Rigorous Curriculum Design
Unit Planning Organizer

Subject(s)	Science
Grade/Course	6
Unit of Study	Forces and Motion
Pacing	Minimum 15 days, Maximum 20 days

Priority Essential Standards

6.P.1 Understand the properties of waves and the wavelike property of energy in earthquakes, light and sound.
6.P.1.1 Compare the properties of waves to the wavelike property of energy in earthquakes, light and sound.
6.P.1.2 Explain the relationship among visible light, the electromagnetic spectrum, and sight.
6.P.1.3 Explain the relationship among the rate of vibration, the medium through which vibrations travel, sound and hearing.
6.P.3.2 Explain the effects of electromagnetic waves on various materials to include absorption, scattering, and change in temperature.

"UNWRAPPED" Priority Standards

6.P.1.1
All waves transmit energy not matter. Nearly all waves travel through matter. Waves are created when a source (force) creates a vibration. Vibrations in materials set up wavelike disturbances that spread away from the source. Wave behavior can be described in terms of how fast the disturbance spreads, and in terms of the distance between successive peaks of the disturbance (the wavelength). Sound and earthquake waves are examples. These and other waves move at different speeds in different materials. Waves are moving energy. Light waves are unique in their ability to travel through a vacuum (space). Sound is a form of energy that results when vibrating materials produce waves that move through matter. Earthquakes are vibrations in the earth that release the (potential) energy stored in rocks (due to their relative positions and consequent pressure). Earthquakes create seismic waves. Compare sound waves (longitudinal waves) to light waves (transverse waves). Energy will cause materials to vibrate. These vibrations are carried as "waves" and transfer energy. Identify the basic characteristics of a transverse wave: trough, crest, amplitude, and wavelength. Identify the basic characteristics of a longitudinal (compressional) wave: amplitude, rarefaction, and compression.

6.P.1.2
Something can be "seen" when light waves emitted or reflected by it enter the eye. Human eyes respond to only a narrow range of wavelengths of electromagnetic waves-visible light. Differences of wavelength within that range are perceived as differences of color. Light travels in transverse waves. Light is a form of energy emitted by the Sun as well as light-producing objects on Earth. Light can be absorbed or reflected by objects depending upon the properties of the object and the type and angle of light when it hits the object. Some materials scatter light and others allow light rays to pass through, but refract the light by changing its speed.
The structure of the human eye can detect many colors in visible light that are reflected by objects. Investigate how the eye works: structures within the eye, functions of these structures in the eye. Optical illusions. Investigate conditions that impair vision.

6.P.1.3
Something can be "heard" when sound waves from it enter the ear. Sound is a form of energy that is caused when vibrating materials produce waves that move through matter. These waves have different characteristics such as frequency and amplitude, which will determine the properties of sound such as pitch and loudness.
The form of the human ear can receive sound waves as vibrations and convert them to signals that are processed by the brain. Investigate how sound travels through different solid materials. Compare how sound travels through different states of matter. Investigate how the vocal cords work to produce sound: structure of vocal cords, function of vocal cords and conditions that affect the sound vocal cords make. Investigate how the ear works: structures within the ear, functions of those structures, conditions that affect hearing.

6.P.3.2
Light and other electromagnetic waves can warm objects. How much an object's temperature increases depends on how intense the light striking its surface is, how long the light shines on the object, and how much of the light is absorbed. When light interacts with matter it is either absorbed, transmitted, refracted) and/or reflected (scattered). An example of scattering is when the sky is blue. The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of the light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of:
Visible spectrum is the portion of the electromagnetic spectrum that is visible to (can be detected by) human eyes. Electromagnetic radiation in this range of wavelengths is called visible light or simply light.
Infrared light has a longer wavelength than visible light and is detected most often by its heating effect. Infrared imaging has applications in space exploration and with satellite imaging.
Ultraviolet light has shorter wavelengths than visible light. These waves lengths are responsible for causing our sunburns. Most of these waves are blocked from entering Earth's atmosphere by the ozone but some days, more ultraviolet waves get through our atmosphere. Scientists have developed a UV index to help people protect themselves from these harmful ultraviolet waves. These are the types of waves used in tanning beds.

"Unwrapped" Concepts (students need to know)	"Unwrapped" Skills (students need to be able to do)	Bloom's Taxonomy Levels
• Properties and characteristics of different types of waves • Transfer of energy through waves • Types of radiation in the electromagnetic spectrum • Be able to distinguish between visible invisible light • Understand how the human eye process light • How sound travels through different mediums • How pitches are made • Structure and function of vocal cords and to the ear • How rainbows are formed	• Compare and contrast sound, light and seismic waves • Examine the process of light transference to images in the human eye • Determine how different sounds travel based on vibration rates and the medium in which they are traveling	Analyze Analyze Evaluate

Essential Questions

Big Ideas
6. P.1.3 Why is it that I see lightening and then I hear the thunder? 6. P.1.2 /6.P3.2 Why is it that I only see a rainbow sometimes after it rains? 6. P.1.1 How close to the center of an earthquake would we need to be in order to feel vibrations?

Engaging Learning Experiences	
Description and timeline	**Authentic Performance Tasks**
1 day review	KWL on Earthquakes
1-2 day Literature Link	6.P.1.1 Waves Reading ck-12 or text resource
2-3 day lesson consisting of labs 1 day lesson	Download lesson plan for The Phenomenon of Sound: Waves Slinky Lab: Earthquakes
1-2 day Literature Link	6.P1.2 and 6.P.3.2 Electromagnetic Reading ck-12 or text resource Visible Light Reading ck-12 or text resource
2-3 day lesson consisting of technology use and a final project 1 day lesson informational	Download lesson plan for The Electromagnetic Spectrum: Waves of Energy Discovery Education Video: Light
1-2 day Literature Link	6.P1.3 Sound Reading ck-12 or text resource
3-4 day lesson overlaps with previous lessons. Requires a fog machine. Good Literature connection piece	Download lesson plan Sound All Around
2 day lesson with literature link	Revisit KWL on Earthquakes: Make connections to classroom experiences; Earthquake Characteristics ck-12

Differentiation Strategies (Additional Supports + Enrichment)	Intervention Strategies (Tiers 1, 2, 3)	Specially Designed Instruction for Special Education Students	Strategies for English Language Learners
Interactive sound lab	Mnemonic devices Frayer Model		Picture card dictionary

Instructional Resources and Materials	
Physical	**Technology-Based**
See individual lesson for sound See individual lesson on electromagnetic spectrum. Web Resources Science of Light Making Light Waves, Sound and Light	Free resources http://www.discoveryschool.com **Ck-12 Physical Science for middle school** Waves: Chapter 19, Sound: Chapter 20 Electromagnetic Radiation 21 Visible light 22 www.ck12.org

Unit Vocabulary Terms		Enrichment / Extension	Interdisciplinary Connections
Primary	Secondary		
Wavelength Frequency Intensity Visible spectrum Amplitude Rarefaction Compression Electromagnetic spectrum Microwave Infrared Ultraviolet Gamma rays Scattering Amplitude Frequency	Reflection Refraction Absorption P waves S waves Surface waves Energy Radiation Visible light x-rays pitch loudness		

<table>
<tr><th colspan="2">Unit Assessment</th></tr>
<tr><th>Pre-Assessment</th><th>Formative Assessment Ideas</th></tr>
<tr><td></td><td>Ticket Out the Door
Stickney note observation
Think, pair, share
Exit Card
3 pluses and a delta
Describe the energy required to make a loud sound and a soft sound.
Explain the relationship among visible light, electromagnetic spectrum and sight.
Sequence the transference of sound vibrations</td></tr>
<tr><th colspan="2">Post Assessment</th></tr>
<tr><td colspan="2">• Create a musical instrument to demonstrate the understanding of how different sounds travel based on vibration rates and the medium in which they are traveling.
• Create a flow chart to sequence the process of light transference to images in the human eye.
• Construct triple Venn comparing and contrasting wave like properties of earthquakes, light and sound
• Teacher made test</td></tr>
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