

Buoy Wave Model

Use data and sketches to connect wave properties with energy.

S8P4.f "Develop and use a model (e.g., simulations, graphs, illustrations) to predict and describe the relationships between wave properties (e.g., frequency, amplitude, and wavelength) and energy."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline the statements that describe how wave properties are related, then circle the frequency and wavelength values in the data table that form each pair.

Testing Waves for a Warning Buoy

- ① Engineers testing a harbor warning buoy use a computer model of water waves. The model holds wave speed constant at 12 meters per second, like waves traveling through the same water conditions. It changes only the number of crests that pass a point each second, called frequency. The table records the resulting wavelengths. Wavelength is the distance between matching crests.

COMPUTER MODEL RESULTS

Frequency (Hz)	Wavelength (m)
2	6
3	4
4	3
6	2

- ② At a constant speed, frequency and wavelength change in opposite directions. In the table, doubling frequency from 2 hertz to 4 hertz makes wavelength shrink from 6 meters to 3 meters. This pattern follows $\text{wave speed} = \text{frequency} \times \text{wavelength}$. A useful model tests one variable at a time. To compare frequency and wavelength, engineers keep wave speed unchanged.
- ③ Energy is not shown by wavelength alone. For waves in the same material, a larger amplitude, the height from the resting position to a crest, carries more energy than a smaller amplitude. Frequency can also affect the rate of energy transfer. Therefore, the buoy model needs amplitude and frequency settings before it predicts wave energy. Graphs help scientists spot patterns.

2 ANSWER WITH EVIDENCE Use the passage

1 Use the table. What happens to wavelength when frequency increases from 2 Hz to 6 Hz?

2 What wave speed does the 3 Hz, 4 m data pair show?

3 Two waves have the same frequency and wavelength, but one has a larger amplitude. Which wave carries more energy?

4 The model keeps wave speed at 12 m/s and uses a frequency of 8 Hz. Predict the wavelength.

3 YOUR TURN Your own words

Draw three labeled wave models across the same width. In Panel 1, draw a low-amplitude wave with two crests. In Panel 2, keep the crest spacing the same but make amplitude larger and label its energy change. In Panel 3, use the original amplitude but draw four crests and label the frequency and wavelength change. Write a two-sentence caption explaining your models.

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PART 1 • READ AND MARK

Underline the statements that describe how wave properties are related, then circle the frequency and wavelength values in the data table that form each pair. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Use the table. What happens to wavelength when frequency increases from 2 Hz to 6 Hz?	Wavelength decreases from 6 m to 2 m. As frequency increases, wavelength decreases when wave speed stays constant.
2	What wave speed does the 3 Hz, 4 m data pair show?	12 m/s, because $3 \text{ Hz} \times 4 \text{ m} = 12 \text{ m/s}$.
3	Two waves have the same frequency and wavelength, but one has a larger amplitude. Which wave carries more energy?	The wave with the larger amplitude carries more energy.
4	The model keeps wave speed at 12 m/s and uses a frequency of 8 Hz. Predict the wavelength.	1.5 m, because $\text{wavelength} = 12 \text{ m/s} \div 8 \text{ Hz}$.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Panel 2 has the same wavelength as Panel 1 but a larger amplitude, so it carries more energy. Panel 3 has more crests across the same distance, so it has higher frequency and a shorter wavelength, and frequency can affect the rate of energy transfer.

Accept equivalent sketches with Panel 2 showing greater amplitude at unchanged crest spacing and Panel 3 showing more closely spaced crests at unchanged amplitude. Students should state that larger amplitude carries more energy and that higher frequency means shorter wavelength when wave speed is constant.