MIDDLE SCHOOL PHYSICAL SCIENCE: SIGNALS

Standards Bundle

Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (SEP: 8; DCI: PS4.C; CCC: Structure, Technology) [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [*Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.*]

Content Overview

This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.

Digitized information (e.g., pixels of a picture) can be stored for future recovery and transmitted without significant degradation. High-tech devices, such as cell phones, can receive and decode information, convert it from digitized form to voice, and vice versa.

Appropriately designed technologies (e.g., radio, television, cell phones, wired and wireless computer networks) make it possible to detect and interpret many types of signals that cannot be sensed directly. Designers of such devices must understand both the signal and its interactions with matter.

Many modern communication devices use digitized signals (sent as wave pulses) as a more reliable way to encode and transmit information.

Phenomena

Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.

- Why does a fidget spinner look different on my cell phone than in real life?
- Why do some people like to listen to records instead of digital music?
- In 2005, the entire United States was required to switch to digital TV.
- Binary, the language of computers, only has two numbers.

Storyline

This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for

student learning, including both rationale and context for the bundle.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information ● Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.	**PS4.C: Information Technologies and Instrumentation** ● Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	**Structure and Function** ● Structures can be designed to serve particular functions.

Each type of electromagnetic wave has properties that make it more useful for some purposes than others. They have different wavelengths and frequencies. Some waves can be used for communication purposes. Radio waves carry information from the antenna of a broadcasting station to the receiving antenna on a radio. Cell phones transmit and receive signals using high-frequency microwaves. Students can explore the structure and function of various modes of wireless communication and integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen.

Formative Assessment

Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.

Obtaining, Evaluating, and Communicating Information

- Create a presentation to compare and contrast the benefits and shortcomings of both analog and digital signals.

Structure and Function

- Explain how the structure of analog signals effects the function.

Influence of Science, Engineering, and Technology on Society and the Natural World

- Explain how the structure of analog signals allow you to store more data in a smaller amount of space.

Science is a Human Endeavor

- Explain how the use of digital signals has advanced science and technology.

Performance Outcomes

These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.

- **Integrate qualitative scientific and technical information** to **support the claim** that digitized signals are a more reliable way to encode and transmit information than analog signals.
- **Clarify claims and findings** *to demonstrate that structural differences in devices* fulfill a variety of communication purposes.