

Electromagnetic Waves

Question Paper 1

| | |
|------------------|-------------------------------------|
| Level | GCSE (9-1) |
| Subject | Combined Science: Trilogy - Physics |
| Exam Board | AQA |
| Topic | 6.6 Waves |
| Sub-Topic | Electromagnetic Waves |
| Difficulty Level | Bronze Level |
| Booklet | Question Paper 1 |

Time Allowed: 57 minutes

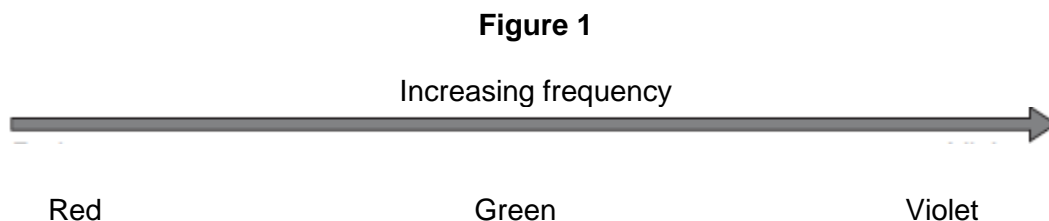
Score: /57

Percentage: /100

Grade Boundaries:

Q1.(a) The visible light spectrum has a range of frequencies.

Figure 1 shows that the frequency increases from red light to violet light.



Use the correct answers from the box to complete the sentence.

| | | |
|-----------|----------------|-----------|
| decreases | stays the same | increases |
|-----------|----------------|-----------|

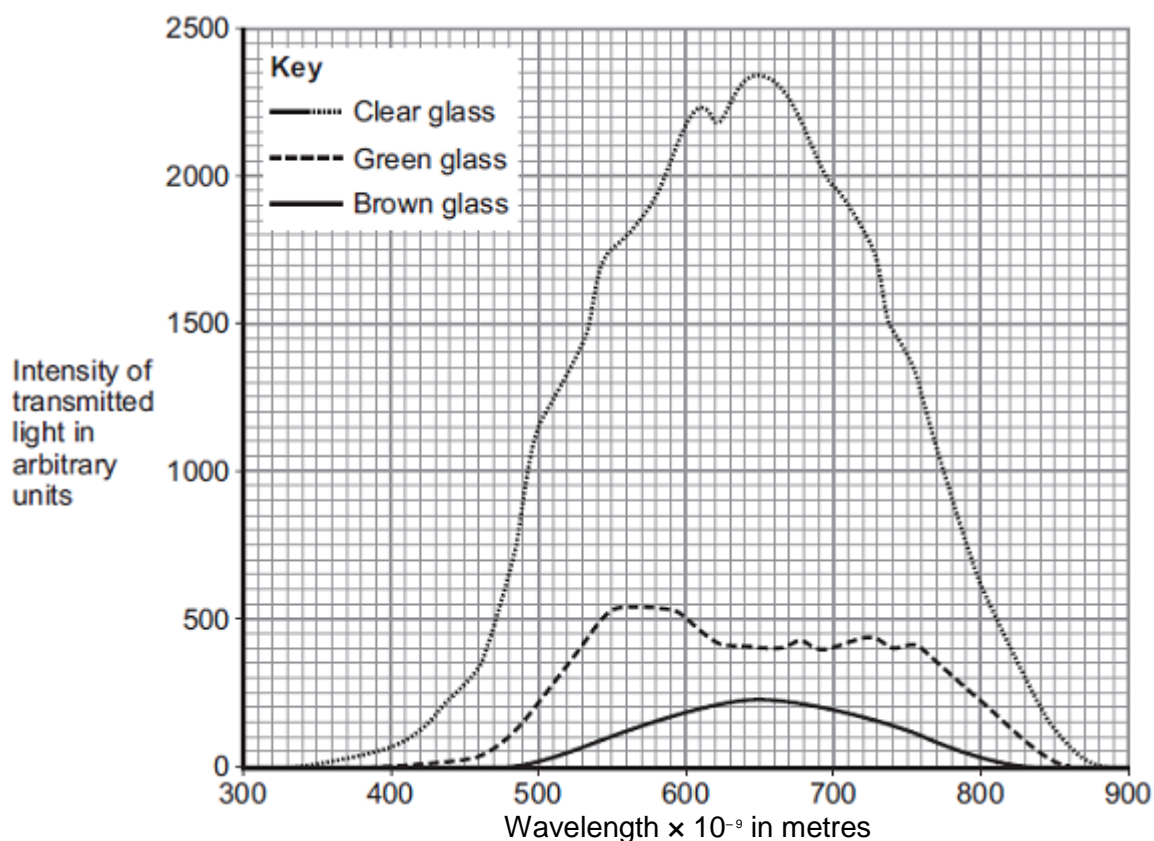
As the frequency of the light waves increases, the wavelength
of the light waves and
the energy of the light waves

(2)

(b) Bottled beer will spoil if the intensity of the light passing through the glass bottle into the beer is too high.

Figure 3 shows the intensity of the light that is transmitted through three different pieces of glass.

Figure 3



- (i) The pieces of glass all had the same thickness.

Suggest why.

.....

(1)

- (ii) Bottles made of brown glass are suitable for storing beer.

Suggest why.

.....

(1)

(Total 4 marks)

Q2. The figure below shows an X-ray image of a human skull.



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- (a) Use the correct answers from the box to complete the sentence.

| | | | |
|----------------|----------------|-----------------|------------------|
| absorbs | ionises | reflects | transmits |
|----------------|----------------|-----------------|------------------|

When X-rays enter the human body, soft tissue

X-rays

and bone X-rays.

(2)

- (b) Complete the following sentence.

The X-rays affect photographic film in the same way that
does.

(1)

- (c) The table below shows the total dose of X-rays received by the human body when different parts are X-rayed.

| Part of body X-rayed | Dose of X-rays received by human body in arbitrary units |
|-------------------------------------|---|
| Head | 3 |
| Chest | 4 |

| | |
|--------|----|
| Pelvis | 60 |
|--------|----|

Calculate the number of head X-rays that are equal in dose to one pelvis X-ray.

.....

Number of head X-rays =

(2)

(d) Which **one** of the following is another use of X-rays?

Tick (✓) **one** box.

Cleaning stained teeth

☐

Killing cancer cells

☐

Scanning of unborn babies

☐

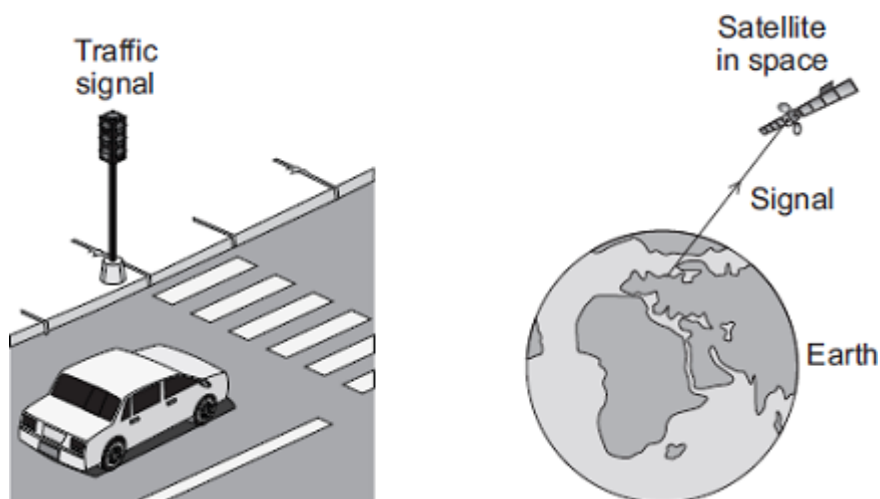
(1)
 (Total 6 marks)

Q3.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 |
|---|---|---|---------------|----------|------------|-------------|

(a) The **four** types of electromagnetic wave named in **Diagram 1** above are used for communication.



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

.....

(1)

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

.....

(1)

- (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?

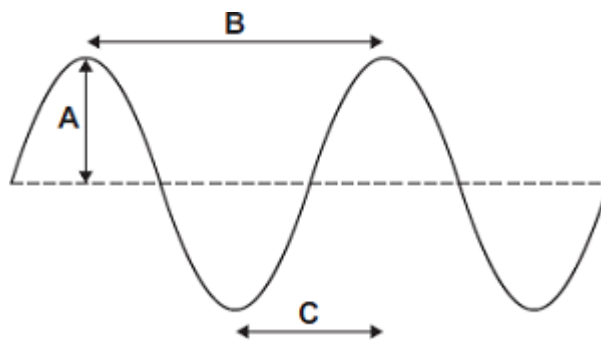
Draw a ring around the correct answer.

J **K** **L**

(1)

- (c) **Diagram 2** shows an infrared wave.

Diagram 2



- (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)

- (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)

- (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.
- (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)

- (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)

(Total 8 marks)

Q4. A lorry has an air horn. The air horn produces sound waves in the air.

- (a) Use **one** word to complete the following sentence.

Sound waves cause air particles to

(1)

- (b) The air horn produces sound waves at a constant frequency of 420 Hz.

The wavelength of the sound waves is 0.80 m.

Calculate the speed of the sound waves.

.....

Speed = m/s

(2)

(Total 3 marks)


- Q5.(a)** The diagram shows the electromagnetic spectrum.

The pictures show four devices that use electromagnetic waves. Each device uses a different type of electromagnetic wave.


Draw a line from each device to the type of electromagnetic wave that it uses. One has been done for you.

| | | | | | | |
|------------|--------|------------------|---------------|----------------|------------|-------------|
| Gamma rays | X-rays | Ultraviolet rays | Visible light | Infra red rays | Microwaves | Radio waves |
|------------|--------|------------------|---------------|----------------|------------|-------------|


Sunbed




Radio



TV remote control



Filament lamp



(3)

- (b) A headline from a recent newspaper article is shown below.

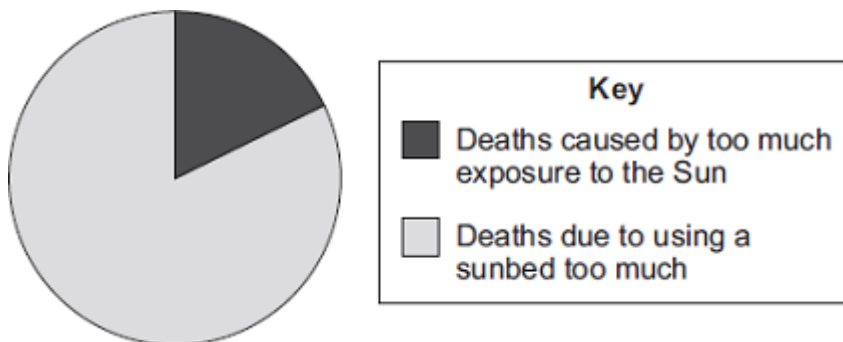


- (i) What serious health problem may be caused by using a sunbed too much?

.....

(1)

- (ii) The pie chart compares the number of deaths in Britain each year which may have been caused by using sunbeds too much, with those which may have been caused by too much exposure to the Sun.



It is difficult for a doctor to be certain that a person has died because of using a sunbed too much.

Suggest why.

.....

.....

(1)

- (iii) A spokesperson for a leading cancer charity said:

'We want people, especially young people, to know the possible dangers of using a sunbed.'

Why is it important that you know the possible dangers of using a sunbed?

.....

.....

(1)
(Total 6 marks)

Q6. Using an optical telescope to look at stars is not always easy because:

- too many street lights often make it too light to see faint stars
- clouds reduce the light getting to the telescope
- atmospheric pollution often distorts the images.

Large optical telescopes are often positioned high up a mountain.

Describe the advantages of positioning a telescope high up a mountain.

.....

.....

.....

.....

.....

.....

(Total 3 marks)

Q7. (a) The diagram below shows six of the seven types of wave that make up the electromagnetic spectrum.

| | | | | | | |
|------------|--|-------------|---------------|----------|------------|-------------|
| Gamma rays | | Ultraviolet | Visible light | Infrared | Microwaves | Radio waves |
|------------|--|-------------|---------------|----------|------------|-------------|

(i) What type of electromagnetic wave is missing from the diagram?

.....

(1)

- (ii) Which of the following electromagnetic waves has the most energy?

Draw a ring around the correct answer.

gamma rays radio waves visible light

(1)

- (iii) Which of the following electromagnetic waves is given out by a TV remote control?

Draw a ring around the correct answer.

infrared microwaves ultraviolet

(1)

- (b) Draw a ring around the correct answer in the box to complete the sentence.

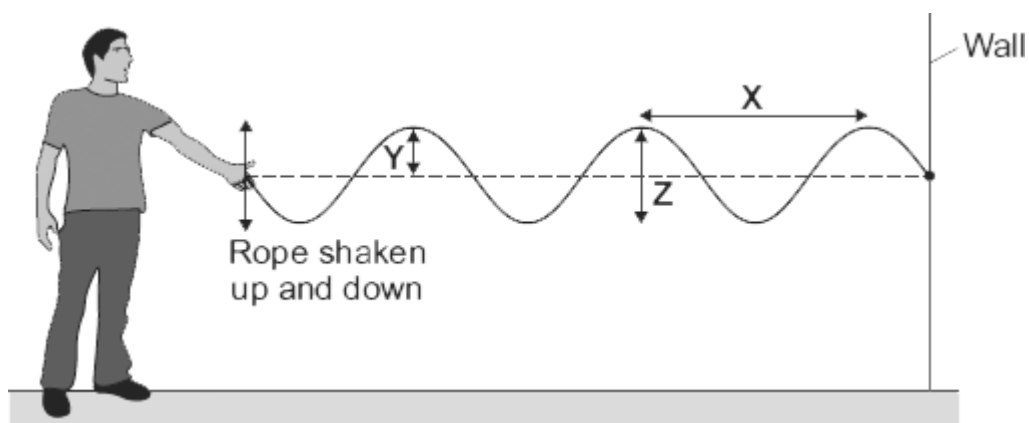
Microwaves travel through a vacuum at

a slower speed than
the same speed as
a faster speed than

radio waves.

(1)

- (c) The diagram shows waves being produced on a rope.
The waves are **not** reflected by the wall.



- (i) Draw an arrow on the diagram to show the direction in which the waves transfer energy.

(1)

- (ii) Which **one** of the arrows, labelled, **X**, **Y** or **Z**, shows the amplitude of a wave?

Write the correct answer in the box.

(1)

- (iii) The waves produced on the rope are transverse.

Name **one** other type of transverse wave.

.....

(1)

- (d) The rope is shaken up and down, producing 3 waves every second. The waves have a wavelength of 1.2 metres.

- (i) State the frequency of the waves.

..... Hz

(1)

- (ii) Calculate the speed of the waves.

Show clearly how you work out your answer.

.....

Wave speed = m/s

(2)
 (Total 10 marks)

- Q8.** (a) The table gives information about the frequencies in the hearing ranges of six different mammals.

| Name of mammal | Frequencies in hearing range |
|----------------|------------------------------|
| Bat | 20 Hz → 160 kHz |
| Dog | 20 Hz → 30 kHz |
| Dolphin | 40 Hz → 110 kHz |
| Elephant | 5 Hz → 10 kHz |
| Human | 20 Hz → 20 kHz |
| Tiger | 30 Hz → 50 kHz |

- (i) Which mammal in the table can hear the highest frequency?

.....

(1)

- (ii) Which mammal in the table, apart from humans, **cannot** hear ultrasound?

.....

(1)

- (iii) Give **one** example of a frequency which an elephant can hear but which a tiger **cannot** hear.

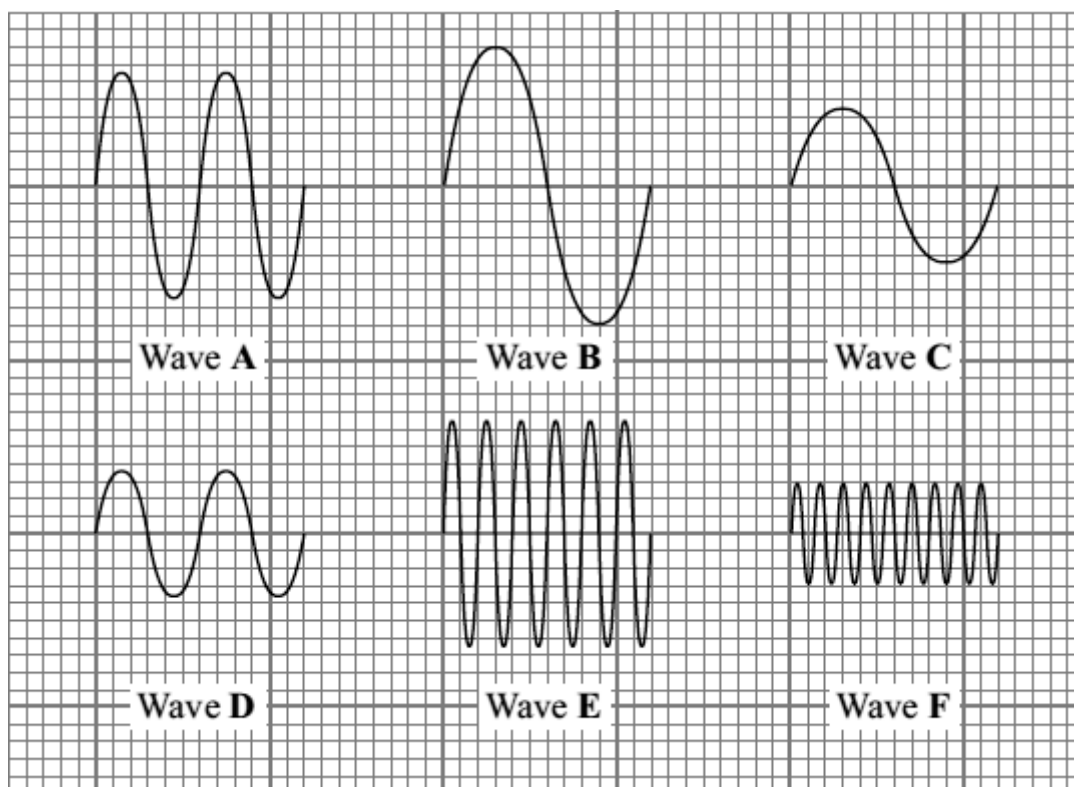
Include the unit in your answer.

Frequency

(1)

- (b) The diagrams show six sound waves, **A**, **B**, **C**, **D**, **E** and **F**, represented on an oscilloscope screen.

They are all drawn to the same scale.



- (i) Which **one** of the waves has the greatest amplitude?

Wave

(1)

- (ii) Which **one** of the waves has the highest frequency?

Wave

(1)

(Total 5 marks)

Q9. 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 |
|------------|--------|------------------|---------------|----------------|-------------|-------------|

- (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)

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

.....

(1)

- (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)

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

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

.....

(1)

- (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)
 (Total 5 marks)

- Q10.** The table shows the electromagnetic spectrum.
 Three types of wave have been missed out.

| | | | | | | |
|---|--|------------------|---------------|--|-------------|--|
| Gamma rays | | Ultraviolet rays | Visible light | | Micro-waves | |
| <div> <div>←</div> <div>Shortest wavelength</div> <div>Longest wavelength</div> <div>→</div> </div> | | | | | | |

- (i) Use words from the box to complete the table.

| | | |
|----------------|-------------|--------|
| infra red rays | radio waves | X-rays |
|----------------|-------------|--------|

(2)

(ii) Which **one** of the following gives a use of gamma rays?

Put a tick (✓) in the box next to your choice.

to communicate with satellites ☐

to see objects ☐

to kill cancer cells ☐

(1)

(iii) Complete the following sentence by drawing a ring around the correct word in the box.

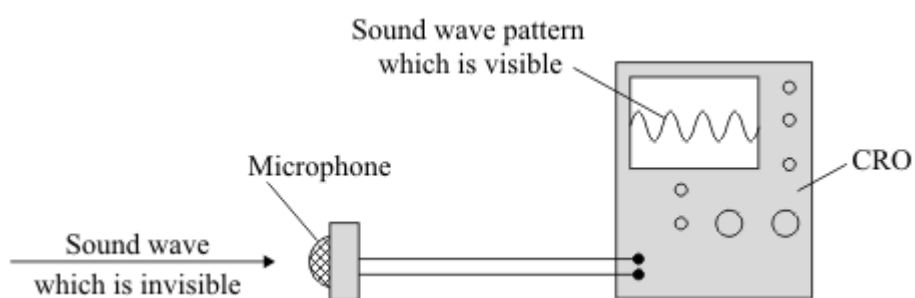
All electromagnetic waves move

| |
|-----------|
| energy |
| gases |
| particles |

 from one place to another.

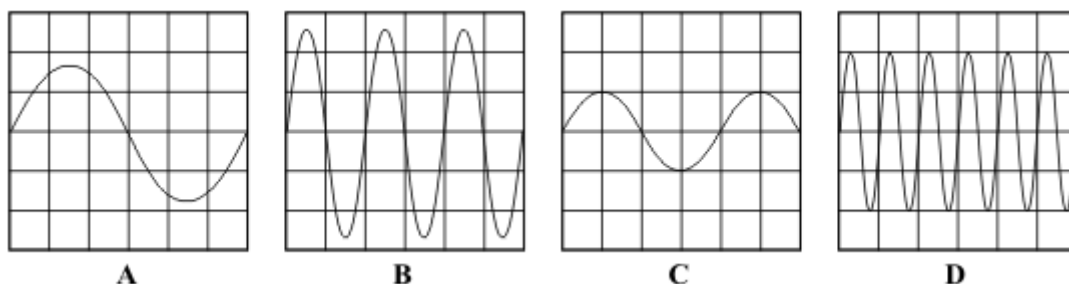
(1)
(Total 4 marks)

Q11. A microphone and a cathode ray oscilloscope (CRO) can be used to show the pattern of a sound wave.



Four sound wave patterns, **A**, **B**, **C** and **D**, are shown.

They are all drawn to the same scale.



(a) Which **one** of the patterns has the smallest amplitude?

.....

(b) Which **one** of the patterns has the lowest frequency?

.....

(Total 2 marks)