



# Call Me... Maybe?

## Electromagnetic Waves



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<b>Grade Level</b>	9th Grade	<b>Time Frame</b>	135 minutes
<b>Subject</b>	Science	<b>Duration</b>	3 class periods
<b>Course</b>	Physical Science		

### Essential Question

How dangerous are electromagnetic waves to humans? Should we be concerned with the new technological advances of today?

### Summary

In this lesson, students will evaluate and argue the benefits and drawbacks of the use of different types of radiation for technological advances. By the end of this lesson, students will be able to evaluate published works' validity on technology associated with human health. This is a multimodality lesson, which means it includes face-to-face, online, and hybrid versions of the lesson. The attachments also include a downloadable Common Cartridge file, which can be imported into a Learning Management System (LMS) such as Canvas or eKadence. The cartridge includes interactive student activities and the teacher's notes.

### Snapshot

#### Engage

Students create a claim and argue opposing viewpoints.

#### Explore

Students read an article on gamma rays and create a superhero based on the advantages and disadvantages of a particular ray.

#### Explain

Students read an article about the electromagnetic spectrum and identify key components of electromagnetic radiation (EMR).

#### Extend

Students explore the job of a Director of Medical Imaging in relation to electromagnetic radiation.

#### Evaluate

Students assess their level of understanding and determine the validity of published work on electromagnetic radiation in association with human health.

## Standards

*ACT College and Career Readiness Standards - Science (6-12)*

**IOD403:** Translate information into a table, graph, or diagram

**EMI301:** Identify implications in a model

**EMI401:** Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

*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.

## Attachments

- [CER—Call Me Maybe - Spanish.docx](#)
- [CER—Call Me Maybe - Spanish.pdf](#)
- [CER—Call Me Maybe.docx](#)
- [CER—Call Me Maybe.pdf](#)
- [Choose Your Superhero—Call Me Maybe - Spanish.docx](#)
- [Choose Your Superhero—Call Me Maybe - Spanish.pdf](#)
- [Choose Your Superhero—Call Me Maybe.docx](#)
- [Choose Your Superhero—Call Me Maybe.pdf](#)
- [Common Cartridge—Call Me Maybe.imscc](#)
- [Electromagnetic Radiation Notes—Call Me Maybe - Spanish.docx](#)
- [Electromagnetic Radiation Notes—Call Me Maybe - Spanish.pdf](#)
- [Electromagnetic Radiation Notes—Call Me Maybe.docx](#)
- [Electromagnetic Radiation Notes—Call Me Maybe.pdf](#)
- [Electromagnetic Radiation Superhero Instructions—Call Me Maybe - Spanish.docx](#)
- [Electromagnetic Radiation Superhero Instructions—Call Me Maybe - Spanish.pdf](#)
- [Electromagnetic Radiation Superhero Instructions—Call Me Maybe.docx](#)
- [Electromagnetic Radiation Superhero Instructions—Call Me Maybe.pdf](#)
- [Lesson Slides—Call Me Maybe.pptx](#)

## Materials

- Common cartridge (attached)
- Lesson Slides (attached)
- Electromagnetic Radiation Superheroes Instructions (attached; one per student)
- Electromagnetic Radiation Notes (attached; print two-sided; one per student)

20 minutes

## Engage (Online)

Have students review the essential questions:

- *How dangerous are electromagnetic waves to humans?*
- *Should we be concerned with the new technological advances of today?*

Next, invite students to participate in a discussion board (in an LMS or elsewhere) with the [C.E.R.T.I.Fy Your Thinking](#) strategy. Have students write their claim, provide three points of evidence, and give comprehensive reasoning to the following prompt:

*"Do you believe the radiation emitted by cell phones can cause harm to the human body? "*

### Teacher's Note: Creating Discussion Posts

Give a 24-hour period for students to create an initial post. Open peer responses the following day. Make sure that students create an initial post before they see others. Continually monitor the discussion board.

To support student discourse and independent thinking, update your discussion board settings to allow threaded replies and hide previous posts until students submit their own.

For more information about facilitating an effective online discussion, visit [K20 Center's best practices for facilitating online discussions](#).

After students post their initial claim, evidence, and reasoning, have them respond to two peers whose viewpoints differ from their own. Then, ask students to return to their original post, review the feedback they received, and revise their reasoning to explain whether they still agree with their claim and why.

40 minutes

## Explore (Face to Face)

### Teacher's Note: Teaching the Hybrid Lesson

If you are teaching the Hybrid lesson, you will need to skip **slides 1–6**, as most of those are covered in the online portion of the Engage.

Move to **slide 7–8**, Inform students that they will be creating comic superheroes based on the seven types of electromagnetic waves. Pass out the **Electromagnetic Radiation Superheroes** and **Electromagnetic Radiation Notes** handout. Place students into groups of seven and have them divide the seven rays among the group. If the class cannot be evenly divided into groups of seven, create an additional group and allow students to choose their rays, or have extra students join another group and select a new superhero from the remaining rays. Each group member should:

1. Create a superhero associated with the ray that you choose.
2. Define what is that ray's superpower and how much energy the superpower produces.
3. Determine if this superpower can be harmful or helpful to living organisms (animals, plants, fungi, bacteria) and how?
4. Review all of the group's drawings and record each ray's definition, advantages, and disadvantages on side A of the **Electromagnetic Radiation Notes** handout.
5. After completion of their notes, have students organize their group's superheroes from least harmful (*longer wavelength*) to most harmful (*shorter wavelength*).

The seven rays students should illustrate are:

- **Non-ionizing:** Radio, microwave, infrared, visible light
- **Ionizing:** UV, X-ray, Gamma

### Teacher's Note: Monitoring Students

Walk around the room and monitor students as they create their superheroes. As they arrange their superheroes in order, avoid guiding them on the spectrum placement; only clarify directions as needed.

50 minutes

## Explain (Online)

After students' drawings and write-ups have been approved, invite students to do a storytelling of their illustration using [Screencastify](#). Screencastify is a Chrome browser extension that provides options to record the screen, video, and audio.

### Optional: Tech Tools

Some other tech tools that can be used by students similar to Screencastify are: [Jing](#), [Loom](#), and [Zoom](#).

Each student's screencast needs to be 1–2 minutes long. Each student should define their ray and discuss what represents the advantages and disadvantages of the ray in their drawing. Students should post their finished screencast to the discussion board.

Once all students have posted their screencasts to the discussion board, ***distribute the following link to students: [Electromagnetic Radiation Notes](#). (This link provides a separate copy to each student.)*** Once students have made personal copies of the handout, ask students to do a [Gallery Walk](#) and collect data from their classmates' screencasts, recording notes in the table on the top half of the handout.

Next, direct students to the [CK-12 20.3 Electromagnetic Spectrum](#) article to read. As students read, instruct them to complete the questions on their Electromagnetic Radiation Notes handout. When they finish, ask them to save and submit their notes.

20 minutes

## Extend (Face to Face)

### Teacher's Note: Preparation & Career Exploration

If you are teaching the Hybrid version of this lesson, skip slide 9 because its content is already addressed in the online Explain section. Use this activity to help students connect electromagnetic radiation to real-world careers, particularly in medical imaging, and ensure they know how to access the video in your LMS and where to submit their written responses afterward.

Move to **slide 10** and tell students: "Today, we are going to learn about a profession that involves electromagnetic radiation on a daily basis. We are going to meet Mrs. Ashley Benard, a Director of Medical Imaging and Radiology Teacher."

Ask students to consider the advantages and disadvantages they may learn about electromagnetic radiation, the type of technology discussed that they use in their line of work. Additionally, alert students to be prepared to answer two questions posed at the end of the video.

- *"Do you believe that we have become more dependent on the technology that surrounds us every day?"*
- *"Is it adding value to our lives physically, mentally, and emotionally? If so, how?"*

Start the [Career-Focused-Director of Medical Imaging for Community Health Centers, Inc with Ashley Benard](#) interview on the slide.

### Embedded video

<https://youtube.com/watch?v=7kW5Lb89nqU>

### Optional Technology: Mentimeter

You may consider having the students place their responses to the two questions in Mentimeter.

To use [Mentimeter](#), visit the site and create an account (or log in), create three open-ended questions in advance. For further instructions on how to create your own Mentimeter, see the K20 Center's [Mentimeter](#) Tech Tool resource. Prepare the questions below.

1. What is something you learned from watching this video that you didn't know before about careers involving electromagnetic radiation?
2. Do you believe that we have become more dependent on the technology that surrounds us every day?
3. Is it adding value to our lives physically, mentally, and emotionally? If so, how?

25 minutes

## Evaluate (Online)

Invite learners to use a quiz page in your LMS (or a similar method) with the [Fist to Five](#) strategy to evaluate their own mastery of the objectives.

Share the following objective statements and have students rate themselves on a scale of 0–5 for each:

1. I can evaluate and defend claims regarding the impact of cell phones.
2. I can correctly identify the advantages and disadvantages of different types of radiation.
3. I understand that longer wavelengths are absorbed as heat.
4. I understand that different waves have different energies that can impact human health.

Using the quiz format in your LMS (or similar), invite students to read Electro Schematics's [Mobile Cell Phone Radiation article](#) and watch Veritasium's "[Do Cell Phones Cause Brain Tumors?](#)" video.

### Embedded video

<https://youtube.com/watch?v=wU5XkhUGzBs>

Have students answer the following quiz questions with 1–2 paragraphs apiece:

- *"Does the radiation emitted by cell phones cause harm to the human body? Why or why not, using evidence from the activities completed for this lesson?"*
- *"Do you still believe the resources you found as evidence to support your claim about cell phone radiation at the beginning of this lesson? Were those sources reliable based on what you have learned? Why or why not?"*

## Resources

- C-K12 Foundation. (2012, December 14). *Electromagnetic Spectrum*. <https://www.ck12.org/book/ck-12-physical-science-for-middle-school/r1/section/20.3/>
- *Free Mobile screen recorder app for Android & IOS*. Loom. (n.d.). <https://www.loom.com/mobile>
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- K20 Center. (n.d.). Fist to Five. Strategies. <https://learn.k20center.ou.edu/strategy/68>
- K20 Center. (n.d.). Gallery Walk. Strategies. <https://learn.k20center.ou.edu/strategy/118>
- K20 Center. (n.d.-b). *Intro to AwwApp*. YouTube. [https://youtu.be/A\\_9ZFL5HWdl](https://youtu.be/A_9ZFL5HWdl)
- K20 Center. (n.d.). Mentimeter. Tech Tools. <https://learn.k20center.ou.edu/tech-tool/645>
- K20 Center. (n.d.). Google Drawings. Tech Tools. <https://learn.k20center.ou.edu/tech-tool/629>
- K20 Center. (n.d.). Screencastify. Tech Tools. <https://learn.k20center.ou.edu/tech-tool/670>
- Mohan Kumar, D. (2014, January 05). *Mobile cell phone radiation*. <https://www.electroschematics.com/mobile-phone-radiation/>
- *One platform to connect. Zoom*. (n.d.). <https://zoom.us/>
- *Sketch, brainstorm and share your ideas. no sign-up required*. Whiteboard for Online Collaboration | Web Whiteboard. (n.d.). <https://webwhiteboard.com/>
- TechSmith. (n.d.). *Camtasia online – free web-based Screen Recorder*. Camtasia. <https://camtasia.techsmith.com/>
- Veritasium. (2015, February 03). Do cell phones cause brain tumors? YouTube. <https://www.youtube.com/watch?v=wU5XkhUGzBs>