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Student number

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Name _____

Date _____

Attempt/Time taken _____

GCSE PHYSICS

Topic Paper: 6.1 Waves in air, fluids and solids (longitudinal and transverse waves)

Part 2

Time allowed: 45 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully meets the requirements of the question
 - shows that each separate point or step supports the overall answer.



40 Marks



- Q7.** (a) The wavelengths of four different types of electromagnetic wave, including visible light waves, are given in the table.

Type of wave	Wavelength
Visible light	0.0005 mm
A	1.1 km
B	100 mm
C	0.18 mm

Which of the waves, **A**, **B**, or **C**, is an infra red wave?

.....

(1)

- (b) A TV station broadcasts at 500 000 kHz. The waves travel through the air at 300 000 000 m/s.

Use the equation in the box to calculate the wavelength of the waves broadcast by this station.

$\text{wave speed} = \text{frequency} \times \text{wavelength}$

Show clearly how you work out your answer.

.....

.....

Wavelength = m

(2)



(c) What happens when a metal aerial absorbs radio waves?

.....
.....
.....
.....

(2)

(d) Stars emit all types of electromagnetic waves. Telescopes that monitor X-rays are mounted on satellites in space.

Why would an X-ray telescope based on Earth **not** be able to detect X-rays emitted from distant stars?

.....
.....

(1)

(Total 6 marks)

Q8. (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
.....
2
.....

(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.

Use the equation in the box to calculate the frequency of the microwaves used to link the computer to the router.

$\text{wave speed} = \text{frequency} \times \text{wavelength}$

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

.....

.....

.....

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.

.....

.....

(1)

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

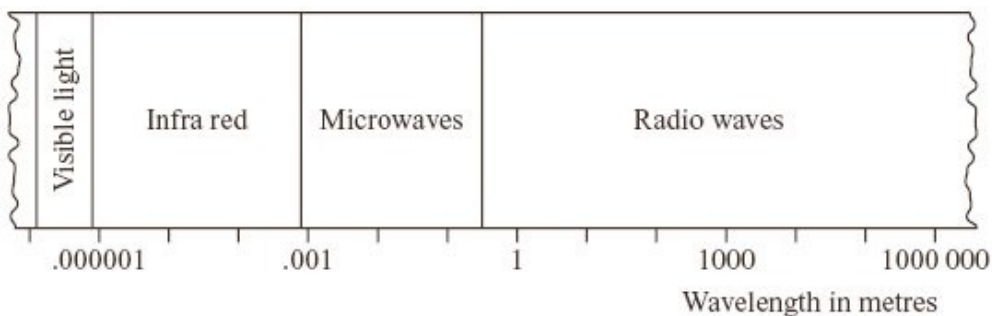
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(1)

(Total 8 marks)

Q9. 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?

..... (1)

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

Use the following equation to calculate the wavelength of the waves broadcast by this radio station. Show clearly how you work out your answer.

wave speed = frequency × wavelength

.....
.....

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)

Q10. (a) Water waves are transverse waves. Sound waves are longitudinal waves.

(i) Explain the difference between a transverse wave and a longitudinal wave.

You may include labelled diagrams in your answer.

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(3)

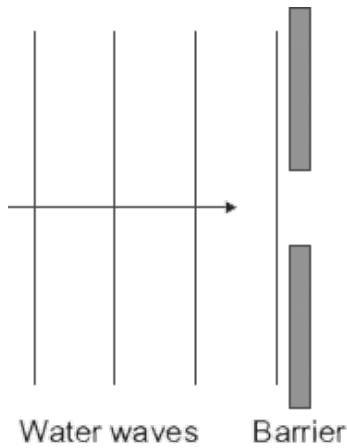
(ii) Name **one** type of wave that may be either transverse or longitudinal.

.....

(1)

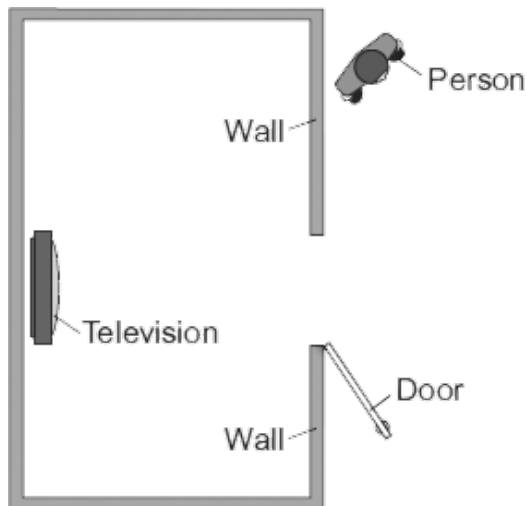


- (b) The diagram shows water waves in a ripple tank moving towards a gap in a barrier. The water waves diffract as they pass through the gap. Complete the diagram to show the diffracted water waves.



(1)

- (c) A television is switched on inside a room. A person outside the room can hear the television, but only when the door is open.



When the door is open, the person can hear the sound but cannot see the television.

Explain why.

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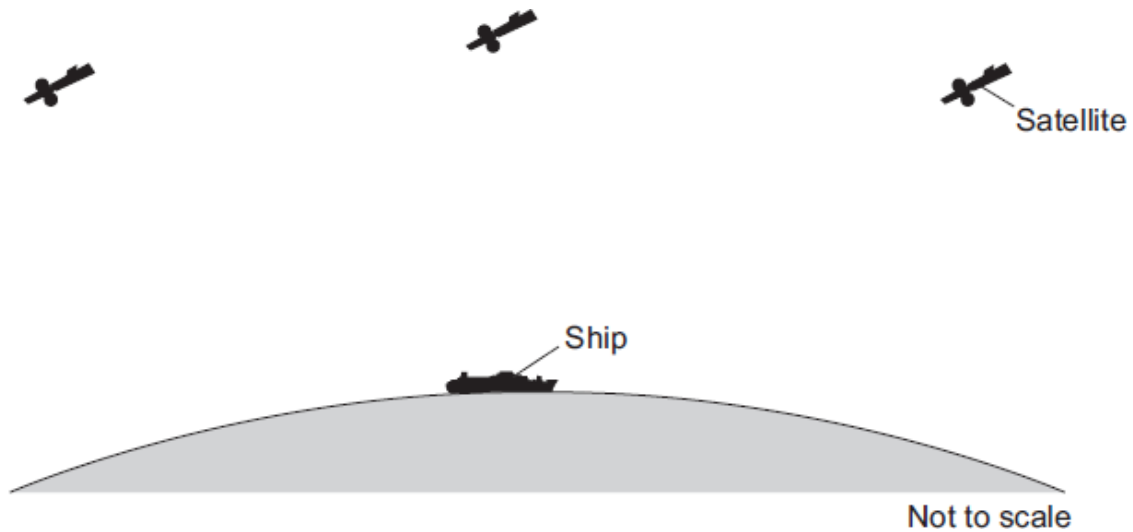
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(2)
(Total 7 marks)



Q11. The ship in the diagram is fitted with a navigation system. The navigation system works out the location of the ship by timing the microwave signals transmitted from at least three satellites.



(a) Microwaves are one type of electromagnetic wave.

Give **two** properties that all electromagnetic waves have.

- 1
-
- 2
-

(2)

(b) The microwaves used in the navigation system are transmitted at a frequency of 1575 MHz.

Use the equation and information in the box to calculate the wavelength of the microwaves used in the navigation system.

$\text{wave speed} = \text{frequency} \times \text{wavelength}$ <p>microwaves travel at 300 000 000 m/s 1 MHz = 1 000 000 Hz</p>

Show clearly how you work out your answer.

-
-
-
-

Wavelength = m

(3)



- (c) The ship is fitted with a metal aerial that receives the microwave signals from the satellites.

For the navigation system to work, what effect must the microwave signals have on the aerial?

.....

(1)
 (Total 6 marks)

Q12. 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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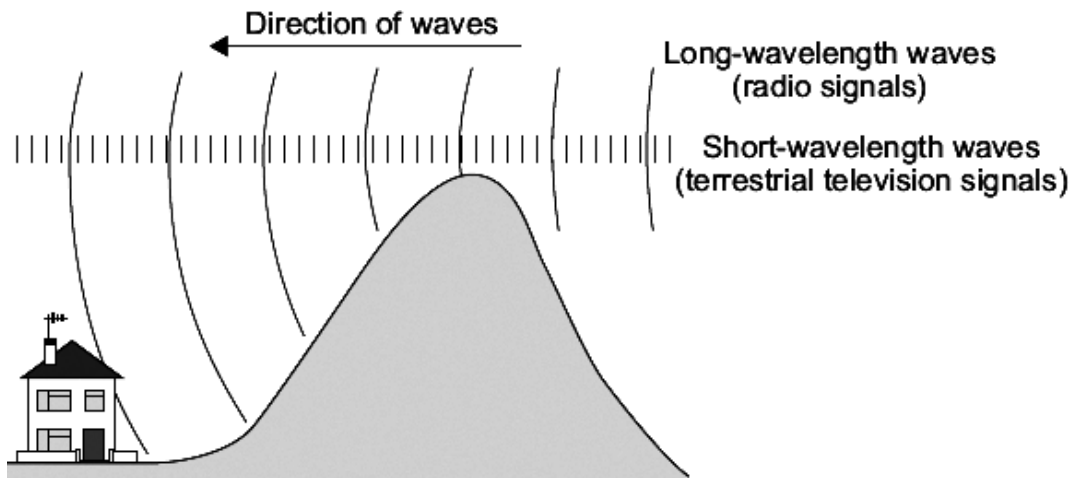
(1)



- (c) Terrestrial television does not use satellites.

Terrestrial television signals and radio signals both use radio waves.

Radio signals are transmitted at a longer wavelength than terrestrial television signals.



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In hilly areas it may be possible to receive radio signals but not receive terrestrial television signals.

Explain why.

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(3)



(d) Electromagnetic waves travel at a speed of 3.0×10^8 m/s.

A radio station transmits waves with a wavelength of 2.5×10^2 m.

Calculate the frequency of the radio waves.

Use the correct equation from the Physics Equations Sheet.

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

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.....
.....

Frequency =

(3)
(Total 9 marks)