

# Messages in Pulses

Use evidence to explain why digital wave signals can carry information reliably.

**MS-PS4-3** "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..."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## 1 READ AND MARK \_\_\_\_\_ Read it twice

**YOUR JOB** Underline the sentence that makes a claim about why digital signals are reliable. Then number three details that support or illustrate that claim, including one detail about waves carrying information.

### A Message in Pulses

- ① When a friend sends a photo or a voice message, information must travel from one device to another. Devices can change information into a pattern of digital signals. A digital signal uses separate wave pulses, often represented as on or off. The receiving device reads the pattern and changes it back into text, pictures, or sound. Light pulses can move through fiber optic cables, and radio wave pulses can travel through air between a Wi-Fi router and a tablet. In both cases, waves carry the coded message.
- ② Digital patterns are reliable because the receiver can distinguish between two categories of pulse. A pulse may arrive clearly, or it may be missing. Small changes in the strength or shape of a pulse usually do not change which category the device reads. By contrast, a message that depends on continuously changing wave values can be changed by noise, such as unwanted signals from nearby electronics. The receiver may have trouble telling what the original value was. Clear categories make copying, storing, and sending information more dependable.
- ③ Imagine a school museum using a fiber optic cable to send labels from a computer to a display. The computer stores each label as a digital pattern and sends light pulses through the cable. If the light becomes a little weaker along the path, the display can still sort pulses into its expected categories and show the label. This does not mean every message arrives perfectly. A pulse can be blocked or extra noise can interfere. Still, using distinct pulse categories gives the system a reliable way to recover the intended information.

**2 ANSWER WITH EVIDENCE** \_\_\_\_\_ Use the passage

**1** Use details from the first paragraph to explain how a message can change from information in one device into information shown or played by another device.

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**2** How do the fiber optic cable and Wi-Fi examples support the claim that waves can communicate coded information?

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**3** What evidence in the second paragraph supports the claim that digitized signals can still be reliable after a small change in a wave pulse?

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**4** How does the museum example support the reliability claim while also showing that digital communication is not perfect?

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**3 YOUR TURN** \_\_\_\_\_ Your own words

Choose a new communication situation, such as a weather station sending data by radio waves or a signal traveling through an optical cable. Write a three-sentence claim-and-evidence explanation of why digitized wave pulses would be reliable. Include the wave type, a possible source of interference or change, and how distinct pulse categories help the receiver.

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**PART 1 • READ AND MARK**

Underline the sentence that makes a claim about why digital signals are reliable. Then number three details that support or illustrate that claim, including one detail about waves carrying information. Accept any marking that follows this job and points at the right text.

**PART 2 • ANSWERS**

| # | QUESTION                                                                                                                                                    | ANSWER                                                                                                                                                          |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Use details from the first paragraph to explain how a message can change from information in one device into information shown or played by another device. | <b>A device changes the message into a digital pattern of wave pulses. The receiving device reads the pattern and changes it into text, pictures, or sound.</b> |
| 2 | How do the fiber optic cable and Wi-Fi examples support the claim that waves can communicate coded information?                                             | <b>They show that coded pulses can travel as light through fiber optic cable or as radio waves through air, carrying a message between devices.</b>             |
| 3 | What evidence in the second paragraph supports the claim that digitized signals can still be reliable after a small change in a wave pulse?                 | <b>The passage says small changes in a pulse's strength or shape usually do not change the category the receiver reads.</b>                                     |
| 4 | How does the museum example support the reliability claim while also showing that digital communication is not perfect?                                     | <b>A weaker light signal can still be sorted into expected categories so the label appears, but a pulse can be blocked and noise can interfere.</b>             |

**PART 3 • YOUR TURN (SAMPLE ANSWER)**

A weather station can send a temperature reading as a pattern of radio wave pulses to a nearby receiver. Weakening of the radio signal or unwanted radio noise may change pulse strength, but the receiver can still identify expected pulse categories when the pulses remain clear enough. Because it reads distinct categories rather than exact wave values, digitized pulses provide a reliable way to transmit the reading.

Accept answers that connect a reliability claim to accurate passage evidence about distinct pulse categories, noise, or signal changes. For Part 3, accept varied communication examples if the response includes all required elements and does not claim that digital signals never make errors.