



Classroom Teacher Preparation

Physics 14: Light Diffraction

Please use the following to prepare for the next SfS lesson.

Description:

Students will study the wave nature of light by carrying out a double-slit experiment. We will use graphical representations of waves to explain that the resulting interference pattern provides evidence that light is a wave. This is an advanced lesson intended for older (7th-8th grade) students.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

7th-8th

- Demonstrate that light is a wave by setting up and running a simple double-slit experiment
- Understand that waves can interfere with one another both constructively and destructively

Disciplinary Core Idea (DCI):

PS4 Waves and their Applications in Technologies for Information Transfer – PS4.B Electromagnetic radiation

- (6th-8th) The construct of a wave is used to model how light interacts with objects.

Science & Engineering Practice (SEP):

Asking Questions and Defining Problems

Preparation:

Students should know that light is a form of energy, and that the wavelength of light dictates its color. If they are completely unfamiliar with the subject of light, P13: *Introduction to Light* may be taught first.

This module is an advanced topic, so use your discretion.

Room Set Up for Activities:

Students will work in groups of 2-3 to set up a double-slit experiment using a laser pointer, a lice comb (provides the narrow slits!), and a card as a small screen. Ideally, each group will need at least 54 inches (4.5 feet) of linear space; this could be from desks pushed together or a cleared space on the floor. If this much space is impossible, the activity can still be performed, but the diffraction pattern will be smaller and harder to see. Another option is to tape the screens to classroom walls and set up the lasers on desks.

While the lasers are reasonably bright, viewing of the interference patterns will be better if the room can be darkened.

There is a lecture demonstration with a 9x13 cake pan filled with water; if the classroom has an ELMO-type projector, the demonstration can be projected; otherwise, students will need space to gather around a centralized desk or table in order to see the demonstration.

Safety:

The laser pointers should not be shined into anyone's eyes.



Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Energy**. Modules include:

Physics 16: Energy – This station-based module presents the concept of energy as the ability to do work and familiarizes students with many of the various forms of energy and the ways they can change forms.

Physics 10: Sound – In this station-based module, students explore how to change the pitch (frequency) and volume (amplitude) of different types of homemade instruments.

Physics 13: Intro to Light – This station-based module introduces students to the properties of light. At the end of this module, students should be able to identify transparent, translucent, and opaque objects, discuss absorption, transmission, reflection and refraction of light, and have a better understanding of light waves and the electromagnetic spectrum.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: <http://www.sciencefromscientists.org/standards/>

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by creating your own 2-slit device at home and experimenting further with light!

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Exploratorium: “Two-Slit Experiment” <http://www.exploratorium.edu/snacks/two-slit-experiment> (The activity for this module is modified from this Exploratorium activity)
- Exploratorium: “Two-Slit Wave Model” <http://www.exploratorium.edu/snacks/two-slit-wave-model>
- How Stuff Works: “How Light Works” <http://science.howstuffworks.com/light.htm>
- 7Active has a straightforward textbook-style explanation (material of this lesson is covered in first 2.5 min) (5:20) https://www.youtube.com/watch?v=MDX3qb_BMs4
- Kahn Academy: “Diffraction Grating, Light Waves” begins with two-slit interference and expands to explain diffraction gratings (14:20): <https://www.youtube.com/watch?v=F6dZjuw1KUo>
- Dr. Quantum has a nice animation of the effect, and a discussion of the quantum weirdness of the *wave-particle duality*: “Double-Slit Experiment” (5:03) <https://www.youtube.com/watch?v=DfPeprQ7oGc>
- Veritasium: “The Original Double-Slit Experiment” replicates Young’s experiment to the amazement of beach-goers (7:39): <https://www.youtube.com/watch?v=luv6hY6zsd0>