

Call Me... Maybe?

Electromagnetic Waves

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Grade Level	9th Grade	**Time Frame**	135 minutes
Subject	Science	**Duration**	3 class periods
Course	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

- Lesson Slides (attached)
- C.E.R. (attached; one per student)
- Electromagnetic Radiation Superheroes (attached; one per student)
- Electromagnetic Radiation Notes (attached; print two-sided; one per student)
- Laptop or tablet (one per student)

30 minutes

Engage

Use the attached **Lesson Slides** to follow along with the lesson. Display with **slide 3** and read the essential questions aloud:

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

Then, move to **slide 4** and read the learning objectives:

Move to **slide 5** and invite students to participate in the C.E.R.T.I.fy Your Thinking strategy. Pass out copies of the **C.E.R.** handout to each student. Inform students that they will create a claim to the following prompt: *Do you believe the radiation emitted by cell phones can cause harm to the human body?* After they have made their claim, direct them to research 3 points of evidence to support their claim and cite where they got their evidence.

Once they have made their claim and collected their evidence, display **slide 6** and split the room into two sections, and have students move to the side of "does cause harm" or "does not cause harm." Next, have them debate over the topic. The process for facilitating a debate is listed below. After the debate, have students return to their seats to come up with their comprehensive reasoning.

Teacher's Note: Debate Facilitation Process

It is always good to begin a class discussion with the rules of how the debate will be conducted:

1. Pick a side to start the discussion (typically start with the side that has the minority)
2. Have one person from that group respond with *one* evidence that supports their claim.
3. Next, give the individual on the other side time to give a rebuttal with their evidence.
4. Take turns back and forth for about 5–10 rounds
5. Ask the groups if there is anyone who would like to switch sides based on the evidence they have heard.
6. Next, give each group 30 seconds to discuss a final summary of why their side is correct.
7. Finally, have a spokesperson share their group's final statement.

40 minutes

Explore

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. 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.

20 minutes

Extend

Teacher's Note: Career Exploration

Use this activity to help students connect electromagnetic radiation to real-world careers and see how the concepts apply in medical imaging. Before beginning, make sure students know how to access the video in your LMS and understand that they will submit written responses after watching.

Move to **slide 10** and Inform 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-Forcused-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) and 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?

20 minutes

Explain

Move group to group and have students explain how they organized their superheroes from least to most harmful. Use these conversations to address misconceptions and guide students in making any needed corrections to their notes.

Move to **slide 9**, direct students to the CK-12 Foundations article 20.3 Electromagnetic Spectrum using the QR code or short link on the slide. Inform students that they will read the article and complete the questions on side B of their **Electromagnetic Radiation Notes** handout.

Teacher's Note: Class Discussion

Consider, after each group has shared out their notes on each ray, asking the class if that matches close to their group's definition, advantage, and disadvantage. If not, discuss the differences between groups.

25 minutes

Evaluate

Go to **slide 11**. Invite students to complete the Fist to Five strategy to help them self-evaluate their mastery of the objectives. Complete this strategy for **slides 12–15**.

Next, move to **slide 16.** Have students recall the claim about cell phones that they made at the beginning of the lesson. Inform learners to keep their claim in mind as they view two opposing viewpoints on the topic. Have learners read the Electro Schematics' Mobile Cell Phone Radiation article.

Move to **slide 17** and invite students to watch Veritasium's "Do Cell Phones Cause Brain Tumors?" video.

Embedded video
https://youtube.com/watch?v=wU5XkhUGzBs

Finally, go to **slide 18** and have learners write 1–2 paragraphs answering the following questions:

1. *Does the radiation emitted by cell phones cause harm to the human body? Why or why not use evidence from the activities completed for this lesson?*
2. *Do you believe the resources you found for your C.E.R. at the beginning were reliable sources based on what you have learned? Why or why not?*

Have students share their thoughts.

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
- K20 Center. (2021, May 10). ICAP - Call Me...Maybe?. YouTube. https://www.youtube.com/watch?v=7kW5Lb89nqU
- 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_9ZFL5HWdI
- 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