Name: _____

Waves

Questions

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Which of the following wave properties is **not** exhibited by sound waves?

(1)

- ☒ **A** diffraction
- ☒ **B** interference
- ☒ **C** polarisation
- ☒ **D** refraction

(Total for question = 1 mark)

Q2.

Sound waves are produced by a vibrating guitar string.

Which row in the table correctly describes the waves produced?

(1)

	Guitar string	Sound
☒ **A**	transverse	transverse
☒ **B**	longitudinal	longitudinal
☒ **C**	longitudinal	transverse
☒ **D**	transverse	longitudinal

(Total for question = 1 mark)

Q3.

Which statement about sound is correct?

(1)

☒ **A** Sound can travel through a solid.

☒ **B** Sound can travel through a vacuum.

☒ **C** Sound waves can travel as polarised waves.

☒ **D** Sound waves travel in a direction perpendicular to the direction of the oscillations.

(Total for question = 1 mark)

Q4.

Which of the following phenomena does **not** occur with sound waves?

☒ **A** diffraction

☒ **B** interference

☒ **C** polarisation

☒ **D** refraction

(Total for question = 1 mark)

Q5. Which term may be defined as the number of waves passing a point in one second?

☒ **A** wave speed

☒ **B** wavelength

☒ **C** period

☒ **D** frequency

(Total for Question = 1 mark)

Q6. Which type of electromagnetic radiation is used for communicating with satellites?

☒ **A** infrared

☒ **B** microwave

☒ **C** ultraviolet

☒ **D** visible light

(Total for Question = 1 mark)

Q7. The diagrams show the motions of a source of sound, S, and an observer, O.

Which line of the table correctly shows the effect this relative motion has on the frequency of the sound heard by the observer.

	Motions of S and O	Frequency
☒ **A**	S ← ● O stationary ●	increased
☒ **B**	S ● → ← ● O	decreased
☒ **C**	S ← ● O ● →	decreased
☒ **D**	S stationary ● O ● →	increased

(Total for Question = 1 mark)

Q8.

The distance travelled by a wave during one oscillation may be described as

☒ **A** frequency.

☒ **B** period.

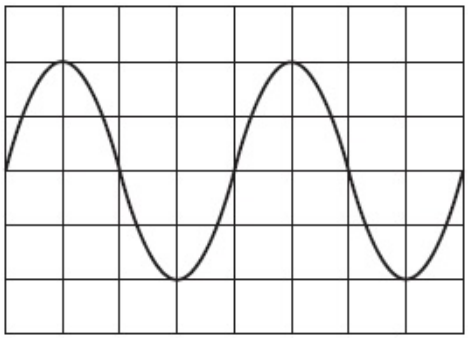
☒ **C** wavelength.

☒ **D** wave speed.

(Total for question = 1 mark)

Q9.

A particular sound is investigated by connecting a microphone to an oscilloscope. The diagram shows the trace of a sound wave on the oscilloscope. The screen of the oscilloscope has a grid on it. On the x-axis 1 division represents 5 ms.



The frequency of the sound wave is

☒ **A** 0.05 Hz

☒ **B** 0.1 Hz

☒ **C** 50 Hz

☒ **D** 100 Hz

(Total for question = 1 marks)

Q10. (a) Some radio signals have a frequency of 218.6 MHz.

Calculate their wavelength.

(2)

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Wavelength = ...

(b) State what is meant by:

(i) frequency

(1)

.....

.....

(ii) wavelength.

(1)

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.....

(Total for Question = 4 marks)

Q11.

Two students are carrying out an investigation to determine a value for the speed of sound in air.

They stand 80 m from a building. One student hits two pieces of wood together to make a loud sound and a short time later an echo is heard. The other student uses a stopwatch to measure the time interval *t* between the two pieces of wood being hit and the echo being heard. The procedure is repeated. The students also measure the air temperature.

(a) Explain how a sound wave travels through air.

(2)

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(b) The students repeat the investigation on a different day. The results are shown in the table.

	temperature / °C	t_1 / s	t_2 / s	t_3 / s	mean t / s
Day 1	12	0.51	0.43	–	0.47
Day 2	18	0.44	0.69	0.48	0.46

(i) Deduce why the students thought it necessary to make a third measurement on day 2.

(1)

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(ii) Calculate the percentage uncertainty in the mean value of time on day 1.

(2)

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Percentage uncertainty = ...

(iii) Calculate the difference in the value for the speed of sound between day 1 and day 2 obtained from these results.

(2)

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Difference in speed = ...

(iv) The students state that the difference in the speed of sound between day 1 and day 2 is due to the change in air temperature.

Explain whether the results obtained are sufficient for this statement to be made.

(2)

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(Total for question = 9 marks)

Q12.

An ultrasonic distance estimator can be used to measure the length of a room.

The estimator is held against one wall. It emits pulses of ultrasound and detects them when they return after reflection by the opposite wall.

(a) Explain why the ultrasound must be emitted in pulses.

(1)

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(b) The shortest distance the estimator can measure is 40 cm.
Calculate the longest pulse duration that would allow this distance to be measured.

speed of ultrasound in air = 330 m s^{-1}

(3)

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Pulse duration = ...

(c) When the estimator is pointed at a sloping wall, as shown in the photograph, it is unable to measure this distance.

Suggest why the estimator is unable to measure the distance to the sloping wall.

(1)

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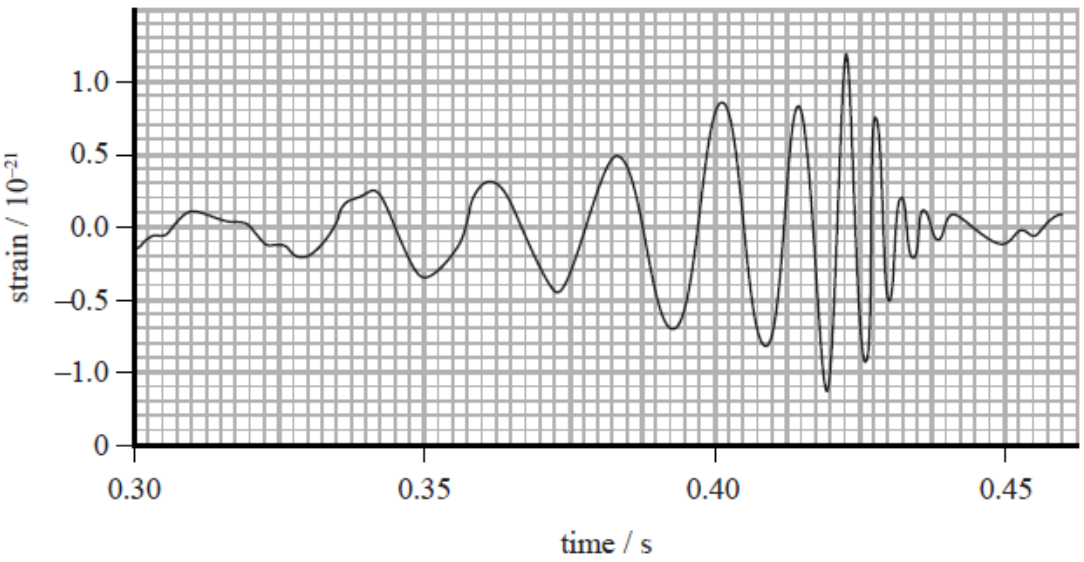
(Total for question = 5 marks)

Q13.

In 2016 scientists at the Laser Interferometer Gravitational-Wave Observatory (LIGO) announced that gravitational waves had been detected.

The signal they detected is shown on the graph.



Gravitational waves travel at the speed of light.

Determine the mean wavelength of the waves detected between 0.30 s and 0.35 s on the graph.

(3)

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Mean wavelength = ...

(Total for question = 3 marks)

Q14.

In February 2013 the largest known meteor for a century exploded over the Ural region of Russia.

The explosion was detected by stations monitoring infrasound, a type of sound with a frequency too low for humans to hear.

Describe how infrasound travels through the air.

(3)

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(Total for question = 3 marks)

Q15. Dolphins use ultrasound when hunting prey. They emit short pulses of ultrasound, known as clicks, and detect the ultrasound reflected from their prey.

(a) Describe how ultrasound travels through water.

(2)

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(b) Suggest why the dolphins emit a series of clicks rather than a continuous sound.

(1)

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(c) When searching for prey the dolphins emit 16 clicks per second.

(i) Show that the time between clicks when searching for prey is about 0.06 s.

(1)

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(ii) Calculate the maximum distance that can be determined by the dolphin when searching for prey.

speed of sound in seawater = 1530 m s^{-1}

(3)

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Maximum distance = ...

(iii) The dolphin increases the number of clicks per second to 125 when near to capturing its prey.

Suggest why.

(1)

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(d) Bats use ultrasound in air when hunting prey. The ultrasound frequency and the duration of the click is the same for both bats and dolphins.

Explain whether bats or dolphins would be able to locate their prey more precisely.

speed of sound in air = 330 m s^{-1}

(3)

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(Total for Question = 11 marks)