

Electromagnetic Waves 2

Q:1 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 mark)

(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 marks)

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

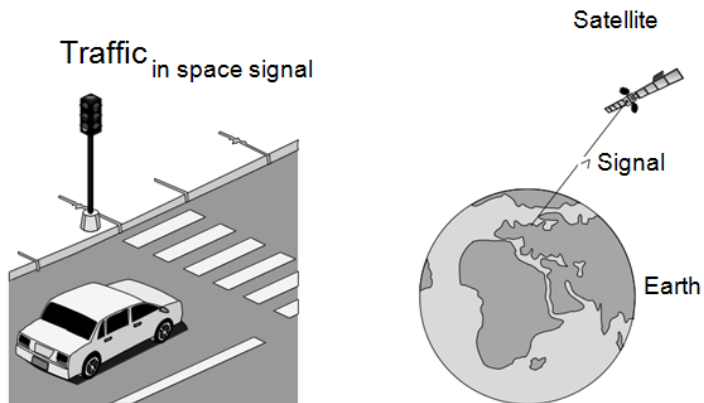
(2 marks)

Q:2 Diagram 1 shows four of the seven types of wave in the electromagnetic spectrum.

Diagram 1

J	K	L	Visible light	Infrared	Microwaves	Radio waves
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(a) The four types of electromagnetic wave named in Diagram 1 above are used for communication.



(a) (i) Which type of electromagnetic wave is used when a traffic signal communicates with a car driver?

(1 mark)

(a) (ii) Which type of electromagnetic wave is used to communicate with a satellite in space?

(1 mark)

(b) Gamma rays are part of the electromagnetic spectrum.

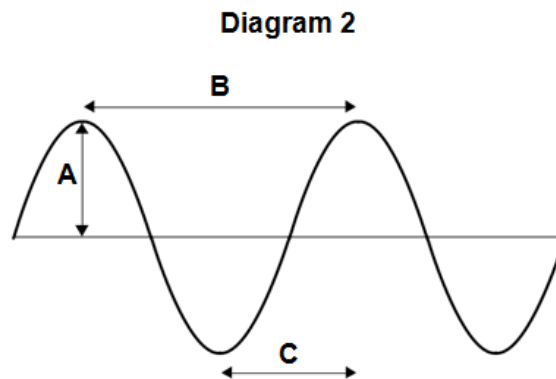
Which letter, J, K or L, shows the position of gamma rays in the electromagnetic spectrum?

Draw a ring around the correct answer.

J K L

(1 mark)

(c) Diagram 2 shows an infrared wave.



(c) (i) Which one of the arrows, labelled A, B or C, shows the wavelength of the wave?

Write the correct answer, A, B or C, in the box.

(1 mark)

(c) (ii) Draw a ring around the correct answer to complete the sentence.

The wavelength of infrared waves is

shorter than
the same as
longer than

 the wavelength of radio waves.

(1 mark)

(d) Mobile phone networks send signals using microwaves. Some people think the energy a person's head absorbs when using a mobile phone may be harmful to health.

(d) (i) Scientists have compared the health of people who use mobile phones with the health of people who do not use mobile phones.

Which one of the following statements gives a reason why scientists have done this?

Tick (☑) one box.

To find out if using a mobile phone is harmful to health

To find out if mobile phones give out radiation.

To find out why some people are healthy.

(1 mark)

(d) (ii) The table gives the specific absorption rate (SAR) value for two different mobile phones.

The SAR value is a measure of the maximum energy a person's head absorbs when a mobile phone is used.

Mobile Phone	SAR value in W/kg
X	0.28
Y	1.35

A parent buys mobile phone X for her daughter.

Using the information in the table, suggest why buying mobile phone X was the best choice.

(2 marks)

Q:3 (a) Ultraviolet and visible light are both electromagnetic waves.

(i) Name one other type of electromagnetic wave.

(1 mark)

(ii) Which one of the following statements is true for electromagnetic waves travelling through a vacuum?

Put a tick (☑) in the box next to your answer.

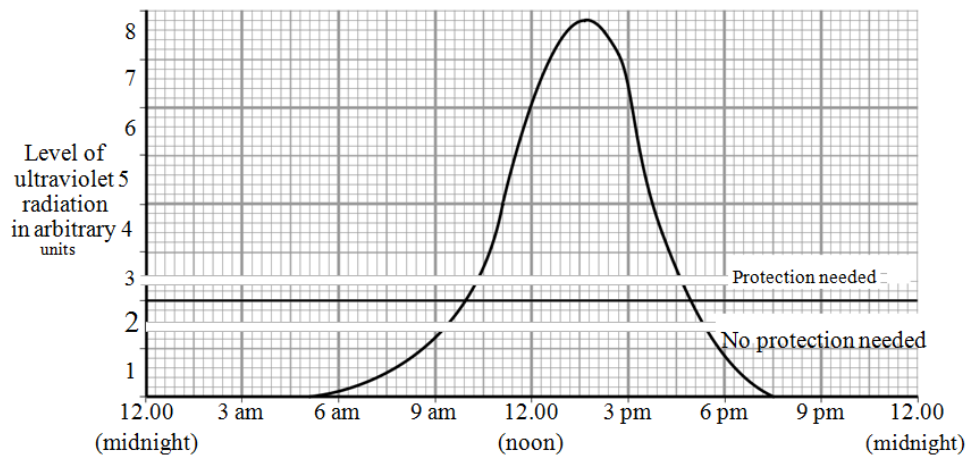
All the waves have the same frequency.

All the waves have the same wavelength.

All the waves travel at the same speed.

(1mark)

(b) The graph shows how the level of ultraviolet radiation changed during a summer day in England.



(i) What serious health problem can be caused by exposure to the ultraviolet radiation from the Sun?

(1 mark)

(ii) Explain why it would be sensible to stay out of the Sun between 10 am and 4 pm in the summer.

(2 marks)

Q:4 The diagram shows the seven types of wave that make up the electromagnetic spectrum.

Gamma rays	X-rays	Ultraviolet rays	Visible light	Infra red rays	Micro-waves	Radio waves
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(a) (i) Microwaves and visible light can be used for communications.

Name one more type of electromagnetic wave that can be used for communications.

(1 mark)

(a) (ii) Name one type of electromagnetic wave that has a longer wavelength than microwaves.

(1 mark)

(b) Wi-Fi is a system that joins a laptop computer to the internet without using wires. A 2400 megahertz microwave signal is used to link a computer to a device called a router.

What quantity is measured in hertz? Draw a ring around your answer.

frequency wavelength wave speed

(1 mark)

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

(c) (i) Suggest one reason why more scientific research into the safety of Wi-Fi systems is needed.

(1 mark)

(c) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

What the politician said was

a fact.
an opinion.
a prediction.

(1 mark)

Q:5 (a) Electromagnetic waves form a continuous spectrum with a range of wavelengths. What is the approximate range of wavelengths of electromagnetic waves?

Tick (☑) one box.

10^{-15} metres to 10^4 metres

10^{-4} metres to 10^{15} metres

10^{-6} metres to 10^6 metres

(b) Infrared waves and microwaves are used for communications.

(b) (i) Give one example of infrared waves being used for communication.

(1 mark)

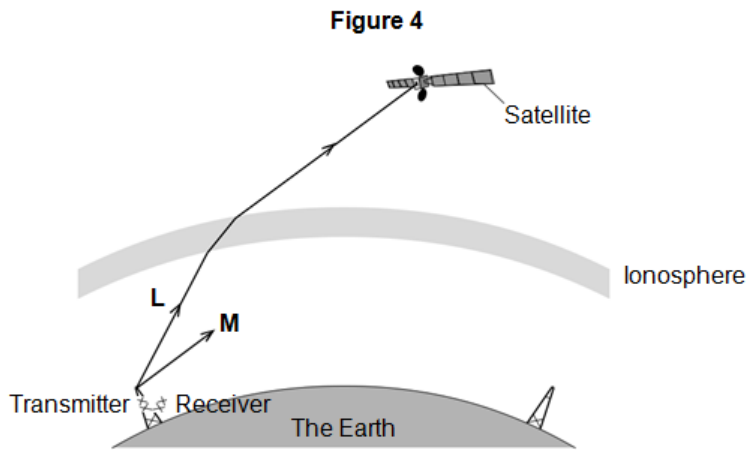
(b) (ii) A mobile phone network uses microwaves to transmit signals through the air. The

microwaves have a frequency of 1.8×10^9 Hz and travel at a speed of 3.0×10^8 m/s. Calculate the wavelength of the microwaves. Use the correct equation from the Physics Equations Sheet. Give your answer to two significant figures.

Wavelength = _____ m

(3 marks)

Q:6 Figure 4 shows a transmitter emitting two electromagnetic waves, L and M.



(a) (i) Wave L is used to send a signal to a satellite. Which part of the electromagnetic spectrum does wave L belong to?

[1 mark]

(a) (ii) What name is given to the process that occurs as wave L passes into the ionosphere?

[1 mark]

(b) Wave M is reflected by the ionosphere.

(b) (i) On Figure 4, draw the path of wave M until it reaches the receiver.

[2 marks]

(b) (ii) On Figure 4, draw a line to show the normal where wave M meets the ionosphere. Label the line N.

[1 mark]

(c) Give two properties of all electromagnetic waves.

1 _____

2 _____

[2 marks]

TOTAL MARKS=30

