

Name:

Date:

P6 - Test 5  
WAVES  
Advanced

**GCSE**

PHYSICS

AQA - Combined Science

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

### Information

- The marks for the questions are shown in brackets

1.

Electromagnetic waves behave differently in different situations.

Electromagnetic waves travel at a speed of  $3 \times 10^8$  m/s in a vacuum.

Microwave radiation has a wavelength of 2 cm.

Calculate the frequency of microwave radiation.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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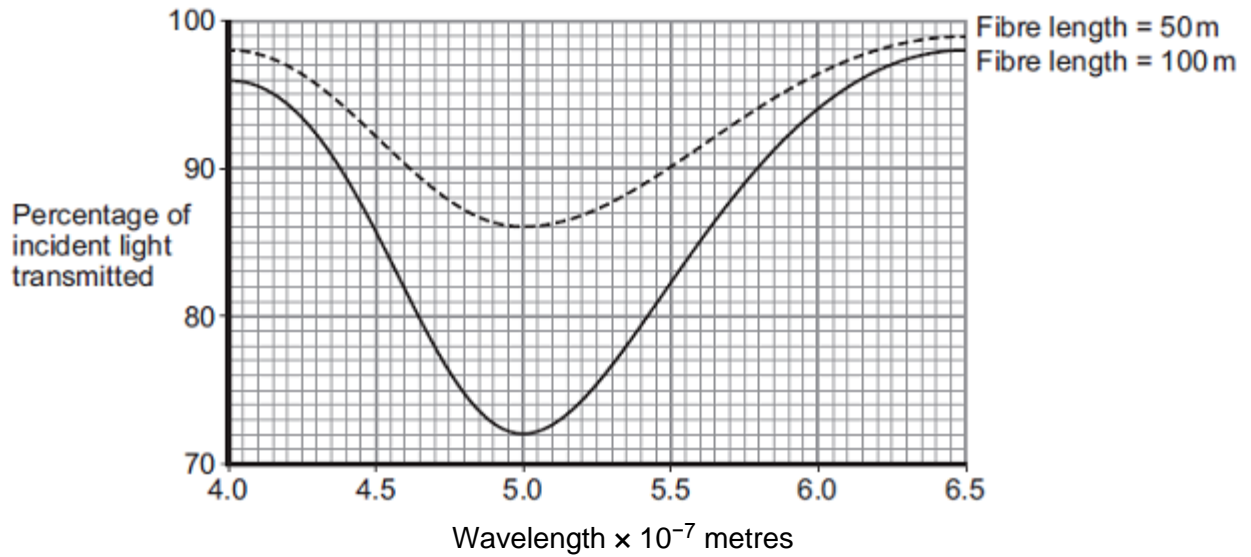
Frequency = \_\_\_\_\_ hertz

**(Total 2 marks)**

2.

Different wavelengths of light can be used to transmit information along optical fibres.

The graph below shows how the percentage of incident light transmitted through a fibre varies with the wavelength of light and the length of the fibre.



Compare the percentages of incident light transmitted through the two different fibres over the range of wavelengths shown.

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(Total 3 marks)

3.

(i) Use the words frequency, wavelength and wave speed to write an equation which shows the relationship between them.

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(1)

- (ii) Calculate the speed of a sound wave with a frequency of 250 Hz and a wavelength of 1.3 m.

Show how you get to your answer and give the unit.

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Speed = \_\_\_\_\_

(2)

(Total 3 marks)

4.

A Doppler probe emits high frequency sound waves.

A doctor uses a Doppler probe to measure the pulse rate of an unborn baby in its mother's womb.

The sound waves have a frequency of  $5.24 \times 10^6$  Hz.

The mean speed of sound through human body tissue is 1540 m / s.

Calculate the wavelength of the sound wave emitted by this Doppler probe as it travels through human body tissue.

Give your answer to **three** significant figures.

Use the correct equation from the Physics Equations Sheet.

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Wavelength = \_\_\_\_\_ m

(Total 3 marks)

5.

All radio waves travel at 300 000 000 m/s in air.

- (i) Give the equation that links the frequency, speed and wavelength of a wave.

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(1)

- (ii) Calculate the wavelength, in metres, of a radio wave which is broadcast at a frequency of 909 kHz. Show clearly how you work out your answer.

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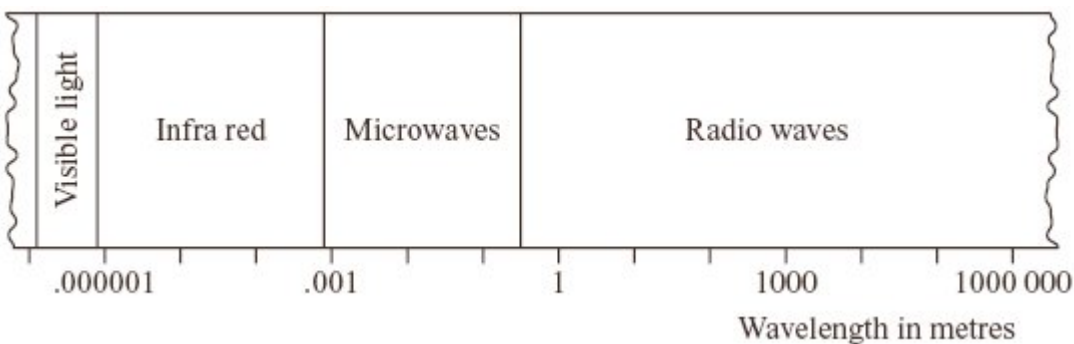
Wavelength = \_\_\_\_\_ metres

(2)

(Total 3 marks)

6.

The diagram represents part of the electromagnetic spectrum.



- (i) Visible light travels through air at 300 000 000 m/s.

Why can we assume that radio waves travel through air at the same speed as light?

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(1)

- (ii) A radio station broadcasts at a frequency of 200 kHz.

Calculate the wavelength of the waves broadcast by this radio station. Show clearly how you work out your answer.

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Wavelength = \_\_\_\_\_ m

(2)

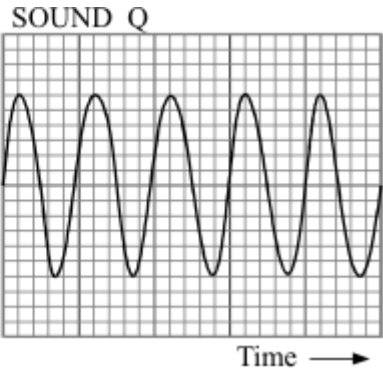
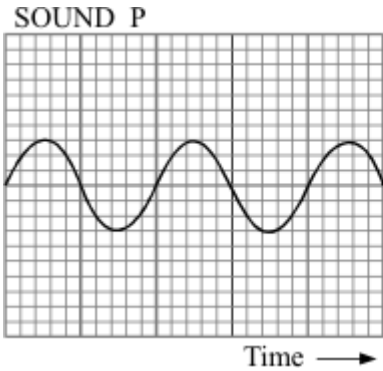
- (iii) Draw a vertical line on the diagram above to show the position of this radio wave in the electromagnetic spectrum.

(1)

(Total 4 marks)

7.

The diagram shows the oscilloscope traces of two different sounds P and Q. The oscilloscope setting is exactly the same in both cases.



P and Q **sound** different.  
 Write down **two** differences in the way they sound.  
 Explain your answers as fully as you can.

1. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

2. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(Total 5 marks)

8.

Radio waves and microwaves are two types of electromagnetic wave.

Both waves:

- can be used for communications
- travel at the same speed through air.

(a) Give **two** more properties that are the same for both radio waves and microwaves.

1. \_\_\_\_\_  
 \_\_\_\_\_  
 2. \_\_\_\_\_  
 \_\_\_\_\_

(2)

- (b) Some satellites are used to transmit television programmes. Signals are sent to, and transmitted from, the satellites using microwaves.

What is the property of microwaves that allows them to be used for satellite communications?

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(1)

- (c) Electromagnetic waves travel at a speed of  $3.0 \times 10^8$  m/s.

A radio station transmits waves with a wavelength of  $2.5 \times 10^2$  m.

Calculate the frequency of the radio waves.

Show clearly how you work out your answer and give the unit.

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Frequency = \_\_\_\_\_

(3)

(Total 6 marks)

9.

- (a) Microwaves and visible light are two types of electromagnetic wave. Both can be used for communications.

- (i) Give **two** properties that are common to both visible light and microwaves.

1. \_\_\_\_\_

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2. \_\_\_\_\_

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(2)

- (ii) Name **two** more types of electromagnetic wave that can be used for communications.

\_\_\_\_\_ and \_\_\_\_\_

(1)

- (b) Wi-Fi is a system that joins computers to the internet without using wires. Microwaves, with a wavelength of 12.5 cm, are used to link a computer to a device called a router. Microwaves travel through the air at 300 000 000 m/s.

Calculate the frequency of the microwaves used to link the computer to the router.

Show clearly how you work out your answer and give the unit.

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Frequency = \_\_\_\_\_

**(3)**

- (c) Wi-Fi is used widely in schools. However, not everyone thinks that this is a good idea.

A politician commented on the increasing use of Wi-Fi. He said: 'I believe that these systems may be harmful to children.'

However, one group of scientists said that there is no reason why Wi-Fi should not be used in schools. These scientists also suggested that there is a need for further research.

- (i) Suggest what the politician could have done to persuade people that what he said was not just an opinion.

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**(1)**

- (ii) Why did the group of scientists suggest that there is a need for further research?

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**(1)**

**(Total 8 marks)**



**10.**

A car aerial receives radio waves from a radio transmitter.

Radio waves are transverse waves.

Sound waves are longitudinal waves.

(a) Describe the difference between transverse waves and longitudinal waves.

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**(2)**

(b) The radio waves have a frequency of  $4.8 \times 10^9$  Hz

Wave speed of electromagnetic waves =  $3.0 \times 10^8$  m/s

Calculate the wavelength of the radio waves.

Give your answer to 2 significant figures.

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Wavelength = \_\_\_\_\_ m

**(3)**

(c) Describe how the radio waves reaching the car aerial produce signals in the electrical circuit of the car radio.

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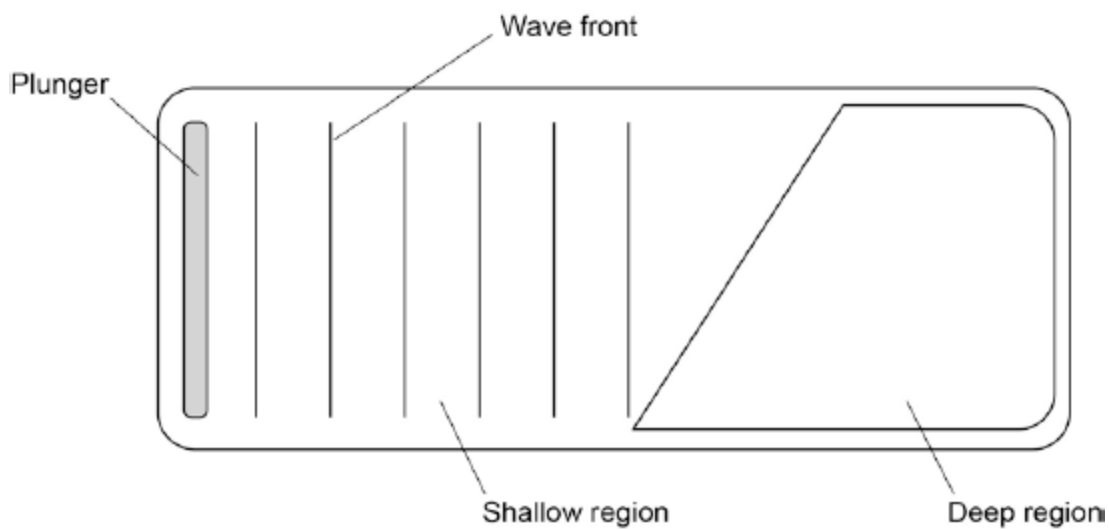
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(3)  
(Total 8 marks)

11.

Some students did an investigation to study the behaviour of waves.

The figure below shows a ripple tank that they used to model the behaviour of waves.



(a) Complete the wave fronts on the figure above.

Show how the wave is refracted as it passes from the shallow region into the deep region.

(1)

(b) Explain what happens to the waves as they pass into the deep region.

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(2)

(c) The waves generated on the surface of the water are transverse waves.

Describe the differences between longitudinal waves and transverse waves.

You may include labelled diagrams to help your answer.

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(3)

(d) Some students investigate the properties of the waves generated in the figure above.

Student **A** says 'the waves move water from one end of the tank to the other'.

Student **B** says 'that's wrong. Only the waves move, not the water'.

Suggest what the students could do to decide which of them is correct.

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(2)

(e) Another student uses a ripple tank where all the water is the same depth.

She measures the wavelength of each wave as 0.34 m.

The period of each wave is 0.42 s.

Calculate the speed of the wave.

Use the correct equation from the Physics Equation Sheet.

Give the unit.

Give your answer to three significant figures.

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Speed = \_\_\_\_\_

Unit = \_\_\_\_\_

**(5)**

**(Total 13 marks)**