
Physics of Sight



Third-Grade Teacher Resource Guide

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Physics of Sight Lesson Summary and Vocabulary

Lesson Summary: The YSI *Physics of Sight* program touches on topics in biology, neuroscience, and physics to offer a basic overview of vision and light. The class begins by helping to complete a layered poster of an eye, learning about how each of its structures functions in human sight. They next apply this newfound understanding to a series of optical illusions, learning about the blind spot in the human eye and the way the brain processes visual information. Finally, students explore the nature of the light spectrum through prism experiments and build a spectroscope they can take home.

Vocabulary: Below are words and concepts that relate to the *Physics of Sight* program.

Blood vessel: Any of the vessels (arteries, veins, or capillaries) through which blood circulates.

Cornea: The transparent part of the sclera covering the iris and the pupil

Fovea: A small pit or depression in a bone or other structure.

Iris: The ring of muscle forming the colored portion of the eye and containing a circular opening, the pupil, in its center.

Lens: A convex, transparent part of the eye behind the iris that focuses light on the retina.

Light: Electromagnetic radiation visible to the eye.

Optic nerve: Cranial nerves consisting of sensory fibers that conduct impulses from the retina to the brain.

Pupil: The expanding and contracting opening in the iris of the eye, through which light passes to the retina.

Refraction: The change of direction of a ray, such as light, in passing from one medium into another in which its velocity is different.

Reflection: The return of light, heat, sound, etc., after striking a surface.

Retina: The innermost layer of the back of the eyeball that receives the image produced by the lens.

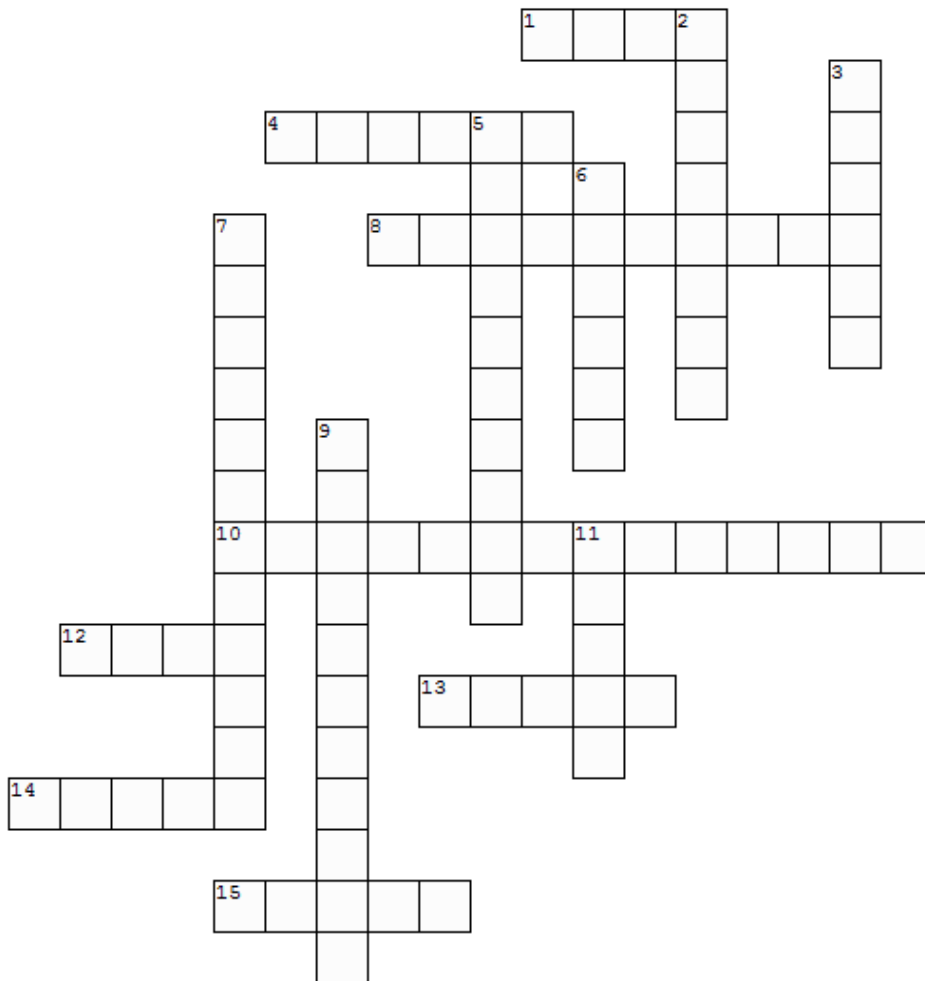
Sclera: A dense, white membrane that forms the external covering of the eyeball.

Sight: Perception of objects by use of the eyes

Spectrum: The band of colors produced when sunlight is passed through a prism, comprising a rainbow

Vitreous humor: The transparent gelatinous substance filling the eyeball behind the lens.

Physics of Sight Language Arts Crossword Puzzle



- | | | | | | | | |
|--------------|------------|--------|--------|-------|----------|----------------|-------|
| BLOOD VESSEL | CORNEA | FOVEA | IRIS | LENS | LIGHT | OPTIC NERVE | PUPIL |
| REFRACTION | REFLECTION | RETINA | SCLERA | SIGHT | SPECTRUM | VITREOUS FLUID | |

Across

1. A convex, transparent part of the eye behind the iris that focuses light on the retina.
4. A dense, white membrane that forms the external covering of the eyeball.
8. The return of light, heat, sound, etc., after striking a surface.
10. The transparent gelatinous substance filling the eyeball behind the lens
12. The ring of muscle forming the colored portion of the eye and containing a circular opening, the pupil, in its center..
13. Electromagnetic radiation visible to the eye.
14. The expanding and contracting opening in the iris of the eye, through which light passes to the retina
15. A small pit or depression in a bone or other structure.

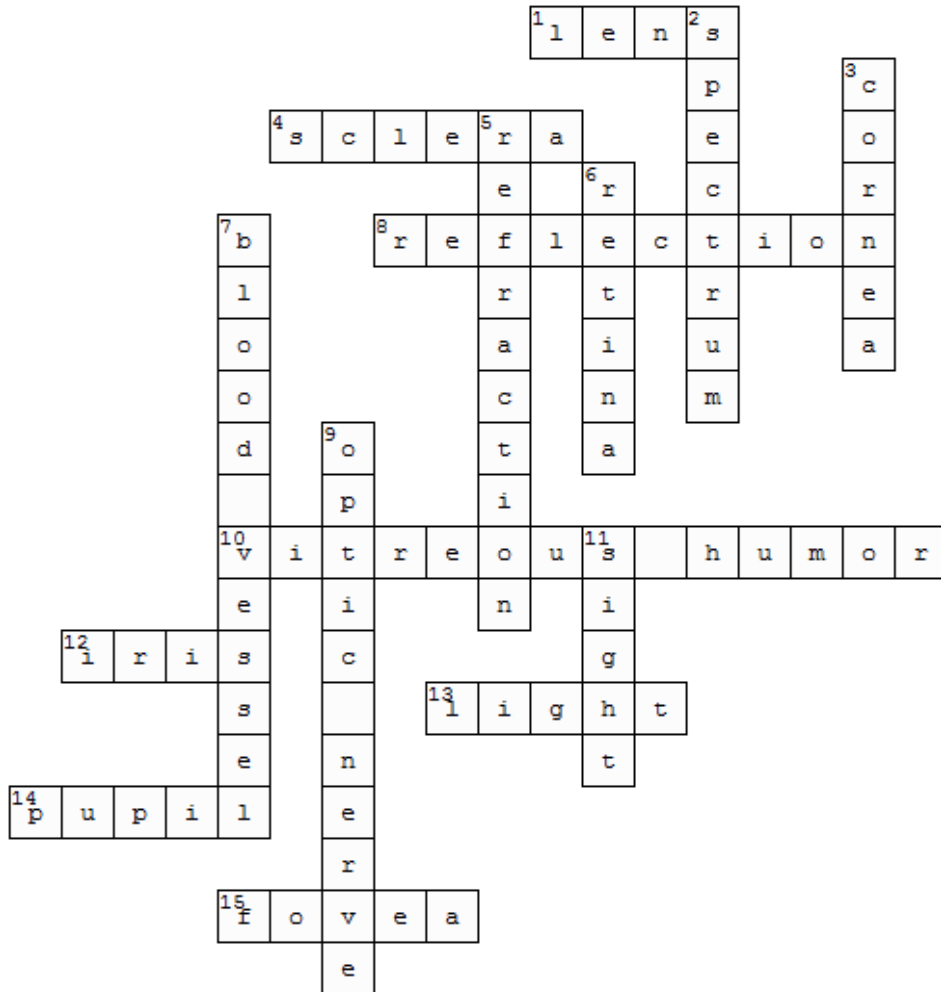
Down

2. The band of colors produced when sunlight is passed through a prism, comprising a rainbow
3. The transparent part of the sclera covering the iris and the pupil.
5. The change of direction of a ray, such as light, in passing from one medium into another in which its velocity is different.
6. The innermost layer of the back of the eyeball that receives the image produced by the lens.
7. Any of the vessels (arteries, veins, or capillaries) through which blood circulates.
9. Nerves consisting of sensory fibers that conduct impulses from the retina to the brain
11. Perception of objects by use of the eyes

Answer Key

Physics of Sight

Language Arts Crossword Puzzle



Across

1. A convex, transparent part of the eye behind the iris that focuses light on the retina (**lens**).
4. A dense, white membrane that forms the external covering of the eyeball (**sclera**).
8. The return of light, heat, sound, etc., after striking a surface (**reflection**).
10. The transparent gelatinous substance filling the eyeball behind the lens (**vitreous humor**).
12. The ring of muscle forming the colored portion of the eye and containing a circular opening, the pupil, in its center (**iris**).
13. Electromagnetic radiation visible to the eye (**light**).
14. The expanding and contracting opening in the iris of the eye, through which light passes to the retina (**pupil**).
15. A small pit or depression in a bone or other structure (**fovea**).

Down

2. The band of colors produced when sunlight is passed through a prism, comprising a rainbow (**spectrum**).
3. The transparent part of the sclera covering the iris and the pupil (**cornea**).
5. The change of direction of a ray, such as light, in passing from one medium into another in which its velocity is different. (**refraction**).
6. The innermost layer of the back of the eyeball that receives the image produced by the lens (**retina**).
7. Any of the vessels (arteries, veins, or capillaries) through which blood circulates (**blood vessel**).
9. Nerves consisting of sensory fibers that conduct impulses from the retina to the brain (**optic nerve**).
11. Perception of objects by use of the eyes (**sight**).

Physics of Sight Language Arts Word Search

Circle the vocabulary in the word search below. Can you find all the earth-related words?

O	P	T	I	C	N	E	R	V	E	A	D	Z	B	T	I
P	H	I	R	D	T	Y	S	R	F	G	S	K	O	O	A
R	M	L	E	D	I	I	E	C	O	R	N	E	A	P	L
E	X	F	F	K	R	N	S	P	E	C	T	R	U	M	K
E	G	O	R	I	W	L	T	U	D	J	F	O	I	U	S
G	B	V	A	T	F	J	U	W	J	K	E	Z	F	W	L
C	T	E	C	A	R	E	L	C	S	A	R	D	H	S	E
Z	S	A	T	F	Y	I	A	N	I	T	E	R	F	M	S
B	Z	V	I	T	R	E	O	U	S	H	U	M	O	R	S
E	W	Q	O	T	M	I	Z	L	D	S	I	G	H	T	E
N	L	C	N	G	J	W	B	Y	I	K	N	W	T	C	V
P	O	R	W	E	Y	H	Y	S	S	P	F	E	J	Z	D
D	R	E	F	L	E	C	T	I	O	N	U	J	L	F	O
A	O	V	L	Z	W	U	Y	I	W	Y	Q	P	N	J	O
O	C	K	Z	J	W	Z	K	H	M	G	R	X	E	P	L
A	Z	V	K	Y	Q	M	Y	S	L	I	G	H	T	X	B

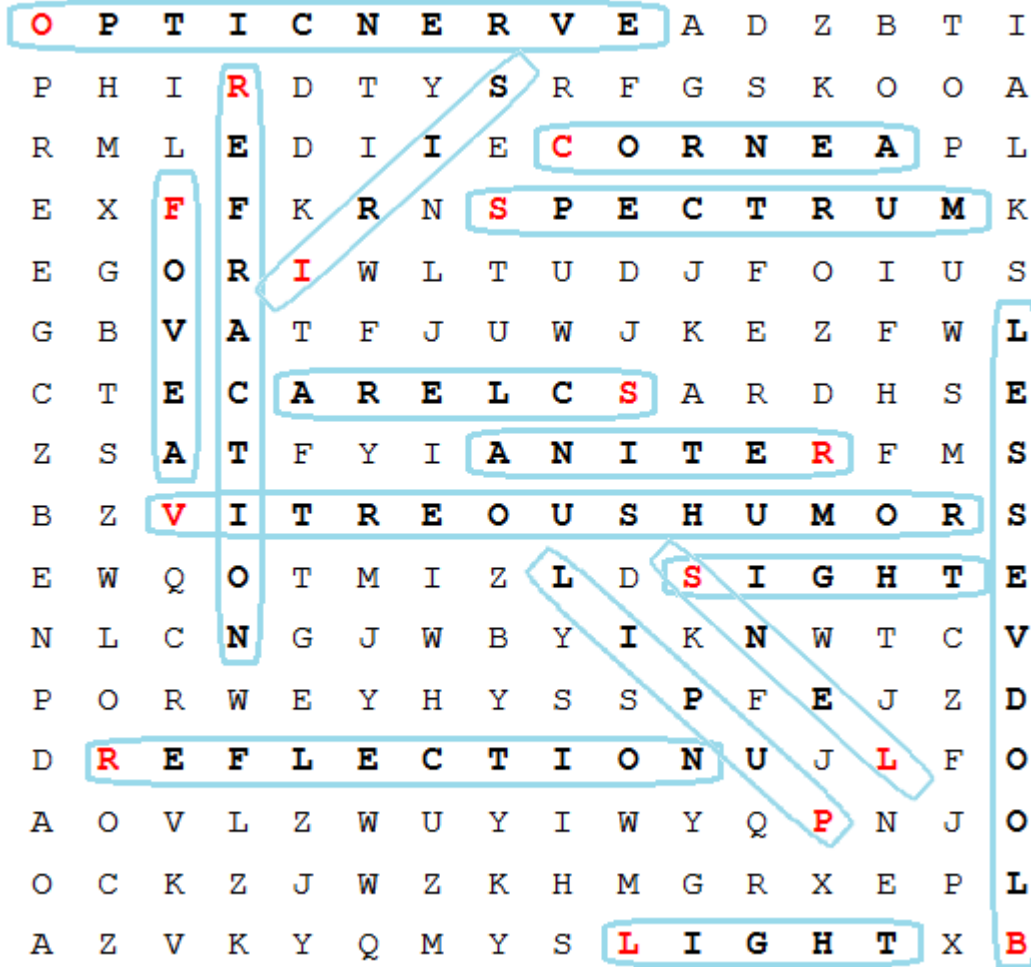
Word Bank

BLOOD VESSEL
CORNEA
FOVEA
IRIS
LENS

LIGHT
OPTIC NERVE
PUPIL
REFRACTION
REFLECTION

RETINA
SCLERA
SIGHT
SPECTRUM
VITREOUS HUMOR

Answer Key
Physics of Sight
Language Arts Word Search



Word Bank

BLOOD VESSEL
CORNEA
FOVEA
IRIS
LENS

LIGHT
OPTIC NERVE
PUPIL
REFRACTION
REFLECTION

RETINA
SCLERA
SIGHT
SPECTRUM
VITREOUS HUMOR

Physics of Sight Extension Activities

The extension activities listed below are from RAFT (Resource Area For Teaching). RAFT educational content is available online (www.raftbayarea.org) at no cost and is aligned to California Science Standards and Next Generation Science Standards. Below is a selection of post-visit activities from RAFT to build on student learning about physics and sight.

[RAFT Idea: Café Wall Illusion - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 4 through 12

Subjects Covered: Physical Science, Life Science

Curriculum topics: Vision, Function of the Eye, Illusion

Description: Students learn about how their eyes function with this fun illusion

<http://www.raftbayarea.org/ideas/Cafe%20Wall%20Illusion.pdf>

[RAFT Idea: Animated Flip Books - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 2 through 8

Subjects Covered: Physical Science, Life Science, Art

Curriculum topics: Eye, Persistence of Vision, Animation

Description: This fun activity will give students the opportunity to create basic animations that can help them understand how motion pictures and the human eye work.

<http://www.raftbayarea.org/ideas/Animated%20Flip%20Books.pdf>

[RAFT Idea: Eye See It - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 3 through 12

Subjects Covered: Physical Science, Life Science

Curriculum topics: Optics, Anatomy, Vision, Structure, Function of the Eye

Description: Use a bulk CD container to model parts of the eye and their functions.

<http://www.raftbayarea.org/ideas/Eye%20See%20It.pdf>

[RAFT Idea: Image Viewer - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 3 through 12

Subjects Covered: Physical Science, Life Science

Curriculum topics: Light, Optics, Refraction

Description: Explore images formed by a pinhole and a lens. See what the eye really "sees" - an inverted image!

<http://www.raftbayarea.org/ideas/Image%20Viewer.pdf>

This page references California Science Content Standards, Common Core, and Next Generation Science Standards, which students will be exposed to during the program.

California Science Content Standards Third Grade:

Physical Sciences: 1. Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

- a. Students know energy comes from the Sun to Earth in the form of light.

2. Light has a source and travels in a direction. As a basis for understanding this concept:

- a. Students know sunlight can be blocked to create shadows.
- b. Students know light is reflected from mirrors and other surfaces.
- c. Students know the color of light striking an object affects the way the object is seen.
- d. Students know an object is seen when light traveling from the object enters the eye.

Investigation and Experimentation: 5. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

- a. Repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.
- b. Differentiate evidence from opinion and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.
- d. Predict the outcome of a simple investigation and compare the result with the prediction.
- e. Collect data in an investigation and analyze those data to develop a logical conclusion.

Excerpted from CA State Standards: <http://www.cde.ca.gov/>

Common Core Third Grade:

Speaking and Listening Standards: Students will...

1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
- c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
- d. Explain their own ideas and understanding in light of the discussion.

Physics of Sight Education Standards

2. Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
4. Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
6. Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Excerpted from Common Core Standards: <http://www.corestandards.org/>

Next Generation Science Standards Third Grade: Engineering Design

- **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
 - **Science and Engineering Practices:**
 - **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
 - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)
 - **Disciplinary core ideas:**
 - **ETS1.B: Developing Possible Solutions:** Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
 - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
 - **Crosscutting Concepts**
 - **Influence of Science, Engineering, and Technology on Society and the Natural World:** Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS-2)
- **3-5-ETS1-3:** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
 - **Science and Engineering Practices:**
 - **Planning and Carrying Out Investigations:** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
 - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)
 - **Disciplinary core ideas:**

Physics of Sight Education Standards

- **ETS1.B: Developing Possible Solutions:** Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)
- **ETS1.C: Optimizing the Design Solution:** Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Excerpted from NGSS: <http://www.nextgenscience.org/>