TASK OVERVIEW

MIDDLE SCHOOL PHYSICAL SCIENCE: CELL SIGNAL

Three-Dimensional Claim

In this task, students can draw on prior learning about properties and behaviors of waves to develop an explanation of the interactions of waves and components of communication systems using evidence about various types of electromagnetic radiation and the impact of building materials on wave transmission.

Disciplinary Core Ideas Crosscutting Concepts Science and Engineering Practices

Tennessee Academic Standards for Science

This task is intended to elicit student learning of the following Tennessee Science Standard:

8.PS4.2: Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission, absorption, and their behavior through a vacuum and/or various media.

8.PS4.3: Evaluate the role that waves play in different communication systems.

Next Generation Science Standards

This task is intended to elicit student learning of the following NGSS elements for each of the three dimensions:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- *Middle School Element:* Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

- *Middle School Element:* When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.

PS4.C: Information Technologies and Instrumentation

- *Middle School Element:* Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.

Crosscutting Concepts

Systems and System Models

- *Middle School Element*: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.
- *Middle School Element*: Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.
- *Grade 3-5 Element*: A system can be described in terms of its components and their interactions.

MIDDLE SCHOOL PHYSICAL SCIENCE: CELL SIGNAL

	STRENGTHS	OPPORTUNITIES FOR IMPROVEMENT
SCENARIO	The scenario details a central phenomenon of a student with no cell phone service, which is a real-world, common experience that many students have encountered directly or indirectly. Students may be interested in the idea that science can explain how technology works (and doesn't work).	The concept of using a cell phone to order pizza from the library may not be relevant to some students.
SENSE-MAKING	The task presents a rich phenomenon for students to potentially make sense of and explain.	Students would be able to more easily make sense of and explain why the call was not able to go through if they used or developed a model that showed why the waves were absorbed or reflected when they came in contact with the wall.
INTEGRATED DIMENSIONS	This task features several prompts that integrate two or three dimensions throughout the task.	Making adjustments to the task so students develop an explanation or model of how or why walls block cell phone calls will provide an opportunity for them to demonstrate their three-dimensional understanding
EQUITY	The task uses accessible language and could easily cultivate an interest in science as it connects science ideas to a real-life occurrence. It also provides multiple ways for students to respond and share their thinking.	Coherence from the student point of view can be improved by revising the task so that it is designed to support students as they work toward developing a culminating explanation.
FEEDBACK SUPPORT	The teacher support documents are well developed and helpful. The teacher grading, scoring scale, and feedback is thorough and includes detailed scoring guidance with "look for" statements.	Building out opportunities for students to construct explanations more thoroughly will better elicit direct, observable evidence of the three-dimensional learning target and students' ability to make sense of phenomena so the task fulfills its intended purpose.

MIDDLE SCHOOL PHYSICAL SCIENCE: CELL SIGNAL

Suggestions for Use

This task could be used as a formative assessment or reframed as the start of an instructional sequence. Once students have engaged with the task, they can ask questions like, "What happens when the wave hits the wall?" or "How does information travel in a cable?" These types of questions would lead students toward investigating and explaining the underlying mechanism for why waves behave the ways they do.

What Are The Major Takeaways?

SUMMARY POINTS	SUGGESTIONS FOR IMPROVEMENT
The central, real-world phenomenon in which a student cannot get cell phone service which is a common experience that many students have encountered, which may cultivate interest. Students are asked to respond to multi-dimensional prompts with writing and/or drawings, and the language used is accessible. The answer key is thorough and includes detailed scoring guidance with "look for" statements linked to the three dimensions.	To improve students' ability to make sense of the phenomenon, the task could ask them to develop a model to show why the waves are absorbed or reflected when they come in contact with the wall and what happens when a wave is absorbed or reflected. This would allow students to better engage in sense-making and to demonstrate their understanding of the targeted dimensions, including waves and their role in information flow.

What Should I Do Before Using This Task?

Users should review the provided guidance to familiarize themselves with instructions and disclosures before using these tasks.

How Were These Tasks Developed?

The tasks were developed and revised by teacher work groups from participating districts in the Tennessee District Science Network (TDSciN), which was launched in early 2019 and managed by NextGenScience. Tasks were evaluated using an adapted version of the Science Task Screener. Teachers worked collaboratively across districts to develop and revise these tasks after attending multiple professional learning sessions. Find out more about the development process here.

NextGenScience
WestEd

NextGenScience, a project at WestEd, works alongside educators to design quality, coherent programs that align science standards, instructional materials, professional learning, and assessments.
@NextGenScience | ngs.wested.org

Thanks to generous support from
ARCONIC FOUNDATION