Cambridge Assessment International Education

Cambridge IGCSE™

9: Waves – Topic questions

Paper 4

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
6	2016	June	41
6	2016	March	42
6	2016	November	41

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

Copyright © UCLES 2017

6 **(a)** Two students are measuring the speed of sound.

The students are provided with a starting pistol, a stopwatch and a long measuring tape. The starting pistol, when fired, produces a loud sound and a puff of smoke at the same instant.

Describe how the students use the apparatus and how they calculate the speed. You may draw a diagram.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

Copyright © UCLES 2017

(b) A device at the bottom of the sea emits a sound wave of frequency 200 Hz.

(i) The speed of sound in sea-water is 1500 m / s.

Calculate the wavelength of the sound in sea-water.

wavelength = ... [2]

(ii) The sound wave passes from the sea-water into the air.

State what happens, if anything, to

- the frequency of the sound, ...

.....

- the speed of the sound. .....

.....

[2]

[Total: 8]

Copyright © UCLES 2017

6 **(a)** Fig. 6.1 represents the waveform of a sound wave. The wave is travelling at constant speed.

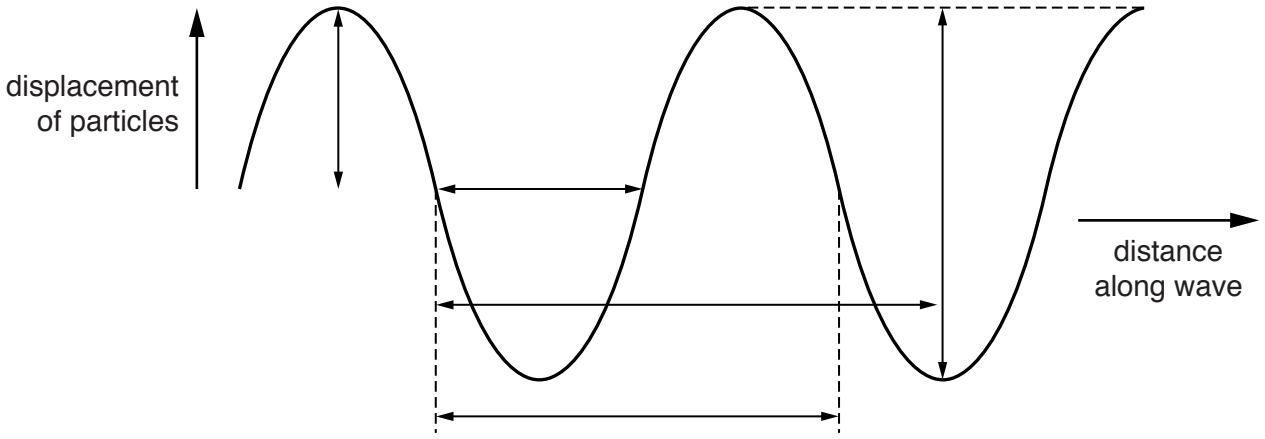

Fig. 6.1

(i) On Fig. 6.1,

1. label with the letter X the marked distance corresponding to the amplitude of the wave, [1]

2. label with the letter Y the marked distance corresponding to the wavelength of the wave. [1]

(ii) State what happens to the amplitude and the wavelength of the wave if

1. the loudness of the sound is increased at constant pitch,

amplitude .....

wavelength .....
[1]

2. the pitch of the sound is increased at constant loudness.

amplitude .....

wavelength .....
[1]

(b) A ship uses pulses of sound to measure the depth of the sea beneath the ship. A sound pulse is transmitted into the sea and the echo from the sea-bed is received after 54 ms. The speed of sound in seawater is 1500 m/s.

Calculate the depth of the sea beneath the ship.

depth = ...[3]

[Total: 7]

Copyright © UCLES 2017

6 **(a)** **(i)** State a typical value for the speed of sound in air.

speed = ...[1]

(ii) State the range of frequencies that can be heard by a healthy human ear.

.....[1]

(b) A sound wave in air has a wavelength of 22 mm.

Fig. 6.1 represents wavefronts of this sound. These wavefronts are successive compressions.

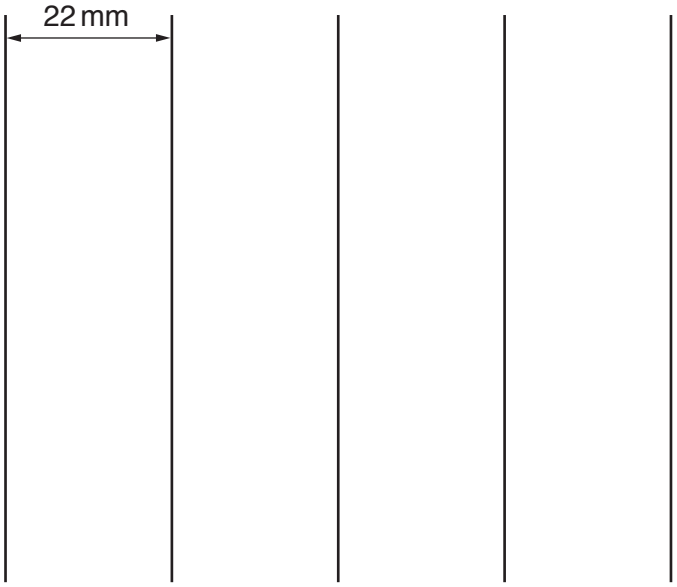

Fig. 6.1

(i) Using your value for the speed of sound in **(a)(i)**, calculate the frequency of the sound wave.

frequency = ...[2]

(ii) On Fig. 6.1, draw dotted lines to represent **three** different rarefactions. [1]

(iii) State, in terms of both molecules and pressure, what is meant by a *rarefaction*.

.....

.....

.....

.....[2]

[Total: 7]

Copyright © UCLES 2017

Question	Answer	Mark
6 (a)	Method 1: Long distance / distance in field measured with the tape One student fires pistol at one end (of this distance) Student at other end starts stop-watch on seeing smoke / light from pistol and st / ops stop-watch on hearing sound of pistol speed = (measured) distance / (measured) time Method 2: Distance of 50 m or more from a vertical wall measured with the tape Student 1 fires pistol at this distance from the wall Student 2 standing next to student 1 starts stop-watch on hearing pistol and stops stop-watch on hearing echo speed = 2 × (measured) distance / (measured) time	 B1 B1 B1 B1 (B1) (B1) (B1) (B1)
6 (b) (i)	v = fλ OR (λ =) v / f OR 1500 / 200 7.5 m	C1 A1
6 (b) (ii)	1 (frequency) does not change 2 (speed) decreases	B1 B1
		Total: 8
6 (a) (i)	1 mark amplitude with **X** 2 mark wavelength with **Y**	B1 B1
6 (a) (ii)	1 amplitude increase and wavelength stays the same 2 amplitude stays the same and wavelength decreases	B1 B1
6 (b)	v = (total) distance / time OR d / t OR 2d / t in any form d = 1500 × 0.054 / 2 40 m OR 41 m	C1 C1 A1
		Total: 7
6 (a) (i)	300 – 360 m / s	B1
6 (a) (ii)	20 Hz – 20 KHz	B1
6 (b) (i)	v = f λ **OR** (f =) v / λ OR (a)(i) / 0.022 Correct answer: e.g. 330 m / s gives 15 000 Hz	C1 A1
6 (b) (ii)	Vertical dotted lines midway (by eye) between each pair of compressions **OR** to right or left of compressions shown with correct spacing (by eye)	B1
6 (b) (iii)	(At rarefactions) molecules have above normal separation / far apart / spread out Pressure (of air) is below normal / low **OR** Molecules exert below normal / low pressure	B1 B1
		Total: 7

Notes about the mark scheme are available separately.

Copyright © UCLES 2017