



# What Is a Wave? Lesson 4

## Electric Avenue



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<b>Grade Level</b>	9th Grade	<b>Time Frame</b>	90 minutes
<b>Subject</b>	Science	<b>Duration</b>	1-2 class period(s)
<b>Course</b>	Physical Science		

### Essential Question

What are waves? How do waves behave differently from particles?

### Summary

In this fourth lesson of the "What Is a Wave?" unit, students will learn how electromagnetic radiation is related to common items, understand how electromagnetic radiation is a form of energy, and create electromagnetic spectrum charts.

### Snapshot

#### Engage

Students construct images and summarize how those images relate to waves.

#### Explore

Students infer how common items are related to electromagnetic radiation.

#### Explain

Students compile Cornell Notes related to the electromagnetic spectrum.

#### Extend

Students create electromagnetic spectrum charts.

#### Evaluate

Students' electromagnetic spectrum charts serve as the evaluation.

## Standards

*Oklahoma Academic Standards (Physical Science)*

**PS.PS4.4** : Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

**PS.PS4.4.1**: When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat).

**PS.PS4.4.2**: Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells.

**PS.PS4.4.3**: Photoelectric materials emit electrons when they absorb light of high enough frequency.

## Attachments

- [Cornell-Notes-Electric-Avenue - Spanish.docx](#)
- [Cornell-Notes-Electric-Avenue - Spanish.pdf](#)
- [Cornell-Notes-Electric-Avenue.docx](#)
- [Cornell-Notes-Electric-Avenue.pdf](#)
- [EM-Spectrum-Chart-Rubric-Electric-Avenue - Spanish.docx](#)
- [EM-Spectrum-Chart-Rubric-Electric-Avenue - Spanish.pdf](#)
- [EM-Spectrum-Chart-Rubric-Electric-Avenue.docx](#)
- [EM-Spectrum-Chart-Rubric-Electric-Avenue.pdf](#)
- [Lesson-Slides-Electric-Avenue.pptx](#)
- [Painting-A-Picture-Images-Electric-Avenue - Spanish.docx](#)
- [Painting-A-Picture-Images-Electric-Avenue - Spanish.pdf](#)
- [Painting-A-Picture-Images-Electric-Avenue.docx](#)
- [Painting-A-Picture-Images-Electric-Avenue.pdf](#)
- [Painting-a-Picture-Chart-Electric-Avenue - Spanish.docx](#)
- [Painting-a-Picture-Chart-Electric-Avenue - Spanish.pdf](#)
- [Painting-a-Picture-Chart-Electric-Avenue.docx](#)
- [Painting-a-Picture-Chart-Electric-Avenue.pdf](#)
- [Puzzled-Photos-Electric-Avenue - Spanish.docx](#)
- [Puzzled-Photos-Electric-Avenue - Spanish.pdf](#)
- [Puzzled-Photos-Electric-Avenue.docx](#)
- [Puzzled-Photos-Electric-Avenue.pdf](#)

## Materials

- Lesson Slides (attached)
- Puzzled Photos (attached, one set)
- Painting a Picture Images (attached, one set)
- Painting a Picture Chart (attached, one per student)
- Cornell Notes handout (attached, one per student)
- EM Spectrum Chart Rubric (attached, one per student)
- Copy paper
- Markers or colored pencils

20 minutes

## Engage

### Teacher's Note: Lesson Prep

Print the attached **Puzzled Images** handout and cut each image into several pieces so that you have enough pieces for each student in your class to have one. Consider laminating the pieces and storing in plastic bags to reuse.

Print the attached **Painting a Picture Images** packet before class and hang the images around the classroom.

Use the attached **Lesson Slides** to guide the lesson. You can review the essential questions and lesson objectives with students on **slides 3 and 4** before beginning the lesson.

Begin by showing **slide 5** and introducing students to the [Puzzled](#) strategy. Give each student a random piece from the **Puzzled Photos**. Tell students to move around the room to locate the other pieces of their image, assemble the pieces to complete the image, and stay together as a group. When students believe they have correctly assembled the pieces to form an image, check to make sure it is correct.

Ask students to discuss with their groups how their image relates to the Waves unit content that they have been learning about. After the discussion, show the complete puzzled images on **slides 6-10** and ask each group to share what their image represents and how it relates to waves.

20 minutes

## Explore

Pass out copies of the **Painting a Picture Chart**. Show **slide 11** and introduce students to the [Painting a Picture](#) strategy. As students view each image posted in the classroom, they should record their observations about each image in the first column of the chart and how each image relates to electromagnetic radiation in the second column of the chart.

After giving students time to view and record their observations for each image, show **slides 12-16** and provide frequency and wavelength range information to students. Have students add this information to the third column of their charts.

Show **slide 17** and play the "[Electromagnetic Spectrum](#)" video.

### Embedded video

<https://youtube.com/watch?v=cfXzwh3KadE>

### Teacher's Note: Lesson Pacing

Consider stopping at this point until the next class period.

30 minutes

## Explain

Pass out copies of the **Cornell Notes** handout. Show **slide 18** and play the "[Heat Sensing Pit Vipers](#)" video.

### Embedded video

<https://youtube.com/watch?v=lySW2-eYilg>

As they watch, ask students to think about how heat-sensing snakes relate to the electromagnetic spectrum. Ask for volunteers to share their thoughts after the video.

Inform students that they now are going to learn about the electromagnetic spectrum in more detail.

Show **slides 19-24** and explain the electromagnetic spectrum to students while they use the Cornell Notes handout to take notes.

Show **slide 25** and ask students to write a summary at the bottom of their note sheet.

Move to **slide 26** and ask students to compare their summaries with a student nearby. Then, ask for volunteers to share their summaries.

30 minutes

## Extend

Show **slide 27** and provide each student with a piece of copy paper and markers or colored pencils. Tell students to create an electromagnetic spectrum chart that includes the information listed. Pass out copies of the **EM Spectrum Chart Rubric** and tell students that you will use the rubric to assess their understanding of the lesson.

## Evaluate

The Electromagnetic Spectrum chart serves as the evaluation activity for this lesson.

## Resources

- BBC Studios. (2008, November 24). Heat sensing pit vipers - deadly vipers - BBC animals [Video]. YouTube. <https://www.youtube.com/watch?v=lySW2-eYilg>
- BestOfScience. (2010, August 1). The electromagnetic spectrum [Video]. YouTube. <https://www.youtube.com/watch?v=cfXzwh3KadE>
- Kameníček, J. (2014, March 31). London Millennium Bridge from Saint Paul's [Image]. Wikimedia Commons. [https://commons.wikimedia.org/wiki/File:London\\_Millennium\\_Bridge\\_from\\_Saint\\_Paul%27s.jpg](https://commons.wikimedia.org/wiki/File:London_Millennium_Bridge_from_Saint_Paul%27s.jpg)
- K20 Center. (n.d.). Cornell notes system. Strategies. <https://learn.k20center.ou.edu/strategy/56>
- K20 Center. (n.d.). Puzzled. Strategies. <https://learn.k20center.ou.edu/strategy/63>
- K20 Center. (n.d.). Painting a picture. Strategies. <https://learn.k20center.ou.edu/strategy/1331>