Learning Target: I can read passages about the properties of waves and then use the information gathered to answer comprehension questions.

FSI 8th Science Reading for Meaning – The Power of Waves, Predicting Energy Through Patterns

From the crash of ocean waves to the invisible signals carrying a text message, waves are everywhere. Waves are disturbances that transfer energy, not matter, through space or a medium. Scientists use **models**—such as graphs, simulations, and illustrations—to understand how wave properties like **frequency**, **amplitude**, and **wavelength** relate to energy.

Modeling the Wave-Energy Relationship

In a computer simulation, students observed three waves moving through water. Wave A had a **high amplitude** and a **short wavelength**, Wave B had a **medium amplitude** and a **medium wavelength**, and Wave C had a **low amplitude** and a **long wavelength**. The simulation measured how much energy each wave transferred to floating objects. The higher the amplitude and frequency, the more the objects were pushed or lifted—showing a direct link between energy and these properties.

Scientists know that **frequency**—how many wave crests pass a point per second—determines how energetic the wave is. **Amplitude**, or wave height, also affects energy; doubling the amplitude can quadruple the energy. **Wavelength**, the distance between crests, is inversely related to frequency: shorter wavelengths mean higher frequency and more energy.

Applying the Model

When engineers design earthquake-resistant buildings, they use wave models to predict how seismic waves will transfer energy through the ground. Similarly, communication engineers adjust the frequency and amplitude of radio waves to send clear signals without using excessive energy.

These models help predict what happens when wave properties change. If frequency increases, so does energy; if amplitude decreases, energy drops. Scientists can simulate these changes and graph results to **predict** outcomes before experimenting in real life—a safe and powerful tool in both research and design.

Multiple Choice & Multi-Select Questions (DOK 3–4)

1. (DOK 3)
Based on the passage, what can be inferred about the relationship between wavelength and energy?
A. Longer wavelengths carry more energy.
B. Shorter wavelengths carry less energy.
C. Shorter wavelengths carry more energy.
D. Wavelength has no effect on energy.

2. (DOK 3)
If engineers double the amplitude of a wave in a simulation, what happens to the wave's energy?
A. Energy doubles.
B. Energy decreases by half.
C. Energy quadruples.
D. Energy remains the same.

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3. (DOK 4)
A student creates a graph comparing wave frequency to energy. Which pattern would best represent the data?
A. A downward slope showing less energy with higher frequency.
B. A flat line showing no change in energy.
C. An upward slope showing increased energy with higher frequency.
D. A curve that drops and then rises again.

4. (DOK 3)
Which wave from the simulation most likely carried the least energy?
A. Wave A B. Wave B C. Wave C D. They all carried the same energy.

5. (DOK 4 – Multi-Select)
Select TWO ways scientists use models to study waves.
A. To predict how changing frequency affects energy
B. To visualize relationships between amplitude and energy transfer
C. To eliminate the need for real-world testing
D. To reduce the importance of accurate measurement

6. (DOK 3)
Which statement best explains why engineers adjust the frequency of radio waves?
A. To change the color of the signal
B. To control the amount of energy used in transmission
C. To reduce the size of the transmitter
D. To make the wave travel faster than light

7. (DOK 4 – Multi-Select)
If a scientist increases frequency while keeping amplitude the same, what TWO outcomes are most likely?
A. The wave's energy increases.
B. The wave's wavelength decreases.
C. The wave's energy decreases.
D. The wave's wavelength increases.

8. (DOK 4)
Students use a computer model to test different waves. Which test best supports the claim that "amplitude and frequency both affect energy"?
A. Changing only amplitude while keeping frequency constant
B. Changing both amplitude and frequency to see combined effects
C. Changing wavelength alone
D. Observing only one wave type

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9. (DOK 3)

Which model would best help scientists predict energy transfer from ocean waves to a shoreline?

A. A simulation showing waves striking the coast at different frequencies
B. A model of wind patterns
C. A temperature graph of the ocean
D. A drawing of fish moving through water

10. (DOK 4)

A student claims that frequency and wavelength are directly proportional. Using evidence from the passage, what is the best way to evaluate this claim?

A. The claim is correct because energy and frequency both increase together.
B. The claim is incorrect because wavelength decreases as frequency increases.
C. The claim is correct because amplitude stays constant.
D. The claim cannot be tested using models.

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