SCIENCE FOUNDATIONS

Waves and wave properties

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you describe everything from ocean waves and stadium waves to sound and light, using the same ideas of height, spacing, and how often the wave repeats. A surfer reads the spacing between waves to judge when to paddle out, and a sound engineer reads the height of a sound wave to judge how loud it is. A radio engineer uses the same language to describe a broadcast signal. Knowing waves and wave properties tells you that very different waves can all be described the same way, so you can compare them directly.



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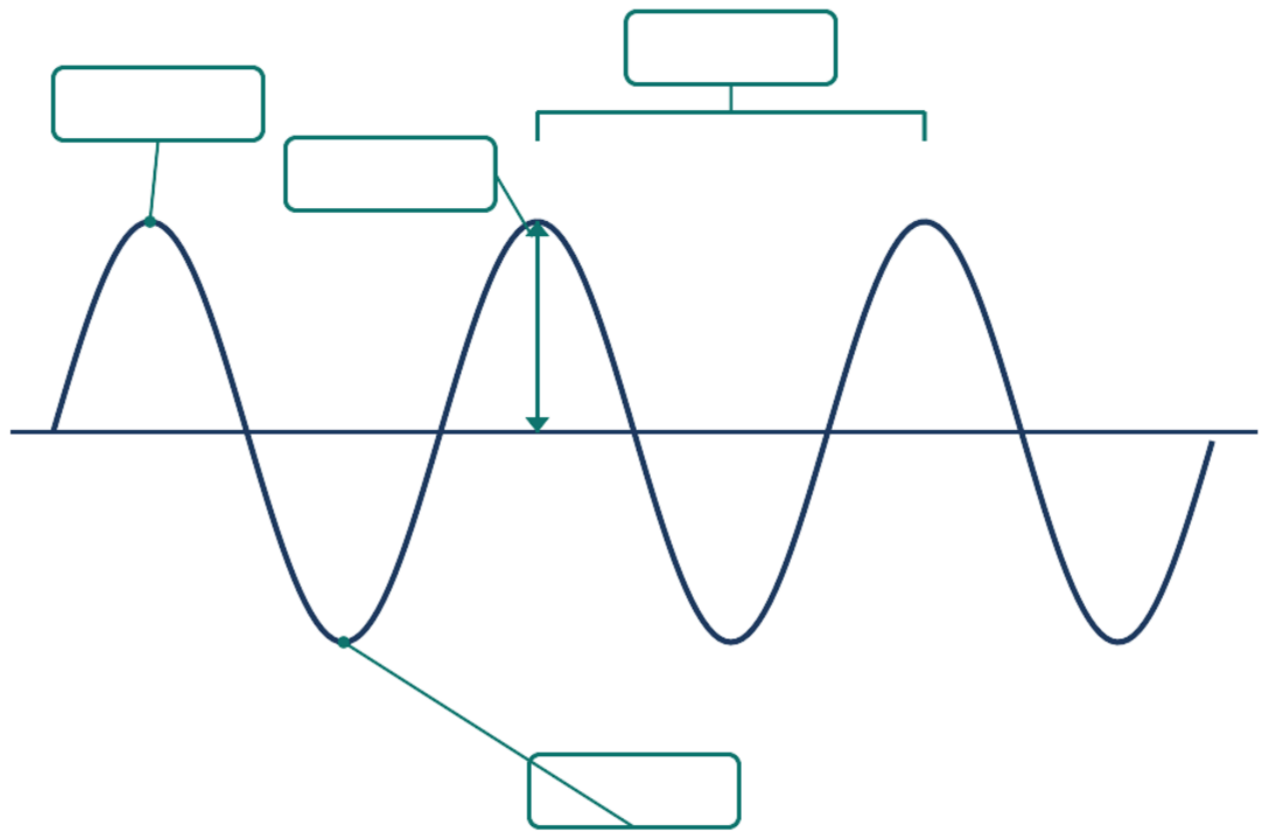
Worked examples

EXAMPLE 1

Q Label a wave diagram: crest, trough, amplitude, wavelength.



SOLUTION

Find the highest point: that is a crest.

Find the lowest point: that is a trough.

Measure amplitude from the middle line to a crest, and wavelength from crest to crest.

The result is crest top, trough bottom, amplitude and wavelength labelled.

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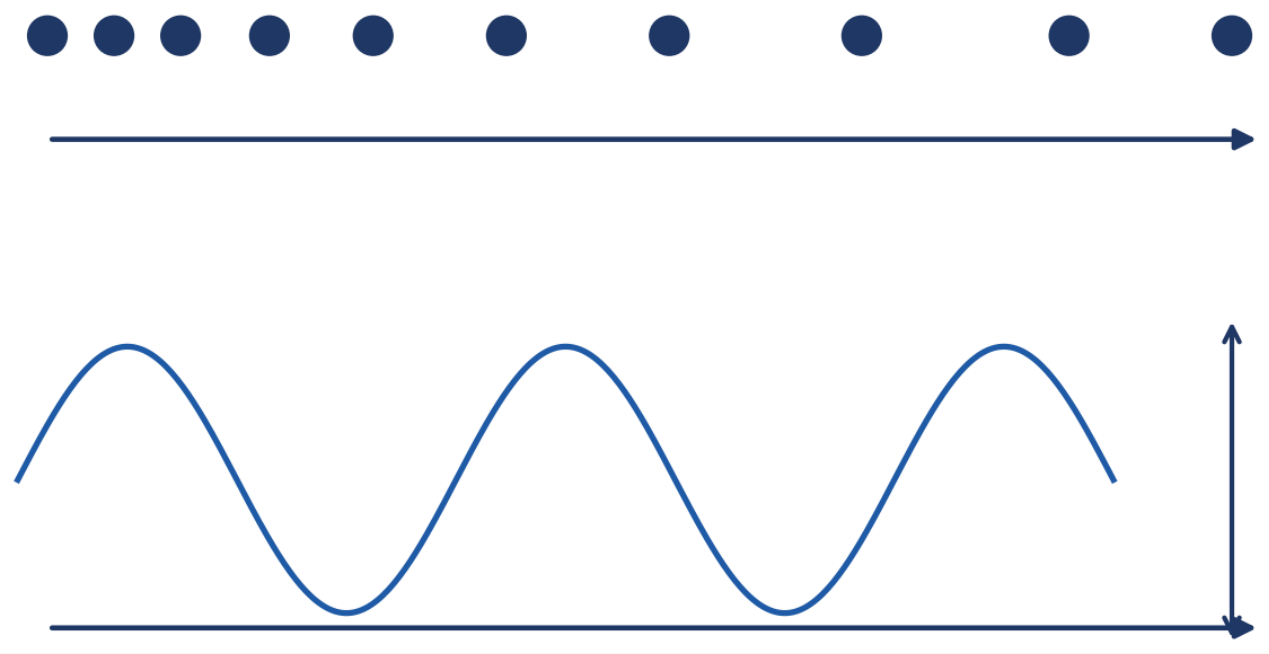
EXAMPLE 2

Q Classify sound and light waves.



SOLUTION

Ask the vibration direction for sound: air vibrates along travel, so longitudinal.

Ask for light: fields vibrate at right angles to travel, so transverse.

Label each one.

The result is sound longitudinal, light transverse.

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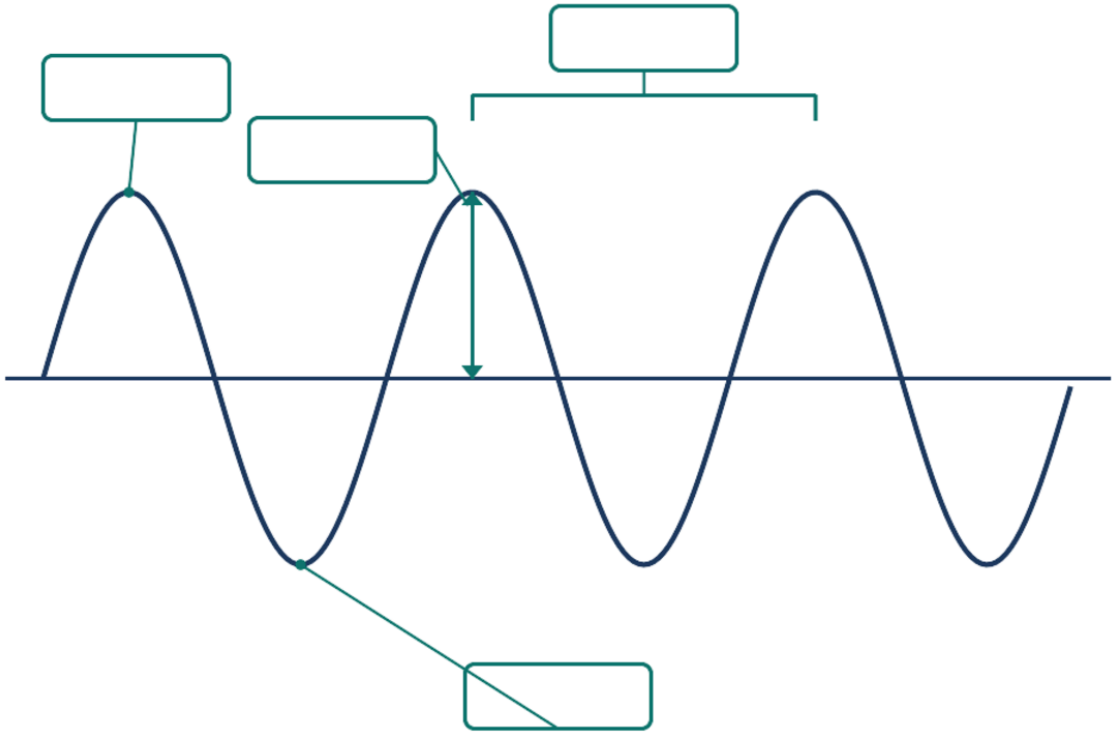
Practice questions

1 How many crests does the wave in the diagram show?



A 3

B 2

C 4

D 1

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2

Where is the amplitude measured from and to, and where is the wavelength measured from and to?

A. Amplitude: crest to trough; wavelength: trough to trough

B. Amplitude: crest to crest; wavelength: middle line to crest

C. Amplitude: middle line to crest; wavelength: crest to crest

D. Amplitude: middle line to trough; wavelength: crest to trough

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3 **Wave A is a wave on a rope that moves up and down as it travels along the rope, and Wave B is a sound wave in air. Classify each as transverse or longitudinal, and state the vibration direction for each.**

- **A** Both transverse, vibrating at right angles to travel
- **B** A: transverse, vibrating at right angles to travel; B: longitudinal, vibrating along the direction of travel
- **C** A: longitudinal, vibrating along the direction of travel; B: transverse, vibrating at right angles to travel
- **D** Both longitudinal, vibrating along the direction of travel

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4 A wave passes a point 10 times in 2 seconds. What is its frequency?

- **A** 5 Hz
- **B** 20 Hz
- **C** 2 Hz
- **D** 10 Hz

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5 A double-headed arrow runs from the rest position up to a crest. What is that distance called?

- **A** Amplitude
- **B** Wavelength
- **C** Frequency
- **D** Crest

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6

A bracket spans from one crest to the next crest. What is that distance called?

A Wavelength

B Amplitude

C Frequency

D Trough

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7

What is the point at the top of a wave called?

A Crest

B Trough

C Amplitude

D Wavelength

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8

What is the point at the bottom of a wave called?

A Trough

B Crest

C Amplitude

D Wavelength

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9

Wave B has a larger amplitude than Wave A. What does a larger amplitude mean?

A Less energy, so quieter or dimmer

B More energy, so louder or brighter

C A higher frequency

D A longer wavelength

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10

Wave B has a longer wavelength than Wave A, and both waves travel at the same speed. What does the longer wavelength mean for the frequency?

A Lower frequency

B Higher frequency

C The same frequency

D Zero frequency

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ANSWER KEY

1. 3

2. Amplitude: middle line to crest; wavelength: crest to crest

3. A: transverse, vibrating at right angles to travel; B: longitudinal, vibrating along the direction of travel

4. 5 Hz

5. Amplitude

6. Wavelength

7. Crest

8. Trough

9. More energy, so louder or brighter

10. Lower frequency

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