Community in the Classroom Presentation Plan

Lesson Name Light and Waves
Presenter(s) Jacob Schlegel

Grade Level 3 **Standards Connection(s)** PhysSci 4

Abstract:

Your opportunity to tell teachers and kids what's going to be fun and interesting about your visit!

We've all seen waves at the beach, but light also behaves like a wave. Waves carry energy with them and can interact with each other to make interesting patterns. This interaction is called wave interference – when waves add together they can constructively or destructively interfere. When light waves cancel each other out, that specific color disappears, and we see what's left. I'll be introducing the idea of wave interference and showing how light waves interfere in everyday life – the rainbow effect on a CD and on soap bubbles.

Vocabulary/Definitions:

Wavelength – distance between two nearest peaks of a wave
Peak and trough – high point and low point on a wave
Spectrum – the entire range of light, visible and invisible
Wave interference – waves can cancel one another or add together

Materials:

Slinky
Flashlight
Laser pointer
CD
Wavetank, dye
Bubble maker, dark paper
Wave transparencies
Overhead projector
Meter stick

Classroom Set-up:

Groups of 2-4 for the iridescence demo
Could use the dark.
Setup/cleanup ~ few minutes

Classroom Visit

1. Personal Introduction: 3 Minutes

Who are you? What do you want to share with students and why? How will you connect this with students' interests?

Hi, everyone. Thanks for letting me visit your class to tell you about waves and light. My name is Jacob, and I am a graduate student at UC Berkeley's chemistry department. I study how molecules move and react. Molecules can move really fast, so we need something that's even faster to watch them. Do you know what the fastest thing in the universe is? Light. My lab uses lasers to make visible and infrared light.

Topic Introduction: 15 Minutes

Big Idea(s), vocabulary, assessing prior knowledge. What questions will you ask to learn from students?

A) Can anyone tell me what we use light for? … Does anyone know what light is? … Light is pretty weird, actually. It is a wave of electricity and magnetism. Today I'll show you how light acts like a wave. [Draw sine wave on board] Where else are there waves? [beach, puddles, sound…] You can see here that this wave just repeats its motion…this part is called a peak, this a trough. The distance between neighboring peaks, or troughs, is called the

wavelength. We'll discover that because light is waves that this CD can split white light into all the colors of the rainbow. [CD demo] [Any Q's about colors, waves, light?]

B) Alright, let's thank the volunteers. Great job. Let me tell you a little more about light. White light—the light you can see - is just a mix of all the colors—what are they? ROY G BIV is the visible spectrum. At the red end, light waves are long; and at the violet end, they're short. [Draw pictures on the board to illustrate] So, remember when you were making slinky waves? Which end is higher energy? (violet) [optional: What's past violet? Ultraviolet. What do we know about that? (skin cancer). If it's past violet, it must be really energetic. Okay, what's before red? Infrared is what we often think of as heat.]

2. Learning Experience(s): 30 Minutes

Demonstrations, hands-on activities, images, games, discussion, writing, measuring… What will you do, what will kids do? Describe in order, including instructions to kids.

A) Take a look at this little wave tank. If I drop a marble in it will make a round wave on the top. [Mix in dye] If you look thru the sides, you'll see a wave like the one I drew on the board– it's basically a slice thru (or sideways view of) the round wave. Now, if I drop two marbles in, the waves start looking weirder, right? Did you know that waves can add together? I'll show you how we predict what the new waves will look like in a bit. What say we make a few types of waves? {volunteer line according to time and class} Can I get about ten volunteers to stand across the front of the room? Now I need one more volunteer to help me with this slinky. [Name] and I are going to show you one type of wave using the slinky and the line of volunteers are going to mimic the wave on the slinky. Could someone use the meter stick to measure the wavelength of our wave? Okay [name] keep it going while the volunteer line tries. [increase nodes on wave] What the new wavelength? Shorter. [name], is this wave using more energy? Okay, volunteer line, try this many waves? What did we learn about wavelength…the shorter wave is more energetic!

B) Back to the visible spectrum. [lights may need to be off] When we hit white light off this CD, it splits up into the spectrum, just like a prism [flashlight]. When we hit light of one color off, it doesn't split [laser pointer]. Let me show you how a CD splits white light. It is called interference. [handout – with transparencies show waves of different starting points 0-180 degress off – add them – talk thru it]. So when the tiny ridges on a CD are spaced just right, some light will cancel out. Where else have you seen something that looks like this? Howabout a butterfly wing? What about an oil slick in the street? Have you ever seen it on a bubble? [bubble demo] Can anyone guess how light waves are interfering on this bubble? [interference of front and back reflections on surface]

3. Wrap-up: Sharing Experiences and Building Connections 7 Minutes

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

The bubble surface works by reflecting light off the front and back sides. It's just like the ridges on the CD. The light waves interfere so that one color is left to see. So we learned today that light is just waves and different colors are different energies and wavelengths. And because light is a wave, it can interfere and make weird patterns, just like dropping two rocks in a pool will make waves that interact to make new patterns.

4. Close: 5 Minutes

How can kids learn more? Thanks and good-bye! Clean-up.

….
[Put soapy paper in trash. Explain that dye in wave tank is safe to pour down the drain – then do so.]
Thanks for being good learners and letting me come talk. Keep your eyes peeled for waves – there everywhere.

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Attach wave interference worksheet.

Link to great website with lots of demo-videos:
http://www.kettering.edu/~drussell/demos.html

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