Electromagnetic spectrum middle school worksheet

Loading... Grade Level: 8 (8-10) Time Required: 45 minutes Lesson Dependency: None Subject Areas: Physical Science, Science and Technology After this lesson, students should be able to: Explain the relationship between the size of a wave and the frequency. Explain the relationship between wave energy and wavelength. Compare all EM waves in terms of their energy and wavelengths. NGSS Performance Expectations ms-PS4-1. Use mathematical representations to describe a simple pattern of waves that includes how the wave amplitude is associated with the energy of the wave. (Grades 6-8) Do you agree with this alignment? Thank you for your feedback! Click to view another curriculum aligned with this Performance Expectations This lesson focuses on the following three-dimensional learning aspects of NGSS: Science & Engineering Practices Disciplinary Basic Ideas Crosscutting Concepts Use Mathematical Representation to Describe and/or Support Scientific Conclusions and Design Solutions. Reconciliation Agreement: Thanks for your feedback! Scientific knowledge is based on logical and conceptual links between evidence and explanations. Reconciliation Agreement: Thanks for your feedback! A simple wave has a repeating pattern with a specific wavelength, frequency and amplitude. Reconciliation Agreement: Thanks for your feedback! Graphs and charts can be used to identify sample data. Reconciliation Agreement: Thanks for your feedback! Students will develop an understanding of the role of troubleshooting, research and development, inventions and innovations and experimentation in problem solving. (Grade K - 12) Details See a coherent lesson Do you agree to this alignment? Thank you for your feedback! Waves (including sounds and seismic waves, waves on water and light waves) have energy and transfer energy when they interact with matter. Waves are a repetitive motion pattern that moves energy from place to place without general displacement of the substance. All kinds of waves have some common features. When waves interact, they apply or interfere with each other, resulting in a change in amplitude. The main modern technologies are based on waves and their interaction with matter. (8th degree) Details See a coherent lesson Do you agree to this alignment? Thank you for your feedback! Collect factors that affect the nature of waves (including frequency, amplitude, wavelength and velocity). (8th degree) Details See a coherent lesson Do you agree to this alignment? Thank you for your feedback! Compare wavelengths and energy waves in different parts of the electromagnetic spectrum (including visible light, infrared and ultraviolet radiation). (8th degree) Details See a coherent lesson Do you agree to this alignment? Thank you for your feedback! Suggest a alignment that is not mentioned above Structure (doc) All About EM-Notes Structure (pdf) All All EM - Notes Outline Answers (doc) All about EM-Notes Outline Answers (pdf) Electromagnetic Spectrum Presentation (ppt) Electromagnetic Spectrum Presentation (pdf) Visit [www.teachengineering.org/lessons/view/clem_waves_lesson04] to print or download. (Make copies in advance, em —Notes Outline(As)- one per student. Also [optionally], prepare to show students the added 11 slide electromagnetic spectrum presentation to accompany the lesson introduction. The slides are animated, so you can click to show the next item when you're ready.) We have already discussed the characteristics of light and how light interacts with objects. Today, we will continue and start talking about the electromagnetic spectrum. (Show students an electromagnetic spectrum scheme.) It turns out that the only type of electromagnetic radiation we can see is visible light, which forms only part of the electromagnetic spectrum. We will start by presenting you all with the EM spectrum and how it is organized, and then we will look at the different types of waves that can be found in this spectrum, many of which you will be familiar with. Invite students to stand up with their feet close together. As they fluctuate in half on the side are they take small steps to the side so that they stand wider. They will not be able to sway on the side as quickly as their position becomes wider. This can help to relate the wave size and frequency. Show the following equation on the board: $v = \lambda * f$ Where: v = wave speed (distance/time) λ = wavelength (distance) f = wave frequency (1/time) The wavelength depends on the material it travels. The speed of the electromagnetic wave (including light) through the vacuum is always the same (300 000 000 metres per second... or 670,000,000 miles per hour! It is represented by c). Through other materials the speed changes! In order to find the electromagnetic wave speed, c (vacuum rate) should be divided only by the refrcedection index shown in Table 1. Table 1: Refrastion index (n) for various materials (Next, divide the outlines of notes and present the lecture materials in the Background section, along with the slides.) Legacy Cycle Information: This lesson falls under the research and review phase of the legacy cycle. At this stage, students begin to learn the basic concepts necessary to develop solutions to the engineering challenge outlined in lesson 1 of this unit. After lesson 4, students should be able to review their initial thoughts, creating new ones that will help solve the engineering challenge. Electromagnetic spectrum (The following lecture material aligns with the slides.) EM Spectrum is a complete (whole) range of EM waves to increase frequency and decrease wavelengths. This means that when you count from left to right on the spectrum chart, wavelengths become smaller frequency becomes higher. There is an inverse relationship between wave size and frequency. Remember: all EM waves travel at the same speed: 300,000km/s. If you remember the formula for speed, it is the wavelength times the frequency. For the answer always be 300,000km/s, as one number goes up, the other is going down. All EM waves are radiation. It's just that longerwave lengths don't have enough energy for them to damage cells. Remember: the higher the frequency, the more energy you wave! Electromagnetic spectrum diagram. Spectrum radio waveforms have the longest wavelengths and lower frequencies; wavelengths range from 1000s meters to 0.001 m. (The shortest radio waves are microwave ovens.) Radio waves are used for RADAR (radio detection and starting), sending sound, images (TV), cell phones, cooking and satellite transmissions. Infrared (heat) has shorter wavelengths from 0,001 m to 700 nm and higher frequencies (nm is one billionth of a meter). Infrared is used to find people in the dark and on TV remote controls. Visible light is what we can see in the EM spectrum. The wavelengths of visible light range from about 700 nm (red light) to 400 nm (violet light). The visible light frequencies are higher than the infrared wave frequencies. Notice how visible light is such a small part of the whole spectrum. ultraviolet wavelengths range from about 400 nm to 10 nm; the frequency (and therefore the energy) is high enough with UV rays to penetrate and cause damage to living cells. We need UV rays to produce vitamin D in our bodies. Even if too much can cause sunburn and skin cancer, UV rays are easy to stop with clothing. UV rays are used to sterilize materials because they kill bacteria at sufficient concentrations. Although people can't see UV light, benes, butterflies, some small rodents, and some birds can. For X-rays, wavelengths are between 10 nm and 0,001 nm. They have enough energy to penetrate deep into the tissue, but are stopped by dense materials such as bones. Used solid structures (for example, looking for cracks in bones and bridges) and for cancer treatment. Gamma rays have the shortest wavelength (less than one trillion meter: 10 to negative 12), so the higher frequencies, therefore, carry the most energy. They are the most damaging tissue and can penetrate the deepest. Its hard to stop! You would need a 3-4 foot thick concrete wall to stop them. Gamma rays are released into nuclear power plants, nuclear bombs and naturally occurring elements on Earth. Sometimes they are used to treat cancer. As we continue to collect information, an important step in the engineering design process, we now know a lot about the electromagnetic spectrum. Tell me what you know. (Listen to students' responses by adding and correcting as needed.) What is the ratio between wave size and frequency? And what about the relationship between wave energy and wavelength? What do you think engineers have done with their understanding of EM? (Listen to students' ideas.) Well, engineers have developed many devices and tools that use different types of waves found in the electromagnetic spectrum. Some examples: radios, X-ray instruments, CT scanners and sterilization methods. These devices use electromagnetic waves in different ways. And since, as we have learned, some waves can be powerful and dangerous, engineers need to understand every aspect of the electromagnetic spectrum to make tools and tools safe for humans. electromagnetic radiation: a phenomenon in the form of self-propagating waves in a vacuum or substance. It consists of electrical and magnetic field components that fluctuate each other in phases and the direction of energy distribution. All travel at light speed. electromagnetic spectrum: the range of all possible electromagnetic radiation frequencies. Note Given: During the lecture, invite students to complete the All-EM-Note outline and refer to their visuals that complement the lecture material. After the notes were cut off on the desks, ask students the various questions that were discussed in the lecture materials. Evaluate students' responses to evaluate their mastery in this topic. Mathematical Worksheet: Shut down the attached mathematical worksheet. Browse NGSS Engineering Equates the Physics Curriculum Center with additional physics and physical science syllabus featuring Engineering. Ellen Zielinski; Courtney Faber Research Experience for Teachers (RET) Program, Center for the Development of Engineering Fibers and Films, Clemson University This lesson was developed using Clemson University's Engineering Fibers and Film Experience — EFF-X Research Experience for Teachers program funded by the National Science Foundation to grant no. EEK-0602040. However, this content does not necessarily represent the policy of the National Science Foundation, and you should not accept the approval of the federal government. Last updated: 14 November 2020