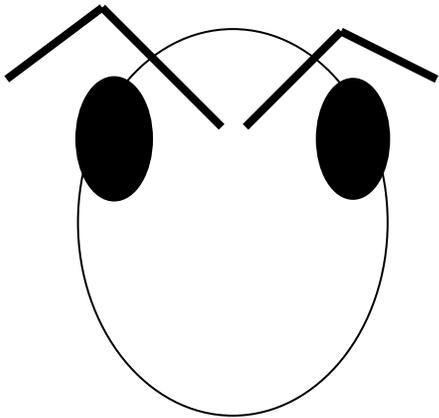
INSECT MOUTHPARTS WORKSHEET



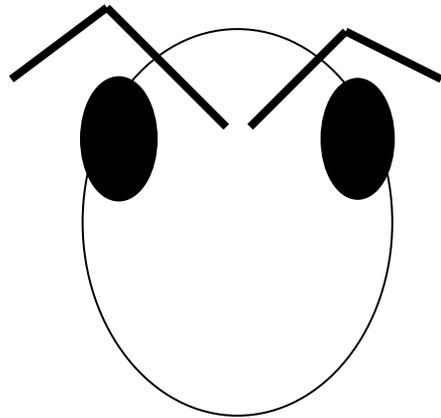
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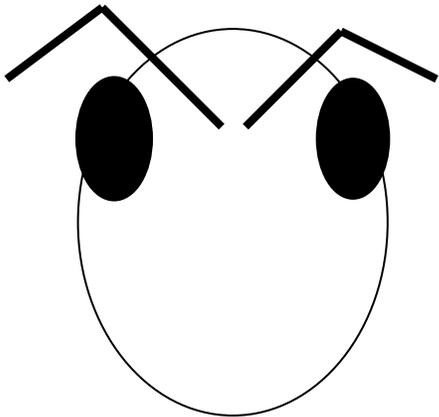
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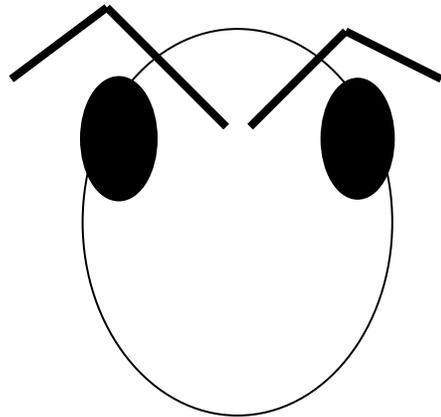
C. _____



D. _____



E. _____



F. _____