



## Light Wave Lesson

<b>Grade Span</b>	6-8th Grade
<b>Time Span</b>	2 (70 min) days
<b>Standards</b>	<p><b>MS-PS4-1</b> Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.</p> <p><b>MS-PS4-2</b> Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.</p> <p><b>Practice Standards:</b>          Analyzing and Interpreting Data          Developing a Model          Engaging in Argument from Evidence          Obtaining, Evaluating, Communicating Information          Using Mathematics and Computational Thinking</p>
<b>Focus Question</b>	What are light waves and how are they reflected, refracted, absorbed, and transmitted?
<b>Overview</b>	Students will be looking specifically at light waves. They will be learning about how these waves of light behave around different mediums of matter.
<b>Objectives</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>● Describe a light wave.</li> <li>● Label parts of a light wave.</li> <li>● Explain how a light wave travels.</li> <li>● Explain what happens when waves are reflected, transmission, and/or, absorbed.</li> </ul>
<b>Materials Needed</b>	<p>For each group you will need:</p> <ol style="list-style-type: none"> <li>1. Computer</li> <li>2. Prisms</li> <li>3. Flashlights</li> <li>4. Polarized sunglasses</li> <li>5. Polarized paper</li> </ol> <p>For Explore Activities: See activities listed for materials needed.</p>



<p><b>Video Material</b></p>	<ul style="list-style-type: none"> <li>• <a href="#">Light Absorption, Reflection, and Transmission</a> Bozeman Science</li> <li>• <a href="#">What is Light-Physics (Simple Explanation)</a></li> <li>• <a href="#">The Science of Light and Color for Kids: Rainbows and Electromagnetic Spectrum - FreeSchool</a></li> <li>• They Might Be Giants: ROY G BIV: <a href="https://www.youtube.com/watch?v=Gf33ueRXMzQ">https://www.youtube.com/watch?v=Gf33ueRXMzQ</a></li> <li>• StudyJams! On Absorption, Reflection, Refraction of Light: <a href="http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light-absorb-reflect-refract.htm">http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light-absorb-reflect-refract.htm</a></li> <li>• Bill Nye the Science Guy: Light and Color (about 20 min.) <a href="https://www.youtube.com/watch?v=g5BHxozBPuA">https://www.youtube.com/watch?v=g5BHxozBPuA</a></li> <li>• StudyJams! On Light: <a href="http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light.htm">http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light.htm</a></li> <li>• <a href="#">Light Waves, Visible, and Invisible - Lucianne Walkowicz</a> (TedTalk)</li> </ul>
<p><b>Vocabulary</b></p>	<ul style="list-style-type: none"> <li>• Wave</li> <li>• Medium</li> <li>• Amplitude</li> <li>• Wavelength</li> <li>• Mechanical Wave</li> <li>• Matter</li> <li>• Energy</li> <li>• Crest</li> <li>• Trough</li> <li>• Transverse</li> <li>• Compression</li> <li>• Compressional Wave</li> <li>• Volume</li> <li>• Frequency</li> <li>• Vibrations</li> <li>• Conductor</li> <li>• Transmission</li> <li>• Sound</li> <li>• Medium</li> <li>• Pitch</li> <li>• Air</li> <li>• Water</li> <li>• Solid</li> <li>• Amplitude</li> <li>• Reflection</li> <li>• Refraction</li> <li>• Diffraction</li> <li>• Absorption</li> <li>• Convex</li> <li>• Concave</li> <li>• Transparent</li> <li>• Electric field</li> <li>• Visible light</li> <li>• Magnetic field</li> <li>• Electromagnetic wave</li> </ul>



<b>Teacher Prep</b>	<p>For the Engage Activities: You will need to put together the stations. The Activity gives materials and tells you how.</p> <p>For Explore Activities: See Activities for preparations.</p>
<b>Background</b>	<ul style="list-style-type: none"><li>• The following: <a href="#">Waves and Wavelike Motion</a> has background information and thinking points about waves.</li><li>• <a href="#">Physics Classroom Waves Background Information</a></li><li>• <a href="#">Physics Classroom: Light Absorption, Reflection, and Transmission</a></li><li>• <a href="#">Information on Reflection of Light</a></li></ul>



## Procedure

### Engage:

#### [Stations of Light Activity from TeachEngineering STEM Curriculum K-12](#)

1. Students break into groups to travel to 4 different stations.
  - a. Station 1: Bending Light
  - b. Station 2: Lens and Light
  - c. Station 3: Prism Rainbows
  - d. Station 4: Polarized Light

### Explore:

1. [Visible Light and Electromagnetic Spectrum from TeachEngineering STEM Curriculum K-12](#)
  - a. Students will explain that light is an electromagnetic wave.
  - b. This activity looks at the electromagnetic spectrum and ties in wavelengths and frequencies from [Intro to Waves lesson](#).
2. [It's Not All Visible](#)
  - a. Students will make a model of the electromagnetic spectrum.
3. [Tour of the Spectrum](#)
  - a. This is a self guided tour of the electromagnetic spectrum.
4. [Light Properties Activity from TeachEngineering STEM Curriculum K-12](#)
  - a. Students will look at the properties of light.
  - b. Students will learn about subtractive and additive color.
3. [Hands On Activity: Graphing the Rainbow from TeachEngineering STEM Curriculum K-12](#)
  - c. After looking at how light travels students will look at light passing through the prism making a rainbow.
  - d. Students will look at graphs of rainbows.

### Explanation:

1. Take students outside with their science journals.
2. In their science journals have students reflect on what they have learned about with light and reflect how nature and light are connected.
  - a. Students should be able to include discussion on:
    - i. Traveling of light
      1. Reflecting
      2. Refracting
      3. being absorbed
    - ii. Color
      1. Subtractive
      2. Additive

### Extension:



	<ol style="list-style-type: none"> <li>1. <a href="#">Building a Fancy Spectrograph from TeachEngineering STEM Curriculum K-12</a> <ol style="list-style-type: none"> <li>a. Students create a model that shows diffraction.</li> <li>b. Students discuss further why spectrographs are important.</li> </ol> </li> <li>2. Read up on how light is used everyday.             <ol style="list-style-type: none"> <li>a. <a href="#">Night Vision</a></li> <li>b. <a href="#">Night Vision for Self-Driving Cars</a></li> <li>c. <a href="#">Graphene Gives You Infrared Vision in a Contact Lense</a></li> <li>d. <a href="#">Infrared Light: Seeing What You Can't See</a></li> <li>e. <a href="#">What is Lidar?</a> NOAA Site</li> </ol> </li> </ol>
	<p><b>Evaluate:</b></p> <p><b>Formative Assessment:</b> From Light Properties Activities: <a href="#">All About Light—Notes Outline (pdf)</a> <a href="#">Color Magic Demo Worksheet (pdf)</a> From Graphing the Rainbow: <a href="#">Graphing the Rainbow Worksheet (pdf)</a></p> <p><b>Summative Assessment:</b> Their journal writing should include understanding of the material presented.</p>
<p><b>Other Optional Activities</b></p>	<ol style="list-style-type: none"> <li>1. Refraction, Reflection, Absorption             <ol style="list-style-type: none"> <li>a. Electromagnetic Waves: Medium PowerPoint <a href="http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/electro_waves_medium/electromagnetic_mediums.pptx?id=24176">http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/electro_waves_medium/electromagnetic_mediums.pptx?id=24176</a></li> <li>b. Electromagnetic Waves: Medium PowerPoint Graphic Organizer <a href="http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/electro_waves_medium/electromagnetic_mediums_notes.doc?id=24158">http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/electro_waves_medium/electromagnetic_mediums_notes.doc?id=24158</a></li> </ol> </li> <li>2. <a href="#">Light and Nature of Seeing Activity</a></li> </ol>