

Level	<h1>Radio Wave Scavenger Hunt with Morse Code Keys</h1>	
Middle School		
Time Required	<b>Lesson Summary</b>	
3 Class Periods (45 minutes each)	In this lesson, students will learn about the history of radio spectrum communication technology. They will investigate and experience Morse Code, explore radio history with a digital scavenger hunt, and investigate materials that can block radio waves.	
<b>Standards Addressed</b>		
<p>I.PS4.3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.</p> <p>MS.PS4.2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.</p> <p>HS.PS4.5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.</p>		
Vocabulary	<b>Objectives</b>	
<ol style="list-style-type: none"> <li>1. Telegraph</li> <li>2. Morse Code</li> <li>3. Regulated</li> <li>4. Allocation</li> </ol>	<ul style="list-style-type: none"> <li>● Students will be able to understand how radio communication has changed throughout history.</li> <li>● Students will be able to understand that although we can't see radio waves traveling, they can be collected and changed into sounds.</li> <li>● Students will be able to determine that radio waves can travel through some materials, but not all.</li> <li>● Students will be able to use Morse Code as a communication tool.</li> </ul>	
<b>Materials</b>		
<ul style="list-style-type: none"> <li>● Copy of FCC "A Short History of Radio" - this can be printed or digital <a href="https://transition.fcc.gov/omd/history/radio/documents/short_history.pdf">https://transition.fcc.gov/omd/history/radio/documents/short_history.pdf</a></li> <li>● Can Radio Waves Be Blocked Investigation - Google Doc Lab Sheet <a href="https://docs.google.com/document/d/e/2PACX-1vQVF4KLIMXKSoF-7wNhm9-NKF-u2qrl6uCO-xroBfirUuCQHKql3k3eWoFYSCpbe7XnAvmnVs0c2IIX/pub">https://docs.google.com/document/d/e/2PACX-1vQVF4KLIMXKSoF-7wNhm9-NKF-u2qrl6uCO-xroBfirUuCQHKql3k3eWoFYSCpbe7XnAvmnVs0c2IIX/pub</a></li> <li>● Radio Spectrum Google Slides - <a href="https://docs.google.com/presentation/d/e/2PACX-">https://docs.google.com/presentation/d/e/2PACX-</a></li> </ul>		

[IvSrHKTpFbaMwPleUPblyFDgUr-2np5HUgAsVF24VHJ2MCI9\\_tYU7td6EBFqFxi3veZKfe-0ejKdg9b/pub?start=false&loop=false&delayms=3000](https://www.youtube.com/watch?v=IvSrHKTpFbaMwPleUPblyFDgUr-2np5HUgAsVF24VHJ2MCI9_tYU7td6EBFqFxi3veZKfe-0ejKdg9b/pub?start=false&loop=false&delayms=3000)

- History of Radio Waves Scavenger Hunt Google Forms - <https://docs.google.com/forms/d/1gpxF-KH2PnT3wGSOsrXkWxv3AUdUajYKLj-QTyWfxhU/copy>
- Lab Investigation Supplies: 2 student cell phones per lab group, aluminum foil, metal pot with metal lid and metal lid, felt, packing peanuts, cardboard, tile, plastic box, foam squares, tape
- Learn Morse Code site - <https://genemecija.github.io/learn-morse-code/>

### Pre-Requisites

Students should have already learned the Electromagnetic spectrum and Properties of waves.

### Safety Considerations

When using headphones while using Learn Morse Code, students should check the volume before beginning so that it is not too loud.

### Pacing Notes

This lesson has been designed to take 3 class periods (45 minutes each). If your class periods differ in length from this, you will need to adjust the following schedule.

Day 1: Radio Spectrum Google Slides and Learn Morse Code Activity

Day 2: Investigate Blocking Radio Waves with Cell Phones Activity and Continue Morse Code Practice if time.

Day 3: Radio Wave Scavenger Hunt Activity

### Before the Lesson

Check to make sure that all of the links work. Be sure that students can access all the materials either digitally or print.

Be sure that Radio Wave blocking investigation materials are cut to sizes large enough to cover a cell phone entirely.

### Assessments

### Classroom Instructions

Pre-Activity Assessments

### Introduction

Slide 1 of Radio Spectrum Google

Have the students complete Slide 1 of Radio Spectrum Google Slides as today's bellringer. Once students have had time to think, have them turn to

<p>Slides (Any words in red are links to videos or webpages). Students will answer in their notebooks how humans have communicated throughout history.</p>	<p>their table partner and share. Then share out and discuss as a whole group.</p> <p>You may want to share the following video and discuss at this point.  <a href="https://www.youtube.com/watch?v=jc2idGS7TwU">https://www.youtube.com/watch?v=jc2idGS7TwU</a></p>
<p>Activity Embedded Assessments</p>	<p style="text-align: center;"><b>Activities</b></p>
<p>Slide #2 is a review of radio wave properties that have been previously taught. Clarify if students have any questions before moving on.</p> <p>Ask: What do you think it was like in an emergency to send messages by Morse Code?</p> <p>What are waves traveling through between phones?</p> <p>Are sound waves traveling between the phones? Be sure students understand that radio waves are light and are converted to sound waves in a speaker.</p>	<p>Day 1:</p> <ol style="list-style-type: none"> <li>1. Continue with direct instruction and discussion using slides #2-6 to give students background on the history of radio communication. There are videos embedded in the slides as well.</li> <li>2. After reviewing slide #6, there is a link embedded to go to Learn Morse Code website. <ol style="list-style-type: none"> <li>a. Once students open up the website, explore the learn tab then have the students click “Legend,” to open the Morse Code key.</li> <li>b. I recommend slowing down the WPM to start.</li> <li>c. Allow students to practice</li> <li>d. Once students feel comfortable, allow one partner to wear headphones and try to determine secret messages their partner is sending them. Be sure they can’t see each other’s screens.</li> </ol> </li> <li>3. Wrap-up Day 1 with Slides #7-9. Discuss the Radio Spectrum as a resource and share all the ways radio frequencies are being allocated. Be sure to review with students what allocated and regulated mean at this point.</li> </ol> <p>Day 2:</p> <ol style="list-style-type: none"> <li>1. Bellringer: Have students complete a bellringer that uses a prerecorded Morse Code message for students to decode.</li> <li>2. Complete Investigate Blocking Radio Waves Activity</li> <li>3. Discuss the materials that could block radio waves and why only those materials worked. (should be aluminum foil and the metal pot with a metal lid - not glass) - Conductive metals may reflect or absorb radio waves.</li> <li>4. Discuss possible benefits of being able to block radio waves.</li> <li>5. Review Radio Frequency allocation from yesterday and discuss the future of wave use as new technology is developed.</li> </ol> <p>Day 3:</p> <ol style="list-style-type: none"> <li>1. Bellringer: Have Ss use Learn Morse Code to complete their name</li> </ol>

	<p>and send a screenshot of their screen to me.</p> <p>2. History of Radio Communication Scavenger Hunt Activity. The link to the FCC Short History of Radio Communication is on the first section of the Google Form, or you can have a print out for students. I will have Ss work with a partner, but the activity can easily be independent.</p>
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Post Activity Assessments	<b>Closure</b>
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<p>Complete 3, 2, 1 closure. Be sure to review before tomorrow’s class to address questions students may still have.</p>	<p>Have students complete 3, 2, 1 closure on index card (based on last 2 classes)</p> <ul style="list-style-type: none"> <li>● 3 things they’ve learned</li> <li>● 2 things they find interesting</li> <li>● 1 question they still have</li> </ul>
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<b>Culturally Inclusive/Responsive Components</b>
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Include women as early radio operators. Jesse Russell was a pioneer in the field of cellular and wireless communications. In 1988, he led the first team from Bell Laboratories to introduce digital cellular technology in the United States.

You may want students to research these topics more with contributions made.

Be careful if you research the history of human communication, many stereotypical images of Native Americans using smoke signals.

<b>Educator Resources</b>
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Background Information: <https://www.wired.com/2009/09/light-and-waves-at-a-basic-level/>

Videos embedded in PowerPoint

1. The Office using Morse Code Scene - funny intro.  
<https://live.myvrspot.com/iframe?v=fMGRkMGUxNjk4NDgyMTIOTk4NzFjNTYlYmRIODMzYzY>
2. James Clerk Maxwell  
<https://live.myvrspot.com/iframe?v=fYjEwNGVjYjY5MGZjMTJlNzgyM2ZlYjA3YWVlZjMxNDk>
3. Tesla and Marconi Wireless Race  
<https://live.myvrspot.com/iframe?v=fYjEwNGVjYjY5MGZjMTJlNzgyM2ZlYjA3YWVlZjMxNDk>