

Vision: How we see

Lesson Plan for Grades __9, 10__
Length of Lesson: _2_ hr _15_ min (2 days)

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Subject area/course: Biology

Materials:

- Sticky notes
- A piece of paper with an arrow drawn on it
- A pencil
- A bowl full of water
- Scissor
- Cardboard covered with black construction paper
- Cardboard covered with white construction paper
- A candle or lamp
- Ruler

TEKS/SEs:

(2) Scientific processes. The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

- (B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;

(10) Science concepts. The student knows that biological systems are composed of multiple levels. The student is expected to:

- (C) analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.

Lesson objective(s):

- Students will be able to describe the how different parts of the eye work together to allow for vision
- Students will explain why and how a visual illusion can occur

Differentiation strategies to meet diverse learner needs:

- Provide a visual illustration of an example model of the eye
- Teacher will wait at least 3 seconds before calling on a student after posing a question

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Learners learning in a second language

- Think pair share: this strategy is when students are asked to pair up to think about the answer to a question or brainstorm activity. Then, they are asked to share their thoughts with the class.
- Review and practice concepts—have students teach each other concepts and note similar and different things that they did.
- Implement more formative assessment. Formative assessment is a strategy teachers use to change their lesson plans on the fly. For example, if a teacher poses a question that students are already supposed to know for a lesson but the teacher finds out that students don't actually know the answer—the teacher will then modify the lesson plan to include a mini lesson on that question or concept.
- Give students an opportunity to practice speaking (before presentation)
 - have them record themselves and send it to teacher for corrections

Students with reading and writing difficulties

- Give students plenty of space to write
- If students have visual impairments, provide recordings or text that is enlarged

Students with attention and behavioral challenges

- Use open ended questions that allow students to express their thoughts
- Structure long term assignments into smaller and manageable segments. Have students work on one task at a time.
- Build in mental breaks that allow students to regroup, stretch, and get out of their seats
- Have students keep an organizer or a binder where they can keep all their work materials in the order that they received them

ENGAGEMENT

- Teacher will place an arrow sign behind a clear bowl of water and ask students to note what happens as the teacher moves the arrow from the middle to either side of the bowl
- The teacher will also submerge a pencil halfway in the water.
- Teacher will pose these questions to the class: “Why does the arrow flip over/reverse directions? Why does the pencil bend?”
- Students will be asked to take a minute to brainstorm the answer with a partner or their group
 - Students will write their answers on a sticky note and save it for later use
- Teacher will randomly call on a few students to provide an answer
- After a few students have answered, the teacher will ask students to save their sticky notes with answers for later use

EXPLORATION

- Students will build a model of the eye
- Teacher will give students a worksheet with instructions (please see student pages for the instructions and worksheet, and teacher pages for the answers) on how to build a model of the eye (instructions below are from the “Procedures” section of this link: <http://www.discoveryeducation.com/teachers/free-lesson-plans/sight-and-light.cfm>)

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1. Use a scissor or a small hook to make a hole through cardboard covered with black construction paper (the teacher may do this beforehand if they wish)
 2. Keep the black cardboard upright on one side of the bowl filled with water and a cardboard covered with white construction paper on the opposite side of the bowl
 3. Place a lamp (or light the candle) so it is shining through the hole in the black cardboard.
 4. Make sure the room is dark and that all lights are off
 5. Move the white cardboard from side to side until an image of the lamp or candle appears on it
- Students will then write notes on how they think this demonstration is a representation of an eye
 - Teacher will then assign students to take a few moments **to read or watch an animation** of how the eye works and take notes.
 - <http://www.physicsclassroom.com/class/refrn/Lesson-6/The-Anatomy-of-the-Eye>
 - <http://sites.sinauer.com/neuroscience5e/animations11.01.html>
 - What are the similarities and differences between the model and an actual eye? Students will be asked to answer these questions on a worksheet

EXPLANATION

- Students will present their model of an eye as a group (teacher will only pick a few groups) and how it is a representation of the eye
- Another group of students will be called on to share similarities and differences between the model eye and an actual eye
- Teacher will pose these questions as students present to gauge student thinking:
 - How do you know?
 - Why do you think that?
 - What was one interesting thing you learned from building this model?

ELABORATION

- Students will be asked to revisit the question of why the arrow reversed directions when placed behind a bowl full of water
- They will take out their sticky notes and be given a few minutes to change their answers if they would like, based on what they learned by building a model of the eye
- Students will then go to the website below and read an explanation about why this phenomenon occurs
 - <http://physicscentral.com/experiment/physicsathome/reversing-arrows.cfm>
- One or two students will be randomly called on to explain why the arrow reversed directions. To randomly call on a student, teachers can make use of popsicle sticks or slips of paper with names in a box.

EVALUATION

- Students will be evaluated based on their answers on their worksheet and their presentations

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SOURCES AND RESOURCES

- Dr. Bruce Hood's Hot Science – Cool Talks Lecture # 95
- <http://physicscentral.com/experiment/physicsathome/reversing-arrows.cfm>
- <http://www.physicsclassroom.com/class/refrn/Lesson-6/The-Anatomy-of-the-Eye>
- <http://sites.sinauer.com/neuroscience5e/animations11.01.html>
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EXPLORATION ACTIVITY or ACTIVITIES

Purpose

To build a model of the eye and learn about how it functions to allow for vision

Materials

- Clear bowl full of water
- Scissor
- Cardboard covered with black construction paper
- Cardboard covered with white construction paper
- A candle or lamp

Safety Information

Students should be careful when making a hole through the cardboard using a sharp object such as a scissor

Procedure

- Students will first build a model of the eye
 1. Use a pen or a small hook to make a hole through black cardboard (the teacher may do this beforehand if they wish)
 2. Keep the black cardboard upright on one side of the bowl and a white cardboard on the opposite side of the bowl
 3. Place a lamp (or light the candle) so it is shining through the hole in the black cardboard.
 4. Make sure the room is dark and that all lights are off
 5. Move the white cardboard from side to side until an image of the lamp or candle appears on it.
- Students will discuss how they think the model represents a real eye
- Then, they will either be assigned to watch a simulation/video or read an article about the eye
 - <http://www.physicsclassroom.com/class/refrn/Lesson-6/The-Anatomy-of-the-Eye>
 - <http://sites.sinauer.com/neuroscience5e/animations11.01.html>

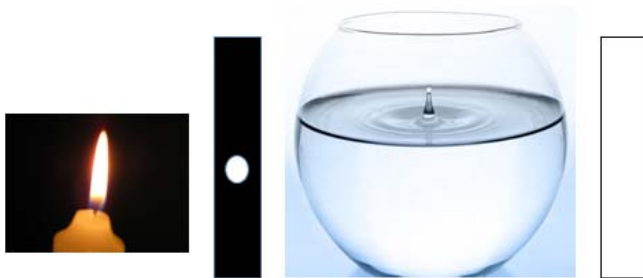
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TEACHER PAGE(S)

Instructions and Worksheet

Instructions to build a model of the eye:

1. Use a scissor or a small hook to make a hole through black cardboard (radius of approximately .7 inches)
2. Keep the black cardboard upright on one side of the bowl and a white cardboard on the opposite side of the bowl (see the diagram below)
3. Place a lamp (or light the candle) so it is shining through the hole in the black cardboard.
4. Make sure the room is dark and that all lights are off
5. Move the white cardboard from side to side until an image of the lamp or candle appears on it
6. Next, compare how the functions of a real eye differs from the model we just made by using one of the links below to learn about the eye
 - a. <http://www.physicsclassroom.com/class/refrn/Lesson-6/The-Anatomy-of-the-Eye>
 - b. <http://sites.sinauer.com/neuroscience5e/animations11.01.html>



Explain how the model represents how the eye functions:

The model is a representation of the eye because there is a small hole in the black cardboard that represents the pupil which lets in light. The glass bowl filled with water represents the lens and the fluid filled eyeball. Since the image forms on the white cardboard, it represents the retina because that is where images in the eye are formed in an upside down fashion.

How does the model that was built differ from an actual eye?

The model differs from an actual eye because in an actual eye doesn't have glass for a lens. Unlike in the model eye, an actual eye has a lens which is made of fibrous material and it is flexible—having the ability to change its shape. Additionally, the eye has an iris which can control the size of the pupil, whereas the model eye just has a fixed pupil (opening) whose shape can't be changed. Although the model eye has a representation of the retina in the form of the white cardboard, it fails to show that there is an optic nerve connected to the retina which sends signals to the brain concerning the image in front of the eye.

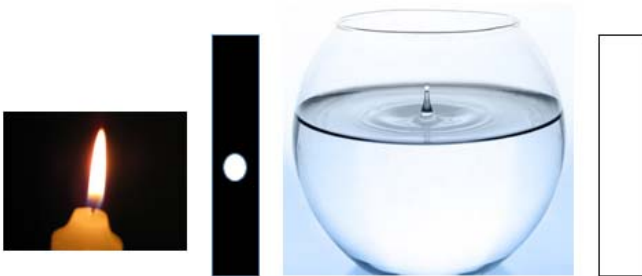
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STUDENT PAGE(S)

Instructions and Worksheet

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Explain how the model represents how the eye functions:

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