Message Through Noise

Use evidence to compare analog and digital signals

MS-PS4-3 "Obtain, evaluate and communicate information to support an evidence-based claim for the reliability of digitized signals to encode and transmit information compared to analog signals. (SEP: 8; DCI: PS4.C; CCC: Structure and Function)"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two observations from the test, circle a sentence that explains how digital signals handle noise, and write 1 beside a sentence that limits the claim about digital signals.

Can the Harbor Hear?

1. At a harbor, a dispatcher sends the message "Dock 6 is clear" over a noisy radio link. A microphone changes the sound of the words into a continuously changing electrical signal. In an analog system, that changing signal is sent much as it is. The receiver turns the arriving signal back into sound. If electrical noise is added during the trip, the signal's shape changes too. The listener may hear crackles that cover part of a word, even though the dispatcher spoke clearly.

2. A digital system first measures the microphone signal many times each second and turns those measurements into numbers. It encodes the numbers as patterns of 0s and 1s for transmission. The receiver decides which digit each arriving part represents, then uses the digits to make sound again. Some noise may change a pulse slightly without changing the digit the receiver reads. Unlike a continuous analog signal, each digit has only two possible values. That structure can help the receiver reconstruct the message despite mild noise.

3. To compare both methods, students sent the same recorded harbor message through two classroom links with the same added noise. On the analog link, they heard hiss over the word "clear." On the digital link, they heard "Dock 6 is clear" without hiss. When they greatly increased the noise, the digital receiver missed some digits, and part of the message dropped out. The test supports a limited claim: digital encoding can preserve a message better under some noisy conditions, but it cannot guarantee that every message arrives.

2 ANSWER WITH EVIDENCE

Use the passage

1. What did the students hear on each link when both had the same added noise? What claim does this evidence support?

2. Why might mild noise change an analog message but leave a digital message understandable?

3. Which observation shows that a digital message is not always delivered correctly?

4. Why does using the same recorded message and the same added noise make the students' comparison more useful?

3 YOUR TURN

Your own words

Choose a message and setting not used in the reading. In 4 to 5 sentences, claim which kind of link would deliver your message more reliably with mild noise, use two details from the reading to explain your prediction, and name one condition that could weaken your claim.

ANSWER KEY

Message Through Noise

GRADES 6-8 · MS-PS4-3

PART 1 · READ AND MARK

Underline two observations from the test, circle a sentence that explains how digital signals handle noise, and write 1 beside a sentence that limits the claim about digital signals. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What did the students hear on each link when both had the same added noise? What claim does this evidence support?	**They heard hiss over "clear" on the analog link but heard the full message without hiss on the digital link. This supports the claim that digital encoding can preserve a message better under some noisy conditions.**
2	Why might mild noise change an analog message but leave a digital message understandable?	**Noise changes the shape of an analog signal. A slightly changed digital pulse may still be read as the same 0 or 1.**
3	Which observation shows that a digital message is not always delivered correctly?	**When the students greatly increased the noise, the digital receiver missed digits and part of the message dropped out.**
4	Why does using the same recorded message and the same added noise make the students' comparison more useful?	**It lets the students compare the links without differences in the message or noise explaining what they heard.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

At a mountain weather station, a worker sends "Wind speed is 12 kilometers per hour" to a nearby office. With mild noise, I predict a digital link would deliver the message more reliably than an analog link. Noise can change the shape of a continuous analog signal, while a slightly changed digital pulse can still be read as the same digit. If noise becomes strong enough to make the receiver miss digits, parts of the digital message could be lost.

Accept claims that use the passage's observations or signal structure as evidence and acknowledge that strong noise can disrupt digital transmission. Part 3 should use a setting and message different from the harbor example.