3.7 Sound Waves and Ultrasound: 10-minute Pack

Total Marks

EDEXCEL 4PH1 · Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State whether sound waves are longitudinal or transverse, in the context of sound travelling through air.

(Total for Question 1 is 1 mark)

2 A teacher demonstrates that sound requires a medium by placing a bell inside a glass jar and extracting the air with a pump so the bell rings more quietly as the air is removed. State the variable that is being changed in this demonstration and why the sound becomes quieter as the air is removed.

(Total for Question 2 is 2 marks)

3 Explain why sound cannot be heard in a vacuum, using the idea of a medium for sound to travel.

(Total for Question 3 is 1 mark)

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4 Describe one industrial use of ultrasound other than flaw detection, and give a brief explanation of how it works in that use.

(Total for Question 4 is 2 marks)

5 A tuning fork produces a sound of frequency 440 Hz in air where the speed of sound is 340 m/s. Calculate the wavelength of this sound in air.

(Total for Question 5 is 3 marks)

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Mark scheme · 3.7 Sound Waves and Ultrasound: 10-minute Pack

Question 1

sound waves are longitudinal **B1**

Answer: Longitudinal

Question 2

identifies the independent variable: amount or pressure of air in the jar **B1**

explains that fewer particles or lower pressure means less efficient transmission of vibrations so sound intensity decreases **B1**

Answer: The amount/pressure of air is changed; as air is removed there are fewer particles to carry vibrations so the sound becomes quieter

Question 3

no medium in a vacuum so there are no particles to vibrate and carry the sound **B1**

Answer: Because a vacuum has no particles to vibrate, there is no medium to carry sound waves

Question 4

names a valid industrial use, e.g. ultrasonic cleaning or level sensing **B1**

gives a correct brief explanation of the principle, e.g. cleaning: ultrasound in a cleaning bath produces cavitation and agitation that removes contaminants; level sensing: echoes from a liquid surface measure distance to detect level **B1**

Answer: Example: ultrasonic cleaning, where high frequency pulses produce cavitation bubbles that remove dirt from objects; or level sensing using echo times to measure liquid height

Question 5

quotes equation $\lambda = v / f$ or rearranges $v = f \times \lambda$ to $\lambda = v / f$ **M1**

substitutes values: $\lambda = 340 / 440$ **M1**

$\lambda = 0.773$ m cao (allow 0.77 m or 0.773... m) **A1**

Answer: 0.773 m (about 0.77 m)

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