Lesson Plan – Bryan Jonsson

Title

The Nature of Light

Primary Subject Area

Physics

Grade Level

9-12

Overview

During this lesson students will be introduced to the concept of a wave through a discussion of the properties of light. Students will conduct a short experiment replicating Young's Double Slit experiment, and then practice basic science skills with a homework assignment.

Approximate Duration

90 min

MA Frameworks

4.1 - Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period) and explain the relationships among them.

Interdisciplinary Connections

None

Lesson Objectives

Students will be able to…

Identify the parts of a wave, including amplitude, frequency, wavelength, and velocity.
Explain how light travels.
Describe how waves can interfere with each other.

Lesson Materials and Resources

laser pens, cardstock with single and double slits, long slinky

Technology Tools and Materials

digital projector and computer with powerpoint

Background Information

Honestly, if you need to read this section, you shouldn't be teaching physics.

Useful Vocabulary

New Vocabulary Word	Meaning
wave	an oscillation propagated through amedium or space such that energy is periodically interchangedbetween two kinds of disturbance.
transverse	perpendicular to the direction of motion
constructive interference	interference which creates a larger amplitude at the central point
destructive interference	interference which creates a lesser amplitude at the central point

Essential Questions to be answered; Grand Challenges

What is light made of?
What are waves?
What happens when light waves interact with other light waves?

Misconceptions

Waves transport matter.
There must be a medium for a wave to travel through.
Waves do not have energy.
All waves travel the same way.
Big waves travel faster than small waves in the same

Lesson Procedures

Opening:

Write these three questions on the board and give student 5 minutes to silently write their responses.

"What is light?"

"How does it get from the Sun to your eye?"

"What gives light its color?"

Have students do a pair share.

Demo 1:

Use a 1 W laser to light a small tissue on fire. Discuss the demo with the students. Be sure to include the following questions:

"What does this demonstrate about light?"

"What did the laser create?"

"What happened to the air between the laser and the tissue?"

Your goal is to connect their knowledge of energy to light. Get them to phrase their answers in terms of energy.

Demo 2:

Turn off the lights in the room and close the blinds on the windows. The room will still allow some ambient light to enter from outside sources. Please ensure that no direct light enters the room. Discuss the situation, making sure to include the following questions:

"All of the lights are off, and no lights are shining in the room. So how is it that you can see me?"

"Where is the light in the room coming from?"

"How is the light getting into the room?"

"Can you think of any other type of energy that travels like this?"

Your goal is to focus their thoughts on how light travels, and then connect this to how sound travels.

Demo 3:

Turn your back to the class and say something. Then turn around and ask who was able to hear you. Guide the discussion as follows:

"How were you able to hear me? I was facing away, so why didn't the sound go away from you?"

"Ok, so you think the sound bounced off the walls. What would happen if we went outside and repeated this? Could you still hear me then? Why?"

"Can you draw how the sound spreads out from my mouth?"

Have the students direct you as you draw a diagram of the sound on the board. Make it look like concentric circles emanating from you so that they will be able to connect it to ripples in a pond.

Demo 4:

Stretch a long slinky (30 ft) along the classroom floor, and have a student hold one end. Create waves in the slinky in pairs to illustrate the following principles: amplitude, frequency, energy, velocity, destructive and constructive interference. Pepper students with questions as to how each pair of waves is different in order to lead them to the concepts.

Student Activity: Young's Double Slit:

Provide students with an activity sheet, laser pens, and cardstock with two slits cut into it. Students will replicate Young's Double Slit experiment and then answer questions on the worksheet regarding the interference patterns.

Review Notes

Use powerpoint to give students a summary of the key terms and concepts encountered during the lesson.

Homework:

Students will design an experiment to measure the power output of a given laser. They are to use the key terms covered in today's lesson when describing the rationale behind their experimental design.

Assessment Procedures

Checks for understanding during the summary notes at the end.
Performance on homework assignment.

Accommodations/Modifications

Vocabulary list

Powerpoint slide printout Alternate homework assignment: Students will receive a flawed procedure for testing the power output of a laser. They must identify and correct the flaws.
Reproducible Materials
homework worksheet
Explorations and Extensions
Students may research uses of lasers in industry, communications, and the military.
Lesson Development Resources
The internet.
Reflections
N/A
Contact Information
N/A