Pollinators Investigators

A unit on animal senses from:

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This unit meets the following Next Generation Science Standards:

Life Science Standards for Fourth Grade:

4-LS1-2: "Use a model to describe that animals use different types of information through their senses, process the information in their brain, and respond to information in different ways."

Science and Engineering Practices:

Students will plan and carry out investigations (SEP-3), analyze and interpret data (SEP-4) and use mathematics and computational thinking (SEP-5) as they engage in argument from evidence of their explorations (SEP-7).

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Summary

As an exploration into how pollinators sense their environments, this unit will engage students in the naturalistic observation of pollinators around their school grounds, lead them through an exploration of hummingbird adaptations, and wrap up with an investigation of hummingbird senses that incorporates science, engineering, arts, and mathematics.

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1. Pollinator Stroll

Supplies:

Science notebooks

Time:

50 minutes

Objectives:

The students will gather evidence about animal senses (NGSS 4-LS1-2) by going outside and observing pollinators in their local environment. Students can use the data they collect as evidence to construct an argument [SEP-7] about the way a pollinator senses its environment. Together, student teams can use a "Questions, Claims, and Evidence" format to organize their argument that certain pollinators are attracted to certain colors, shapes, and smells.

Activity:

Review the most common animal pollinators with the students (bees, butterflies, hummingbirds, beetles, moths, and ants). Tell the class that they will be going out to see if they can find these pollinators and (hopefully) catch a few in the act of pollinating. Have the students bring their science notebooks for logging their observations. The students can work individually or in teams to log their observations

Take the class on a short walk outside or to a contained space they can explore at-will. Ideally, plan a route where they will see flowers and choose a time of day when the sun is bright. This will be the best chance for seeing a variety of species.

For each pollinator sighting the students should record:

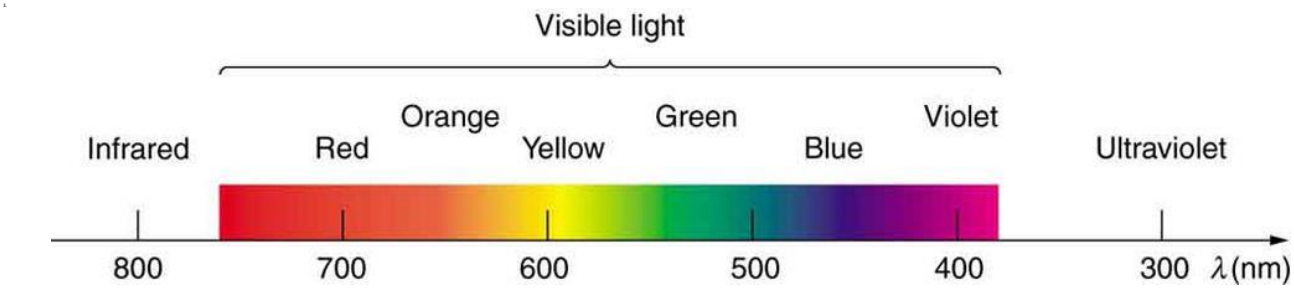
1. What kind of pollinator do you see?
2. What is it doing? Is it flying or perching? Is it moving zig-zag or in a straight line? What else can you observe about its behavior?
3. Where is it? Is it on a flower, a branch, a piece of trash? What colors, smells, and textures are in its surroundings?

When you return to the classroom, have the students team up and use their observations to develop arguments about how pollinators sense their surroundings. They may choose to support their arguments with graphs, drawings, or models. You may prefer to have the students choose one pollinator or include every kind observed. At the end of the lesson, have the students write down what they still wonder. Do they wonder why bees were only at one kind of flower or why hummingbirds were sitting in the branches? These questions can be used to spark curiosity for further research.

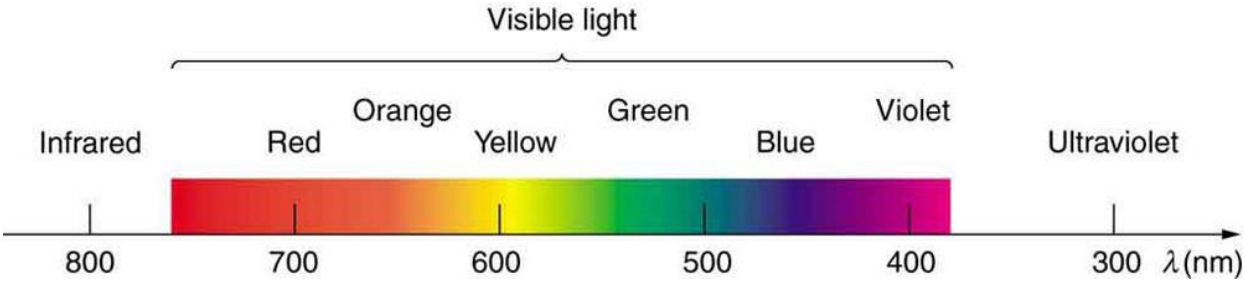
2. Pollinator Senses

The colors shown indicate what colors humans can see. After watching the pollinator video, circle the colors that each pollinator below can see. Then, use a separate sheet of paper to draw and color what a flower might look like for each of the four kinds of pollinators!

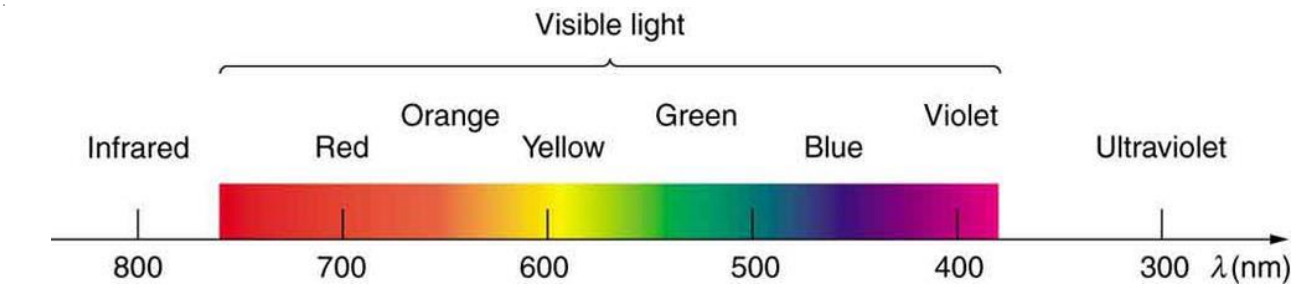
Beetles:



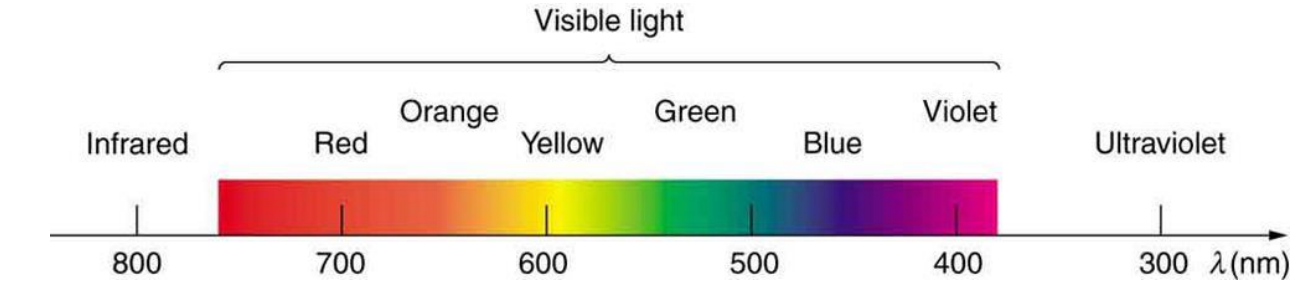
Bees:



Hummingbirds:



Butterflies:



3. All about hummingbirds

Supplies:

Science notebooks

Time:

20 minutes

Objectives:

The students will test their reading comprehension skills in a short reading about hummingbird adaptations and senses (4-LS1-1 and 4-LS1-2). Encourage the students to ask questions about hummingbirds.

Activity:

Have the students do the one page reading labelled "All about hummingbirds." When they have finished, have them answer the question worksheet.

Discuss the answers as a class. At the end of the lesson, have the students write down what they still wonder about hummingbirds. These questions can be used to develop testable hypothesis for the Hummingbird Experimentation Station activity.

All about Hummingbirds

Birds, especially hummingbirds, have good eyes and seem to be especially attracted to bright colors. Animal eyes (humans too) have what we call cone cells. These cone cells help the animal to see colors. Humans have three kinds of cones. Hummingbirds have five cones, which allow them to see ultra violet light. However, birds have a poor sense of smell (yes, it is OK to put fallen babies back into the nest -- the parents cannot smell your scent). Bird-pollinated flowers are brightly colored, especially red, but lack odor.

Hummingbird-visited flower petals are curved to be out of the way. Hummingbirds are hover-feeders, so the flowers are designed to dust the bird's head and back with pollen as the bird probes the flower for nectar. Flowers such as Columbine, red Salvia, and Fuchsia are favorite nectar sources for hummingbirds. Very thin tubular blossoms, such as those of red fairy trumpet, keep out fat bees, but are exactly the right length and width for the beaks of hummingbirds.

Being a hummingbird is like driving a car with a one-gallon gas tank: there is an almost constant need to refuel. Hummingbirds are often dangerously close to the limits of their energy reserves. On cold nights, when the costs of keeping warm are especially high, it may be too risky for a hummingbird even to keep its engine idling.

At such times, a hummingbird bristles its feathers to let its body heat escape, and its temperature quickly approaches that of its surroundings. Its heart rate drops dramatically, and it may stop breathing for minutes at a time. It appears lifeless, clinging motionlessly to its branch with its head drawn close to its body and its bill pointing sharply upward. At daybreak it revs its metabolic engines and warms itself again.

This sort of temporary hibernation is called *torpor*. Hummingbirds become torpid as an adaptation that not only deals with energy crises, but also saves energy for migration. And since birds lose moisture with every breath, becoming torpid also helps hummingbirds in dry areas conserve water.

Name _____

1. Hummingbirds are especially attracted to what color flowers?

2. Do hummingbirds have a good sense of smell?

3. Do hummingbirds have good eyesight?

4. What do hummingbirds eat?

5. What shaped flowers favor hummingbirds?

6. Pollen sticks to which parts of a hummingbird's body?

7. What is *torpor*?

8. How does *torpor* help hummingbirds in dry climates?

4. Hummingbird Experimentation Station

Supplies:

- Empty 2-liter bottles with caps
- Hummingbird nectar (Prepare the hummingbird feeder beforehand by boiling 4 parts water to 1 part sugar)
- Materials for decorating feeders (could include permanent markers, acrylic paints, different colors of foam for cutting out flowers or other shapes, pipe cleaners, stickers, straws, glue)
- Sharp scissors or an exacto-knife
- String (embroidery thread works)

Time:

Initial set-up: 30 minutes

Feeder visits: 15 minutes/visit. Aim for visiting at least 2 times a week.

Objectives:

The students will gather evidence about animal senses (NGSS 4-LS1-2) by setting up an experiment on what kinds of feeders hummingbirds like. Students can use the data they collect as evidence to construct an argument [SEP-7] about hummingbird senses.

Activity:

You may want to prepare the bottles ahead of time, which should have labels removed and several holes at least the size of your palm. It is important that all openings are roughly on the same height of the bottle so that all can have the same amount of nectar.

Arrange the students into teams and tell them that they have a challenge: See who can design a feeder that hummingbirds will visit the most. Give each team an empty 2-liter bottle. You may want to have the students write a plan in their science notebooks before designing their feeders. What kinds of decorations would attract a hummingbird? Why?

Have the teams decorate their feeders until they are happy with it. The students can decorate with markers, pipe cleaners, or paints. Some students may choose to make their feeders look like a flower, while others may choose more abstract forms.

Tie a string around each bottleneck and hang outside. You may also want to consult with the students to predict the best hanging locations. Put the same measured amount of nectar in each feeder. You may also want to make a line with a permanent black marker where the nectar reaches.

The first few days, you should plan to make regular class visits to see which feeders have been visited. The hummingbirds may initially prefer some red feeders, and so these may be quickly visited. However, hummingbirds are quick learners, and so they are likely to visit all feeders eventually. If no evidence exists that hummingbirds have visited the feeders, have the students come up with reasons why that might be. The students may want to bring their science notebooks to take notes.

At the end of the week, or chosen amount of time for the experiment, bring the feeders inside. It is not recommended to leave it out longer than 2 weeks, as the sugar water could grow mold and hurt the hummingbirds. Measure how much nectar was taken from each feeder using measuring cups. If all 2 liter bottles are the same shape, another option is to use a ruler to measure the distance between the nectar level and the solid black line. Have the students log how much nectar was taken from each feeder in their science notebooks. Keep all feeders out on a table somewhere so that students can see them.

The question is what kinds of feeders hummingbirds prefer, and so discuss how to analyze the results. What categories could we come up with? Red feeders, blue feeders, multi-color feeders, etc.? Flower feeders, solid color feeders, etc.? Feeders by the flowers vs feeders by the window? Decide on a way to analyze the results. Make a table of the results, and have the students make a graph based on this table. A writing activity could easily be incorporated by having the students write up their findings. Have the class develop claims about hummingbirds based on what they found and identify questions they still have about hummingbirds for further research.