3.18 Wave Properties and Behaviour: Test Pack

AQA 8464 · Calculator allowed · about 20 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State whether each of the following waves is transverse or longitudinal.

(i) A sound wave travelling through air.

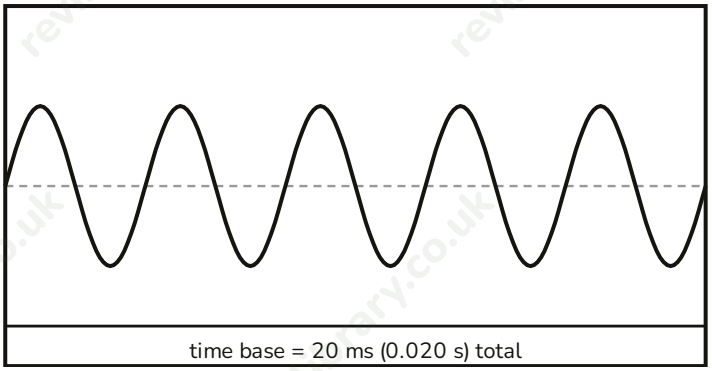
(ii) A light wave travelling through a vacuum.

(iii) A ripple travelling across the surface of a garden pond.

(Total for Question 1 is 3 marks)

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2 A microphone connected to an oscilloscope displays a displacement-time graph for a sound wave. The trace shows the wave completing exactly 5 full cycles in a time of 20 ms (0.020 s).



(a) Calculate the period of the sound wave. **(2)**

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(b) Use your answer to part a and the Physics Equations Sheet equation frequency = 1 / period (f = 1/T) to calculate the frequency of the sound wave. **(2)**

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(Total for Question 2 is 4 marks)

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3 Give one medical use and one industrial (non-medical) use of ultrasound waves.

(Total for Question 3 is 2 marks)

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4 When a wave crosses a boundary between two different materials, its speed and wavelength change, but its frequency stays the same. Explain why the frequency does not change.

(Total for Question 4 is 2 marks)

5 A loudspeaker emits a sound wave that travels through air at 330 m/s and has a wavelength of 1.65 m. A dog whistle emits an ultrasound wave that travels through the same air at the same speed, but its frequency is 100 times higher than the frequency of the sound wave from the loudspeaker. Use the Physics Equations Sheet: wave speed = frequency * wavelength ($v = f * \lambda$), to calculate the wavelength of the ultrasound wave from the dog whistle.

(Total for Question 5 is 4 marks)

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Mark scheme · 3.18 Wave Properties and Behaviour: Test Pack

Question 1

(i) longitudinal	**B1**
(ii) transverse	**B1**
(iii) transverse	**B1**

Answer: (i) longitudinal (ii) transverse (iii) transverse

Question 2

(a) substitutes correctly: T = 0.020/5	**M1**
(a) T = 0.004 s (4 ms), cao	**A1**

(a) Answer: 0.004 s (4 ms)

(b) substitutes correctly: f = 1/0.004	**M1**
(b) f = 250 Hz, cao (ft from their answer to part a)	**A1**

(b) Answer: 250 Hz

Question 3

medical use, e.g. pre-natal (antenatal) scanning to image a fetus in the womb, or breaking up kidney stones (any suitable medical use)	**B1**
industrial use, e.g. non-destructive testing to detect cracks/flaws inside metal objects, or measuring the depth of the sea/a lake, or cleaning delicate objects (any suitable industrial use)	**B1**

Answer: Medical: antenatal scanning of a fetus. Industrial: detecting flaws inside metal objects (non-destructive testing).

Question 4

the frequency of a wave is set by the source producing it (the rate at which the source vibrates)	**B1**
the number of wave cycles arriving at the boundary each second must equal the number leaving it, as waves are not created or destroyed there, so the frequency cannot change, oe	**B1**

Answer: Frequency is fixed by the source; the number of waves arriving at and leaving the boundary each second must match, so the frequency is unchanged.

Question 5

finds the frequency of the loudspeaker's sound wave: f = v/λ = 330/1.65 = 200 Hz	**M1**
finds the frequency of the ultrasound wave: 200 * 100 = 20 000 Hz	**M1**
rearranges and substitutes to find the new wavelength: λ = v/f = 330/20 000	**M1**
λ = 0.0165 m (1.65 cm or 1.65 x 10^{-2} m), cao	**A1**

Answer: 0.0165 m (1.65 cm)

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