

Wave Theory: Physics of Light and Sound

Essential question:

- How will understanding the physics principles of Sound and Light help me create art and music?

Some guiding questions for workshop

- Is light a wave or a particle?
- How do waves travel through air, water, land? (What mediums?)
- In what ways can energy waves travel?
- What is the relationship between light and color?

Vocabulary

- wave, mechanical waves, electromagnetic waves
- transverse wave, longitudinal waves, compression waves, frequency, wavelength, energy, peak, trough, amplitude
- electromagnetic spectrum, radio waves, microwaves, infrared light, visible light, ultra violet light, x-rays, gamma rays
- reflection, refraction, diffusion, transparent, translucent, opaque
- friction, resonate, echo, percussive, resonance chamber, vibration, amplify, acoustics

Introduction to the electromagnetic spectrum.

<http://www.brainpop.com/science/energy/electromagneticspectrum/>

How do our eyes see light?

<http://www.sciencechannel.com/tv-shows/cheat-sheet/videos/how-do-our-eyes-work.htm>

Discussion of types of waves.

<http://www.brainpop.com/science/energy/waves/>

Energy transport, movement of waves: Use dominoes to show movement of waves and transfer of energy.

<http://youtu.be/ARM42-eorzE> How does this movement of the dominoes simulate or replicate wave theory, or does it?

Use Slinky to demonstrate transverse waves and compression waves.

Introduction to sound

<http://www.brainpop.com/science/energy/sound/>

Demonstrate movement of sound waves through different mediums using the rulers and marbles.

How do our ears hear sound? <http://youtu.be/-bKy02f1pD4>
Play “telephone” using three different sound altering devices: cups, fabric, inflated balloons.

Just for Fun

Optical Illusions <http://youtu.be/5oZtx8vVnA0> and <http://youtu.be/pX5obnHWgLc>

Lab Activities

Sound experiments

- Dancing Slime (Cool Physics Activities for Girls p. 26): Non Newtonian Fluid. Students experiment with making slime (or salt/sand) move using only sound waves.
- Sound Wave Experimentation, similar to the first activity (Geek Mom, p. 116) Students will explore Chladni Patterns. Students can make their own to take home. Supplies: large can or recycled container, such as a large yogurt tub, any kind of speaker that can go under the container, salt or sand.

Free exploration with materials to make a sound producing element/instrument

Possibilities include Cuica, harp, pipes (instruments that make sound through strumming, plucking, tapping or blowing)

Light Experiments

- Prisms and lenses. Can you bend light and extract various colors? Materials might include water, clear glass pans, flashlights, optical items.
- Optical Illusions: (See video links above)
- Painting with light—students will create visible/invisible pictures using light, tape and a plastic canvas. (Geek Mom, p 204)
- Stained Glass Windows using crepe paper and clear plastic (glue or starch) to create artistic patterns.

Free exploration of art materials to create visual art with light as a component.

Possibilities include water paints, stained glass windows, experiments with various colored cellophanes, mini led lights.

Reading List

- **Introducing Physics: Light and Sound.** Brown Bear Books. Tuscon, AZ. 2010.
- Claybourne, Anna. **Gareth Stevens Physical Science: Sound.** Gareth Stevens Publishing, WI. 2007
- Gardner, Robert. **Light, Sound, and Waves Science Fair Projects: Using Sunglasses, Guitars, CDs and Other Stuff.** Enslow Publishers, Inc. NJ. 2004.
- Hammond , Richard. **DK: Can You Feel the Force: Putting the Fizz Back Into Science.**
- Isaacs, April. **Characteristics and Behaviors of Waves: Understanding Sound and Electromagnetic Waves.** The Rosen Publishing Group, New York. 2005.
- Levine, Shar and Leslie Johnson. **The Science of Sound and Music.** Sterling Publishing Company, New York. 2000.
- Milios, Rita. **Sound in the Real World.** ABDO Publishing Company, Minneapolis, MN. 2013.
- Skurzynski, Gloria. **Waves: The Electromagnetic Universe.** National Geographic Society, CA. 1996.
- Slade, Suzanne. **Cool Physics Activities for Girls.**
- Spilsbury, Louise and Rickard. **Light and Sound.** Heinemann Library, 2014.
- Stille, Darlene. **Waves: Energy on the Move.** Compass Point Books, MN. 2006.