

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

- Common Cartridge (attached)
- Choose Your Superhero (attached; one per class)
- Electromagnetic Radiation Superheroes Instructions (attached; one per student)
- Electromagnetic Radiation Notes (attached; one per student)

20 minutes

Engage

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.

30 minutes

Explore

Teacher's Note: Activity Prep for Explore

Before beginning the activity below, download a class sign-up sheet: Choose Your Superhero. Once you create a sign-up sheet, keep the digital link handy. You will distribute this link to students and have them sign up for a superhero.

If using an LMS for this activity, insert your copied link into your LMS for students to access.

Invite students to create superheroes based on the seven types of electromagnetic waves. Share your prepared **Choose Your Superhero** sign-up sheet with students, and have each student sign up for a superhero of their choice.

Communicate the following procedure to students. This information may be embedded in an LMS or may be shared in a virtual classroom such as Google Classroom. It is also included in the attached **Electromagnetic Radiation Superheroes Instructions** handout.

Overview:

Now that we have discussed the pros and cons of cell phones and the energy they emit, let's dive into other rays that produce energy around us. Today, we will be creating superheroes based on the seven types of electromagnetic waves. These rays can be **non-ionizing,** where they are not likely to cause significant damage to human cells, or **ionizing,** where they do cause significant damage. Your job is to choose an ionizing or non-ionizing ray and determine that ray's level of destruction by creating a superhero.

Procedure:

1. Sign up for your superhero using the *Choose Your Superhero* [Instructor note: add your link here] sign-up document. There can only be three individuals per ray.
2. Create a superhero associated with your ray.
    1. Define that ray's superpower and how much energy the superpower produces.
    2. Determine how that superpower can be harmful and helpful to living organisms (animals, plants, fungi, bacteria).
3. Save, upload, and submit your drawing and write-up to be reviewed for feedback.

The seven rays students can illustrate are:

- **Non-Ionizing**: radio, microwave, infrared, visible light
- **Ionizing**: UV, X-ray, gamma

Optional: Drawing Tools

Students can create their superheroes using any of these tools:

- A sheet of paper and drawing tools (students will need to take a picture and upload it)
- Microsoft PowerPoint
- A Web Whiteboard (for instructions on how to use A Web Whiteboard, view the K20 Center's Intro to A Web Whiteboard video.)
- Google Drawings
- Any other drawing tech tool that will display their original work

Each student should submit their drawing and write-up for you to review and give feedback.

50 minutes

Explain

Teacher's Note: Preparation for Explain

Before beginning the activity below, download a copy of the Electromagnetic Radiation Notes handout. Once you create a copy of the handout, you will distribute this attachment to students.

If using an LMS for this activity, insert your copied link into your LMS for students to access.

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: Camtasia, 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 into the discussion board.

Once all students have posted their screencasts into the discussion board, distribute the link you created for the **Electromagnetic Radiation Notes** handout to the students. Once students have a copy 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

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.

Communicate the following procedure to students. This information may be embedded in an LMS or may be shared in a virtual classroom such as Google Classroom.

> 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.

Provide the Career-Focused - Director of Medical Imaging for Community Health Centers, Inc. with Ashley Benard video to students.

Embedded video

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

Ask students as they watch the interview to consider the advantages and disadvantages they may learn about electromagnetic radiation and the type of technology that they use in Mrs. Benard's 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?"*

Have students answer these questions and turn in their responses via your LMS.

Optional Modification: Discussion Posts

Consider creating a page within your LMS for students to answer these questions in a discussion post. Then, have students respond to their peers' posts.

25 minutes

Evaluate

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
- 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