

Unit 4: How Organisms Process Information

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **3 weeks**
Status: **Published**

Disciplinary Core Ideas

Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

4-PS4-2	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
4-LS1	From Molecules to Organisms: Structures and Processes
4-LS1-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Essential Question

Specific NGSS: 4-LS1-2 and 4-PS4-2

Essential Unit Question:

- How do animals use their perceptions and memories to make decisions?

Guiding Questions:

- How do animals receive and process different types of information from their environment in order to respond appropriately?
- What happens when light from an object enters the eye?

Objectives:

- SWBAT use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. \
- SWBAT develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Concepts that will be taught...

1. A system can be described in terms of its components and its interactions.
2. Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain.
3. Animals are able to use their perceptions and memories to guide their actions.
4. Cause-and-effect relationships are routinely identified.
5. An object can be seen when light reflected from its surface enters the eyes

Learning Activities

- In this unit of study, students use the concept of *systems* to understand that every animal has internal and external structures that allow it to take in information from the environment in which it lives, process that information, and respond in ways that increase its chances to grow, reproduce, and survive.
- The way in which an organism gathers information will depend on the organism and the body structures that pick up signals from the environment. Many animals, like humans, have sense organs that gather information from the environment through seeing, hearing, feeling, smelling, and tasting. Some animals have sensory receptors or other mechanisms that allow them to sense such things as light, temperature, moisture, and movement. Students need to understand that all animals pick up information from their environment through senses or sensory receptors. In many animals, nerves or neurons then transfer that information to a centralized place (the brain) where it is processed; then, through reflex reactions or learned behaviors, the organism responds in ways that will help it survive and reproduce. In addition, animals often store this information in their brains as memories and use these memories to guide future actions. As students observe animals, either through direct observation or using text and digital resources, they should use models, such as drawings, diagrams, and pictures, to describe the ways that animals (and humans) receive, process, store, and respond to information from the environment in order to survive, grow, and reproduce.
- To continue the progression of learning, fourth graders focus on the sense of sight, using models to understand and describe that light reflects from objects and enters the eye, allowing objects to be seen. In first grade, students learned that objects can be seen only when illuminated, and they determined the effect of placing different materials in the path of a beam of light.
- In this unit, students need opportunities to develop a conceptual understanding of the role that light plays in allowing us to see objects. Using a model can help with this process, which might include the following steps:
 - To review prior learning, ask students to describe what happens to our ability to see objects in a room with no light, and what happens when different types of materials are placed in the path of a beam of light. (If necessary, demonstrate using flashlights and a variety of transparent, translucent, and opaque materials).
 - Using penlights, a variety of lenses, mirrors, and pieces of cardboard, allow students to explore the

behavior of light when it comes into contact with these objects. Have students draw and describe what they observe.

- Using a cardboard shoebox with a 1-cm. slit at one end, shine a flashlight into the box through the slit, and ask students to describe what they see. Place a clear plastic cup of water in the path of the light, and ask students to describe what they observe.
- Students should first observe that light travels in a straight line. Lenses and water allow the light to pass through; however, the beam of light is refracted (bent). Mirrors do not allow the light to pass through, but do reflect light, sending the beam in a different direction. The cardboard does not allow any light to pass through, and the beam of light is no longer visible in the same way.
- Next have students observe a large object, such as a book. Ask them to describe what they see. Place a sheet of transparency film or clear plastic wrap in front of the book, and ask students to again describe what they see. Ask, “How are you able to see the book even though I have placed something in between you and the object?”
- Take away the clear plastic wrap and place a sheet of dark construction paper in front of the book, and ask student to describe what they see. Ask, “Why are you no longer able to see the book?”
- To help students as they try to understand the role that light plays in allowing us to see objects, tell them that they will be using a model that demonstrates how we see objects.
- Have students use pinhole viewers. (If possible, make these ahead of time. You can find a variety of models and types that are easy to build on the Internet. YouTube has a number of videos that show pinhole viewers made from a variety of materials such as a Pringles tube or black poster board.) Show students how the pinhole viewers are constructed and what is inside each. Then have students go outside and view objects using the pinhole viewers. As students make observations, they should document what they observed.
- As a class, discuss what students observed, then draw a model on the board that depicts the phenomenon. (Light bounces off of an object, travels through the pinhole, and is visible—upside down—on the tracing paper inside the pinhole viewer.)
- Tell students that this is what happens with our eyes. Light bounces off objects, similar to the way in which it bounces off a mirror, and that light travels into the eye, enabling us to see the objects. We could see the book through the clear plastic wrap because the light that bounces off the object is able to travel through the transparent material and still reach our eyes. We could not see the book through the dark construction paper because the light that was bouncing off the object could not travel through the paper, so our eyes did not receive that light. Therefore, we did not see the book.
- With guidance, as needed, have students draw models/diagrams of the pinhole viewer and the human eye, and have them describe what they observed.

Unit: Human Machine - Body, Senses & the Brain

***These 4 Mysteries provide 4 weeks of content. This introductory human body unit takes the perspective that we can think about our bodies as being like a machine. We have parts for moving around, sensors, and a built-in computer. Students explore their senses and consider how the information we process helps us understand and react to our environment.*

Mystery 1: Muscles & Skeleton

***Students discover the mechanism by which their muscles control their bones (i.e., how their bodies move!). In the activity, students develop a robotic finger based on how their own fingers work.*

Essential Question - Why do your biceps bulge?

Materials: Each student will need - a Robot Finger template, scissors, a ruler, a notebook or pile of paper, a 3 X 5 card, 1 sticker measuring about 1/2" by 1/2", 18" of string, 2 paperclips (small or medium). If you decide your class will make robot hands, each group of four students will need - 4 completed Robot Fingers, a Robot Hand template, a sheet of cardboard that's at least 6" by 8" (from cereal box), a glue stick, scissors.

Procedure: Prior to teaching lesson, watch activity instructions and obtain/print out all necessary student materials and teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. View Exploration video (25 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping and carrying out Activity: Robot Finger (30 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: Informal observation during exploration & activity, Mystery 1 assessment

Mystery 2: Eyes & Vision

***Students discover the basics of how their eyes work, and figure out some of the causes of vision problems. In the activity, students develop a working model of a human eye.*

Essential Question - What do blind people see?

Materials: Each student will need - a credit-card-sized 3X magnifying lens, Front of the Eye template, scissors, a marker, colored pencil or crayon for coloring the iris, 2 stickers measuring about 1/2" by 1/2", a 3 X 5 card.

Procedure: Prior to teaching lesson, watch activity instructions and demonstration video. Then obtain & print out all necessary student materials and teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. View Exploration video (25 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping and carrying out Activity: Eye Model (30 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: Informal observation during exploration & activity, Mystery 2 assessment

Mystery 3: How Eyes Work

***Students delve further into the workings of the eye, exploring the function of their iris and pupil. In the activity, students add to their eye model (created in Mystery 2) and experiment to see how the pupil affects vision.*

Essential Question - How can some animals see in the dark?

Materials: Each student will need - "A Smaller Pupil" handout, scissors, the same color markers students used to color the iris last time.

Procedure: Prior to teaching lesson, watch activity instructions and demonstration video. Then obtain and print out all necessary student materials & teacher answer keys. Access Mystery Science website on SmartBoard. Utilize classroom iPads for small group/individual use as desired. View Exploration video (20 min). Follow prompts for stopping points for questioning & discussion. Guide students in prepping and carrying out Activity: Pupil Card (20 min). Optional Extras are available to supplement lesson (2 hrs).

Assessment: Informal observation during exploration & activity, Mystery 3 assessment

Assessments

Science Textbook

- Chapter Review
- Chapter Test

Mystery Science

- Individual Mystery Assessments
- Summative Assessment
- Informal Observation during explorations & activities

Teacher-Made Assessments

- Quizzes
- Tests
- Classwork
- Homework
- Projects

Materials & Resources

www.mysteryscience.com

Mystery 1: Each student will need - a Robot Finger template, scissors, a ruler, a notebook or pile of paper, a 3 X 5 card, 1 sticker measuring about 1/2" by 1/2", 18" of string, 2 paperclips (small or medium). If you decide your class will make robot hands, each group of four students will need - 4 completed Robot Fingers, a Robot Hand template, a sheet of cardboard that's at least 6" by 8" (from cereal box), a glue stick, scissors.

Mystery 2: Each student will need - a credit-card-sized 3X magnifying lens, Front of the Eye template, scissors, a marker, colored pencil or crayon for coloring the iris, 2 stickers measuring about 1/2" by 1/2", a 3 X 5 card.

Mystery 3: Each student will need - "A Smaller Pupil" handout, scissors, the same color markers students used to color the iris last time.

Accommodations & Modifications

- Large print textbooks
- Additional time for assignments
- Review of directions
- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Adaptive writing utensils
- Support auditory presentations with visuals
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Space for movement or breaks

- Extra visual and verbal cues and prompts
- Books on tape
- Graphic organizers
- Quiet corner or room to calm down and relax when anxious
- Preferential seating
- Alteration of the classroom arrangement
- Reduction of distractions
- Answers to be dictated
- Hands-on activities
- Use of Manipulatives
- Follow a routine/schedule
- Alternate quiet and active time
- Teach time management skills
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Daily check-in special education teacher
- Visual daily schedule
- Varied reinforcement procedures
- Immediate feedback
- Personalized examples