AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.2.2

Properties of electromagnetic waves 1

Past-paper questions

Tier	**Foundation**
Question groups	**18**
Available paper years	**2007–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.6.2.2 Properties of electromagnetic waves 1

Question 01

June 2007 | PHY1F | Original Q4 | Legacy

4 (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. ☐

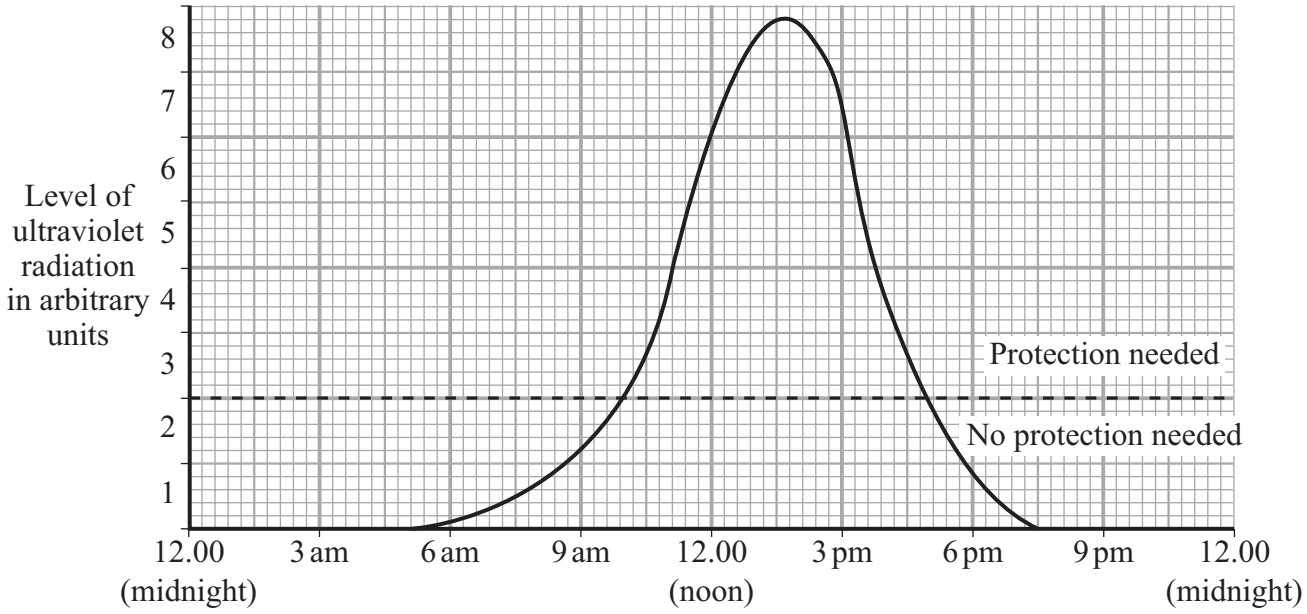
(1mark)

4.6.2.2 Properties of electromagnetic waves 1

Question 01 · continued

BLANK

(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)

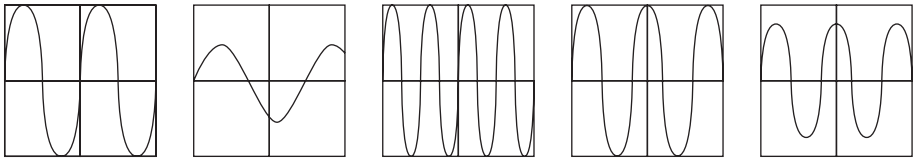
5

4.6.2.2 Properties of electromagnetic waves 1

Question 02

June 2008 | PHY3F | Original Q3 | Legacy

3 (a) A student uses a microphone to send different sounds to an oscilloscope. The diagrams show five traces, **A**, **B**, **C**, **D** and **E**, on the oscilloscope. All the traces are drawn to the same scale.



A **B** **C** **D** **E**

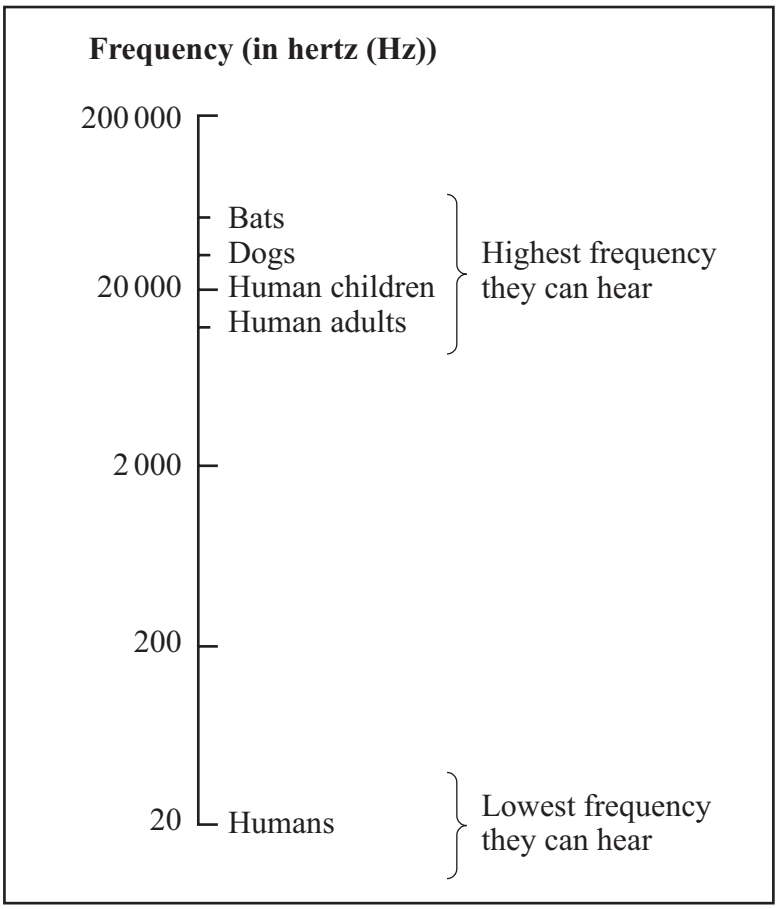
3 (a) (i) Which **three** diagrams show traces with the same amplitude?

Diagrams ....., ... and ..... . *(1 mark)*

3 (a) (ii) Which **two** diagrams show traces with the same frequency?

Diagrams ..... and ..... . *(1 mark)*

3 (b) The diagram shows the sound frequencies which some living things can hear.



4.6.2.2 Properties of electromagnetic waves 1

Question 02 · continued

for mark

3 (b) (i) What is the widest range of frequencies that a human child can hear?

.....

(1 mark)

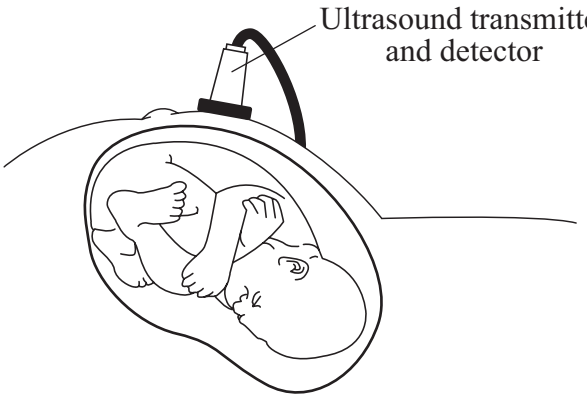
3 (b) (ii) Why can some dog whistles be heard by dogs but not by humans?

.....

.....

(1 mark)

3 (c) An ultrasound scan can be used to make a picture of a baby in its mother's womb. An ultrasound transmitter and detector are placed above the mother's womb. Ultrasound goes into the body of the mother and into the body of the baby.



Use the correct words from the box to complete the sentences.

detector	**reflection**	**refraction**	**sound**	**substance**	**transmitter**

3 (c) (i) When the ultrasound crosses from one ..... to another, some ultrasound becomes an echo caused by ..... .

3 (c) (ii) This information is collected by the ultrasound ..... and made into a picture on a screen.

(3 marks)

7

4.6.2.2 Properties of electromagnetic waves 1

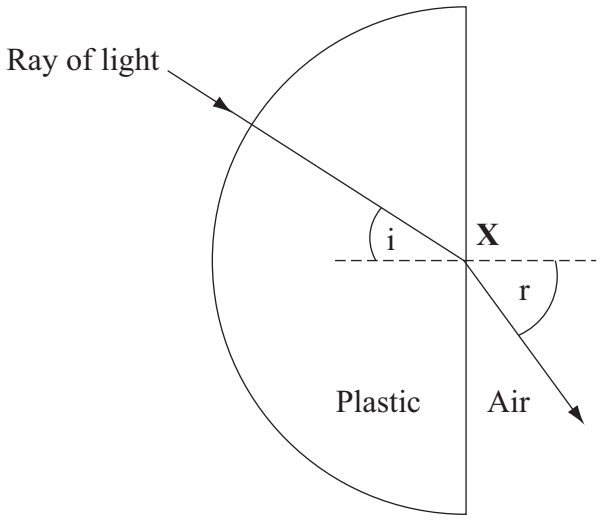
Question 03

June 2008 | PHY3F | Original Q6 | Legacy

6 (a) A student investigated the refraction of light as it passes out of a transparent plastic block.

She aimed a ray of light at point **X**. She marked the position of the ray as it passed through the transparent plastic block and into the air.

The angle ***i*** is the angle of incidence.



6 (a) (i) What is the name of angle **r**?

.....

(1 mark)

6 (a) (ii) What is the name of the dashed line?

.....

(1 mark)

4.6.2.2 Properties of electromagnetic waves 1

Question 03 · continued

for mark

6 (b) A camera uses a lens to produce an image which falls on a light detector.



Name a light detecting device which may be used in a camera.

.....

(1 mark)

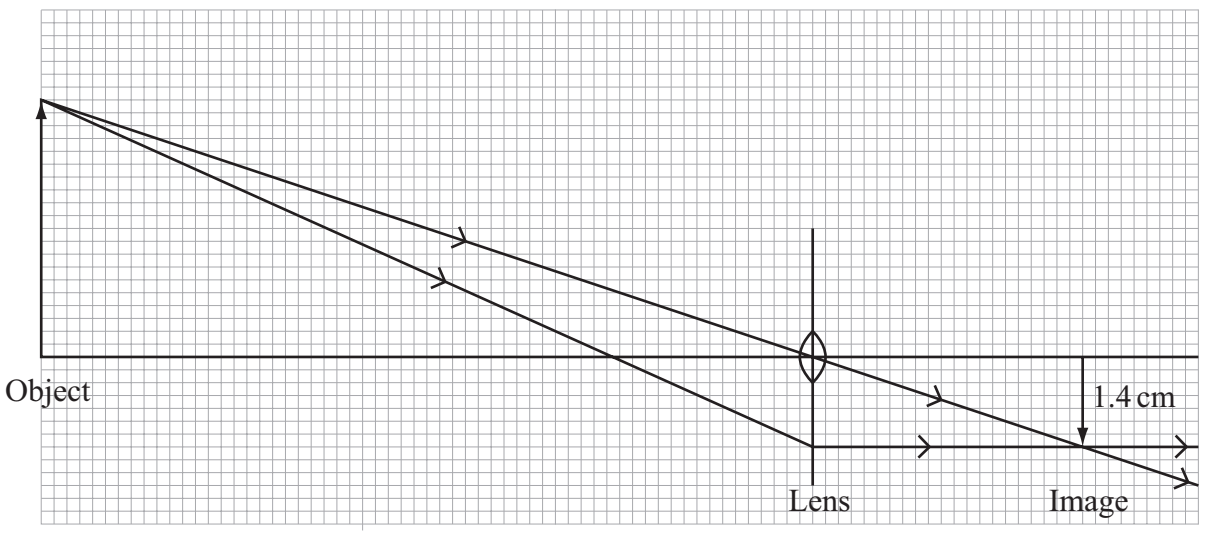
Question 6 continues on the next page

4.6.2.2 Properties of electromagnetic waves 1

Question 03 · continued

for mark

6 (c) The diagram shows the position of an image formed in a camera.



6 (c) (i) What type of lens is shown in the diagram?

.....

(1 mark)

6 (c) (ii) Use the equation in the box to calculate the magnification.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification = ... *(2 marks)*

6 (d) Why does the image formed in a camera have to be a real image?

.....

.....

(1 mark)

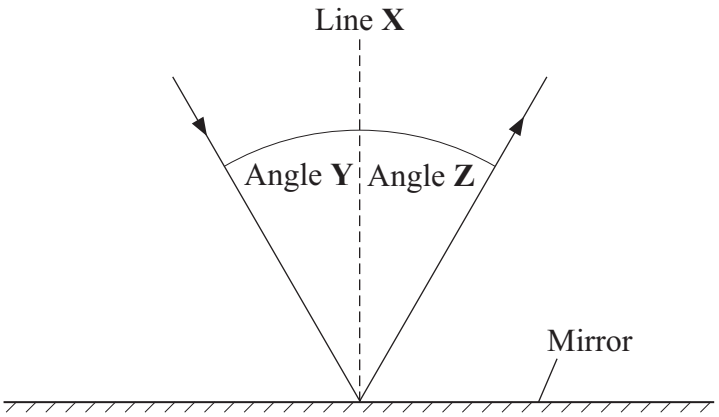
7

4.6.2.2 Properties of electromagnetic waves 1

Question 04

January 2010 | PHY3F | Original Q1 | Legacy

1 (a) The following diagram shows a ray of light which is reflected by a mirror.



1 (a) (i) Use **one** word from the box to complete the sentence.

concave	**convex**	**plane**

The mirror is a ..... mirror.

(1 mark)

1 (a) (ii) Complete the sentence.

Line **X** is a vertical line at right angles to the mirror and is called the

..... .

(1 mark)

4.6.2.2 Properties of electromagnetic waves 1

Question 04 · continued

for mark

Complete the following sentences by drawing a ring around the correct line in each box.

1 (a) (iii) Angle **Y** is called the angle of

incidence
reflection
refraction

.

(1 mark)

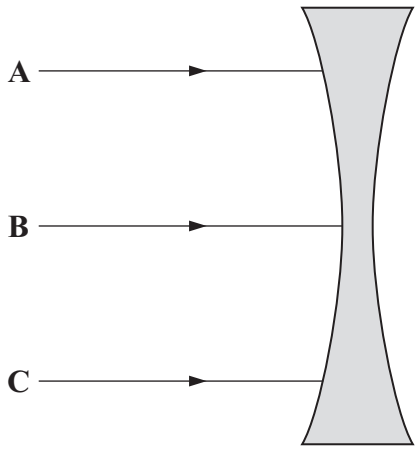
1 (a) (iv) If angle **Y** is doubled, then angle **Z** will

be halved
stay the same
be doubled

.

(1 mark)

1 (b) The following diagram shows the side view of a lens and three parallel rays of light, **A**, **B** and **C**.



1 (b) (i) Use **one** word from the box to complete the sentence.

converging	**diverging**	**plane**

The diagram shows a ..... lens.

(1 mark)

1 (b) (ii) Add to the diagram to show what will happen to **each** of the three rays of light, **A**, **B** and **C**.

(2 marks)

7

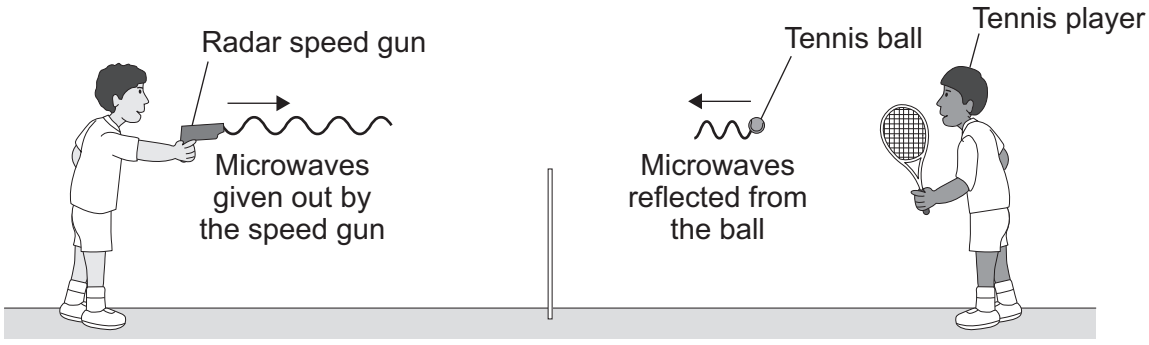
4.6.2.2 Properties of electromagnetic waves 1

Question 05

March 2011 | PHY1BP | Original Q8 | Legacy

QUESTION EIGHT

The picture shows a radar speed gun being used to measure how fast a tennis player hits the ball.



Some of the microwaves from the radar speed gun are absorbed by the ball and some are reflected by the ball.

8A What effect will the absorbed microwaves have on the ball?

1 The temperature of the ball will increase slightly.

2 The ball will go faster.

3 The temperature of the ball will decrease slightly.

4 The ball will go slower.

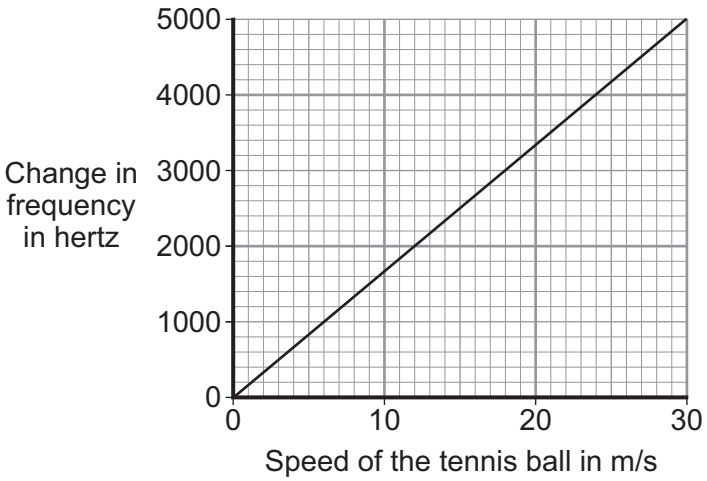
8B Which row in the table describes how the frequency and wavelength of the reflected microwaves are different from the microwaves given out by the speed gun?

	Frequency of reflected waves	Wavelength of reflected waves
1	higher	longer
2	lower	shorter
3	higher	shorter
4	lower	longer

4.6.2.2 Properties of electromagnetic waves 1

Question 05 · continued

The graph shows how the change in frequency of the microwaves depends on the speed of the ball.



8C The data has been drawn as a line graph because . . .

1 frequency and speed are both categoric variables.

2 frequency and speed are both continuous variables.

3 frequency is a categoric variable and speed is a continuous variable.

4 frequency is a continuous variable and speed is a categoric variable.

8D The speed gun measures the change in frequency as 3000 Hz.

What is the speed of the ball?

1 18 m/s

2 20 m/s

3 21 m/s

4 22 m/s

4.6.2.2 Properties of electromagnetic waves 1

Question 06

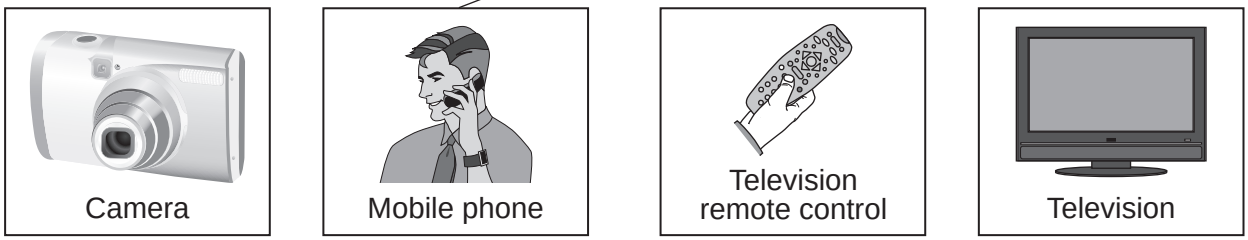
June 2012 | PH1FP | Original Q2 | Legacy

2 (a) The diagram shows the electromagnetic spectrum.

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

Draw **one** line from each device to the type of electromagnetic wave the device uses. One line has been drawn for you.

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



(3 marks)

2 (b) Visible light waves travel through space at a speed of 300 000 km/s.

How fast do infrared waves travel through space?

.....

(1 mark)

2 (c) Draw a ring around the correct answer in the box to complete the sentence.

Infrared waves have

a longer wavelength than
the same wavelength as
a shorter wavelength than

visible light waves.

(1 mark)

4.6.2.2 Properties of electromagnetic waves 1

Question 06 · continued

2 (d) The two diagrams, **A** and **B**, show a light ray travelling into a glass block.

Diagram A

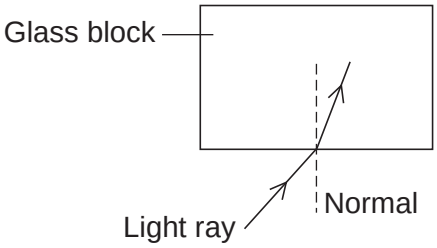
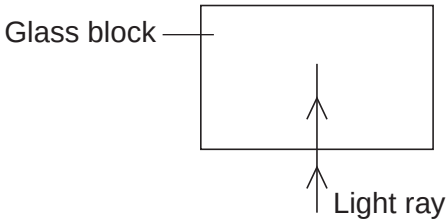


Diagram B



2 (d) (i) Look at **Diagram A**.

What name is given to the process that happens as the light enters the glass block?

.....

(1 mark)

2 (d) (ii) Look at **Diagram B**.

The light enters the glass block without changing direction.

Why?

.....

.....

(1 mark)

7

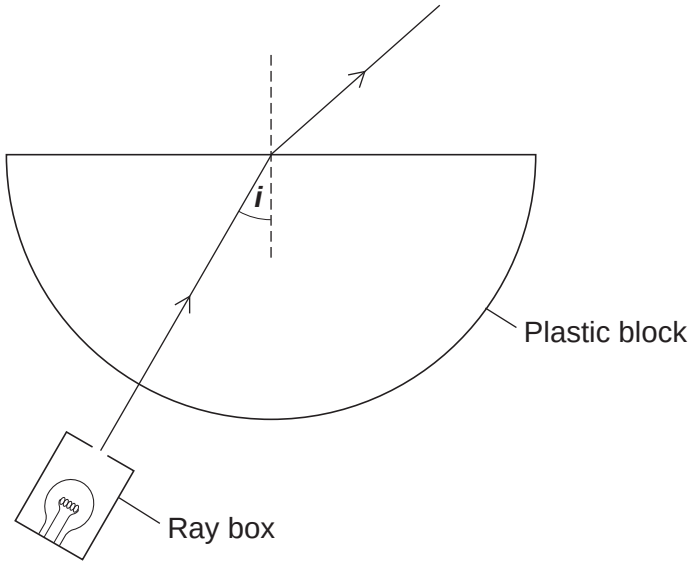
4.6.2.2 Properties of electromagnetic waves 1

Question 07

January 2013 | PH1FP | Original Q6 | Legacy

6 A student investigated the refraction of light as it passed out of a clear plastic block into the air.
Diagram 1 shows the apparatus the student used.

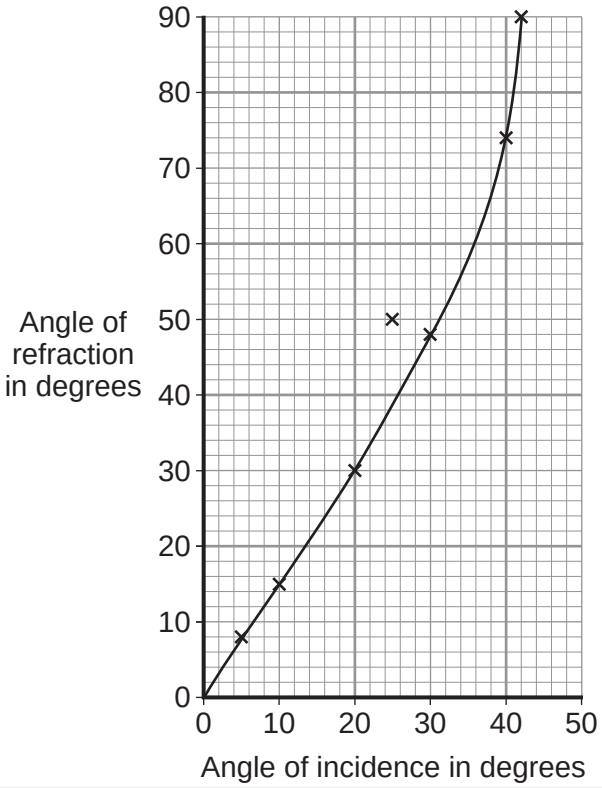
Diagram 1



6 (a) The angle ***i*** is the angle of incidence.

Use the letter ***r*** to mark the angle of refraction on **Diagram 1**. *(1 mark)*

6 (b) The student measured the angle of refraction for different angles of incidence.
The results are shown in the graph.



4.6.2.2 Properties of electromagnetic waves 1

Question 07 · continued

6 (b) (i) One of the results seems to be anomalous.

Draw a ring around the anomalous data point on the graph.

(1 mark)

6 (b) (ii) The student did measure the angles of incidence accurately.

What is likely to have caused the anomalous result?

.....

.....

(1 mark)

6 (b) (iii) What conclusion can the student make from the results shown in the graph.

Draw a ring around the correct answer in the box to complete the sentence.

The angle of refraction is

less than
equal to
greater than

the angle of incidence.

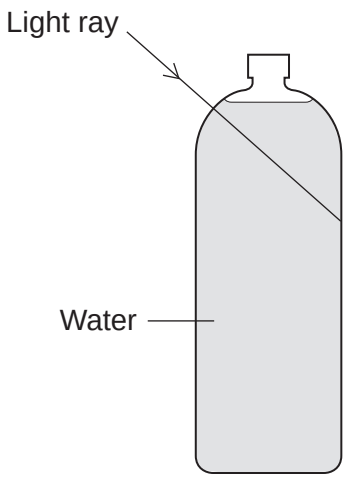
(1 mark)

6 (c) Light travelling from water into air is refracted in the same way as when light travels from plastic into air.

Diagram 2 shows a large bottle, filled with water. The bottle is made from clear plastic.

Draw on **Diagram 2** the path of the light ray as it passes out of the bottle into the air.

Diagram 2



(2 marks)

Question 6 continues on the next page

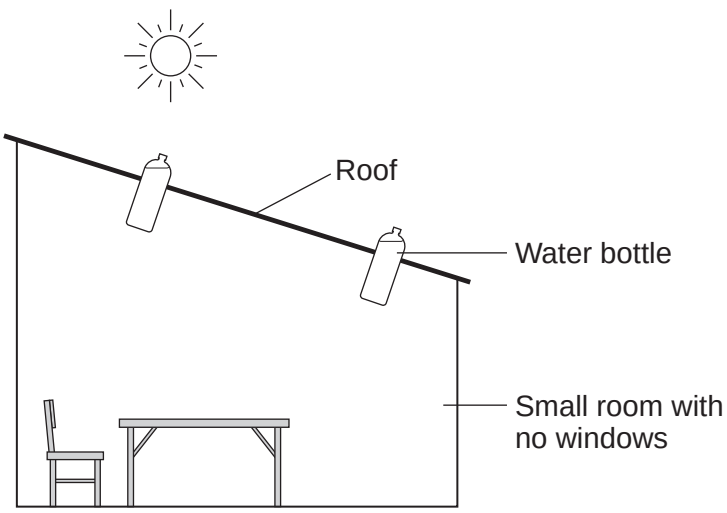
4.6.2.2 Properties of electromagnetic waves 1

Question 07 · continued

6 (d) In some countries, people are too poor to pay for electricity. Some people living in small houses with no natural light use bottles filled with water as a sort of light bulb.

The bottles are fitted into small holes in the roof of the house. Sunlight goes into the bottle of water. When the light leaves the bottle, the light is refracted, causing sunlight to spread into the room.

Diagram 3



6 (d) (i) What is likely to be the most important outcome of using this simple device to provide light?

Tick (✓) **one** box.

People will have enough light to work inside their homes. ☐

Fewer plastic bottles will be thrown into rubbish tips. ☐

Plastic bottles will increase in value. ☐

(1 mark)

6 (d) (ii) Suggest **one** disadvantage of using this device compared with using a light bulb.

.....

.....

.....

(1 mark)

8

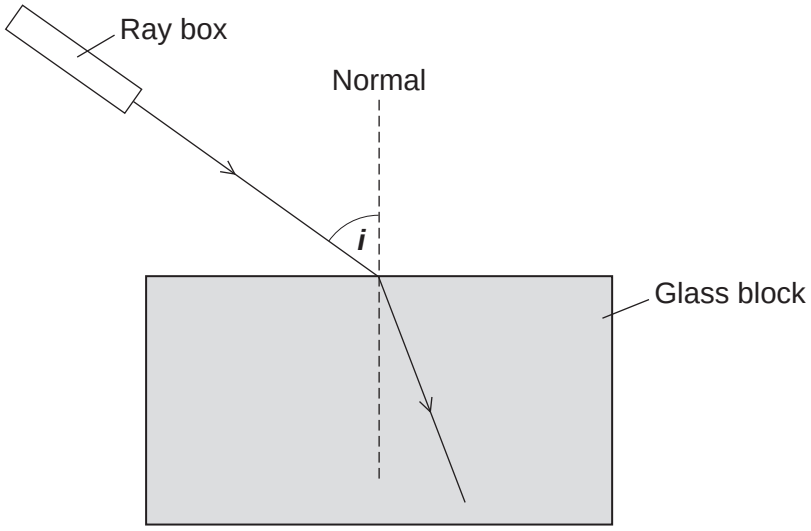
4.6.2.2 Properties of electromagnetic waves 1

Question 08

June 2015 | PH3FP | Original Q5 | Legacy

5 (a) **Figure 8** shows a ray of light entering a glass block.

Figure 8



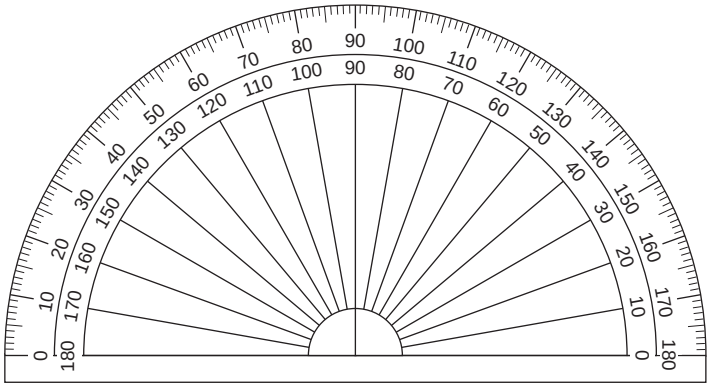
5 (a) (i) The angle of incidence in **Figure 8** is labelled with the letter ***i***.

On **Figure 8**, use the letter ***r*** to label the angle of refraction.

[1 mark]

5 (a) (ii) **Figure 9** shows the protractor used to measure angles ***i*** and ***r***.

Figure 9



What is the resolution of the protractor?

[1 mark]

Tick (✓) **one** box.

1 degree ☐ 5 degrees ☐ 10 degrees ☐

4.6.2.2 Properties of electromagnetic waves 1

Question 08 · continued

5 (a) (iii) **Table 1** shows calculated values for angle ***i*** and angle ***r*** from an investigation.

Table 1

Calculated values
sin ***i*** = 0.80
sin ***r*** = 0.50

Use the values from **Table 1** to calculate the refractive index of the glass.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

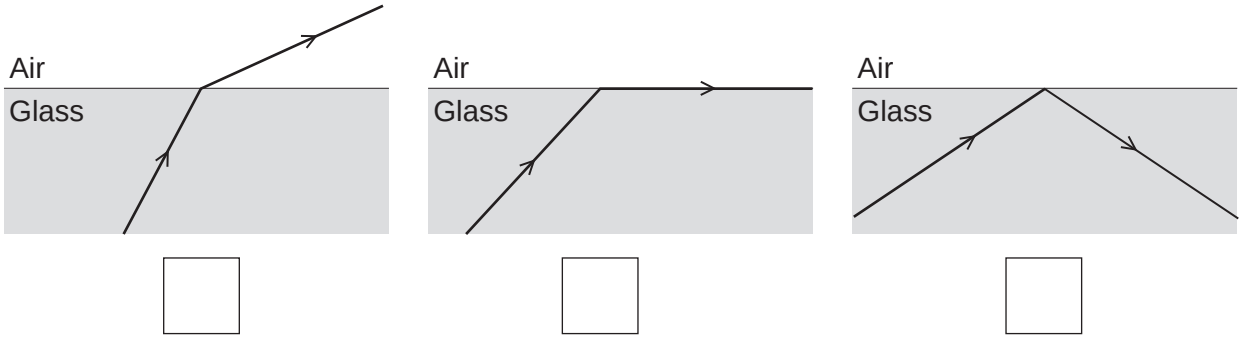
Refractive index = ...

5 (b) The diagrams below show a ray of light moving through glass.

Which diagram correctly shows what happens when the ray of light strikes the surface of the glass at the critical angle?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

Question 5 continues on the next page

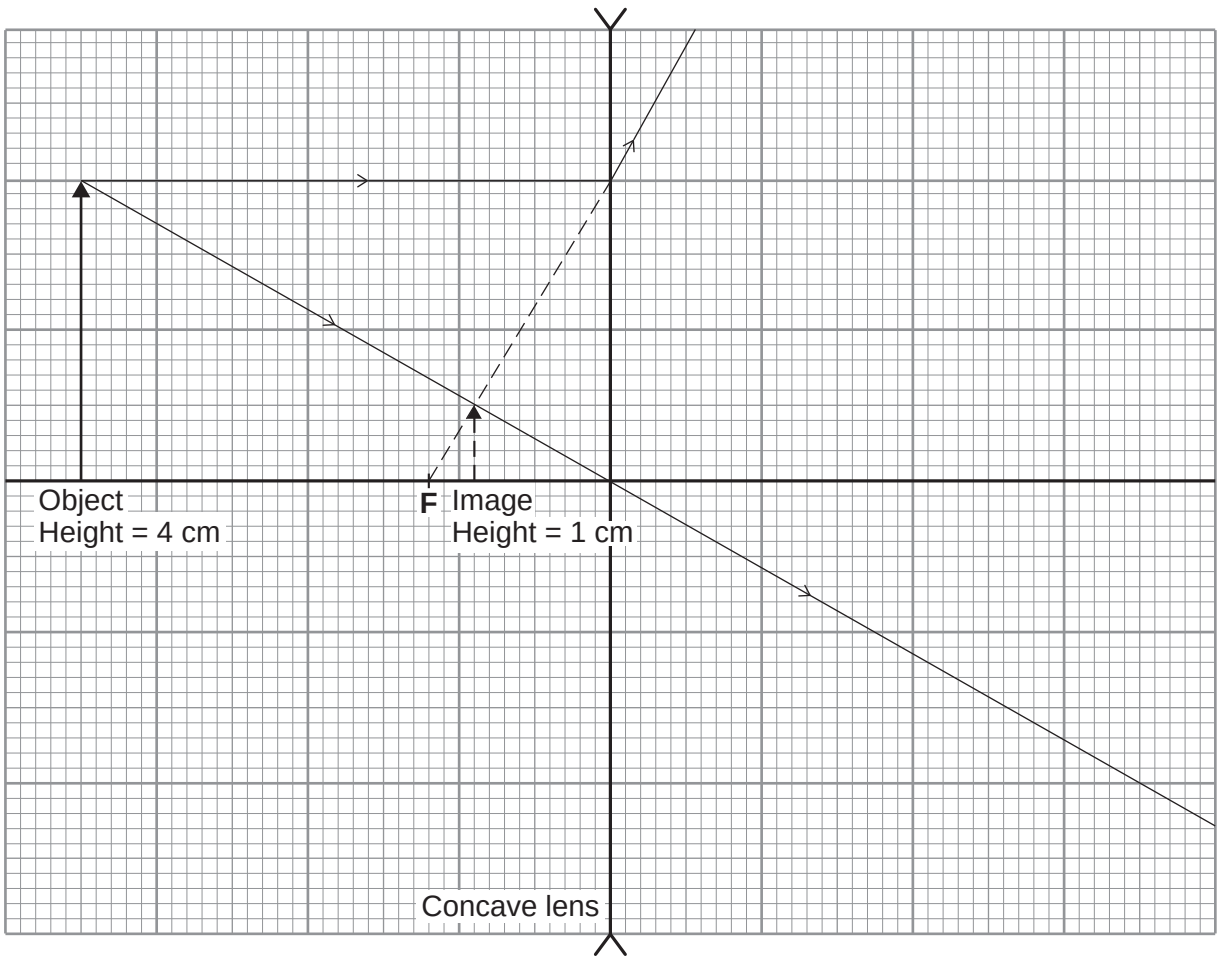
4.6.2.2 Properties of electromagnetic waves 1

Question 08 · continued

5 (c) A concave (diverging) lens is fitted into a door to make a security spyhole.

Figure 10 shows how this lens produces an image.

Figure 10



5 (c) (i) State **one** word to describe the nature of the image in **Figure 10**.

[1 mark]

.....

4.6.2.2 Properties of electromagnetic waves 1

Question 08 · continued

5 (c) (ii) Use data from **Figure 10** to calculate the magnification of the image.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Magnification = ...

5 (c) (iii) What is another use for a concave lens?

[1 mark]

Tick (✓) **one** box.

A magnifying glass ☐

Correcting short sight ☐

To focus an image in a camera ☐

9

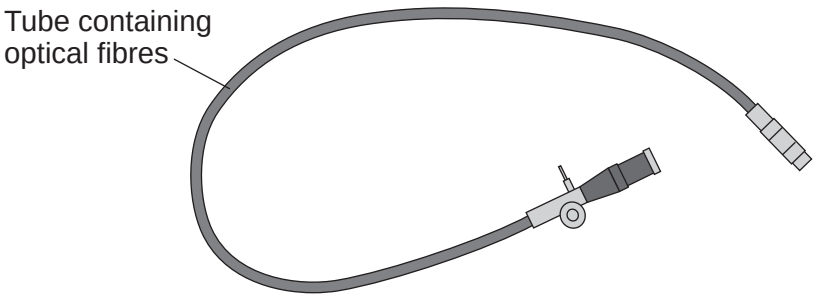
4.6.2.2 Properties of electromagnetic waves 1

Question 09

June 2016 | PH3FP | Original Q7 | Legacy

7 An endoscope is a piece of equipment used by doctors. An endoscope contains optical fibres. **Figure 9** shows an endoscope.

Figure 9



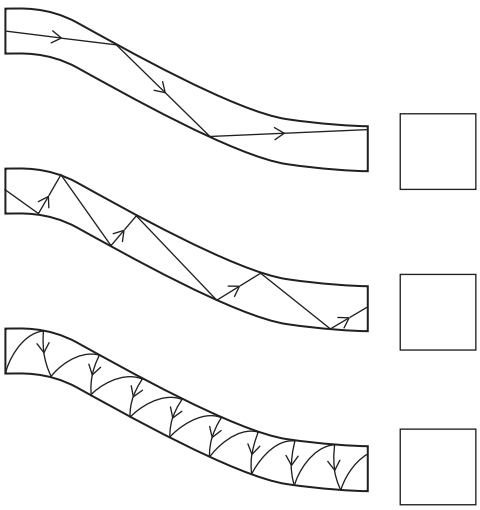
7 (a) State what a doctor would use an endoscope for.

[1 mark]

7 (b) Which **one** of the following diagrams correctly shows how a ray of light travels through an optical fibre?

[1 mark]

Tick (✓) **one** box.

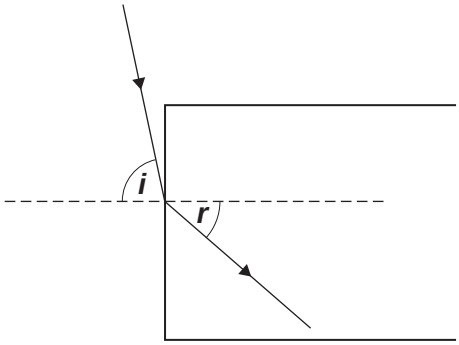


4.6.2.2 Properties of electromagnetic waves 1

Question 09 · continued

7 (c) **Figure 10** shows a ray of light entering an optical fibre.

Figure 10



The angle of incidence ***i*** is 78°
The angle of refraction ***r*** is 40°

Calculate the refractive index of the optical fibre.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Refractive index = _____

5

4.6.2.2 Properties of electromagnetic waves 1

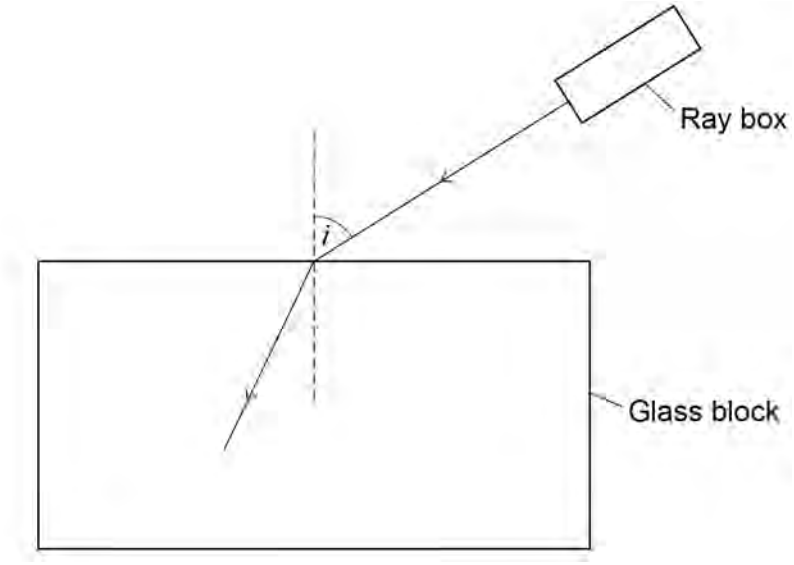
Question 10

June 2019 | 8463/2F | Original Q5

0 5 A student used a ray box and glass block to investigate refraction of light.

Figure 15 shows a ray of light entering the glass block.

Figure 15



0 5 . 1 In **Figure 15**, the angle of incidence is labelled with the letter ***i***.

Label the angle of refraction in **Figure 15** with the letter ***r***.

[1 mark]

0 5 . 2 Measure the angle of incidence in **Figure 15**.

[1 mark]

Angle of incidence = _____ °

0 5 . 3 Complete **Figure 15** to show the path taken by the ray of light through the glass block and out into the air.

[3 marks]

4.6.2.2 Properties of electromagnetic waves 1

Question 10 · continued

0 5 . 4 Complete the sentence.

Choose an answer from the box.

[1 mark]

random	**systematic**	**zero**

The student repeated the measurement three times and calculated the mean to reduce the effect of _____ errors.

Table 2 shows the student's values for the angles of incidence and the mean angles of refraction.

Table 2

Angle of incidence in degrees	Mean angle of refraction in degrees
20	13
30	19
40	**X**
50	31

0 5 . 5 For an angle of incidence of 40° the three measurements for the angle of refraction were:

23° 27° 25°

Calculate the value of **X** in **Table 2**.

[1 mark]

_____

_____

X = _____ °

4.6.2.2 Properties of electromagnetic waves 1

Question 10 · continued

0 5 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**greater than**	**less than**

The student used the data in **Table 2** and correctly concluded that the angle of refraction is _____ the angle of incidence used.

0 5 . 7 Why is the student's conclusion only valid for angles of incidence between 20° and 50°?

[1 mark]

0 5 . 8 The student repeated the investigation using a transparent plastic block.

Why did the student use a transparent block and not an opaque block?

[1 mark]

4.6.2.2 Properties of electromagnetic waves 1

Question 10 · continued

0 5 . 9 The student wanted to compare the refraction caused by the plastic with the refraction caused by the glass.

What must the student keep the same for both the plastic block and the glass block?

[1 mark]

Tick (✓) **one** box.

- The angles of incidence tested ☐
- The angles of refraction tested ☐
- The number of results recorded ☐
- The size of the two blocks ☐

11

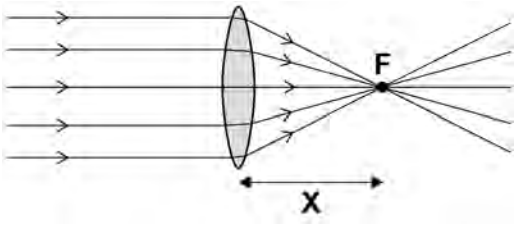
4.6.2.2 Properties of electromagnetic waves 1

Question 11

June 2019 | 8463/2F | Original Q8

0 8 . 1 **Figure 20** shows parallel rays of light being refracted by a convex lens.

Figure 20



What is distance '**X**' called?

[1 mark]

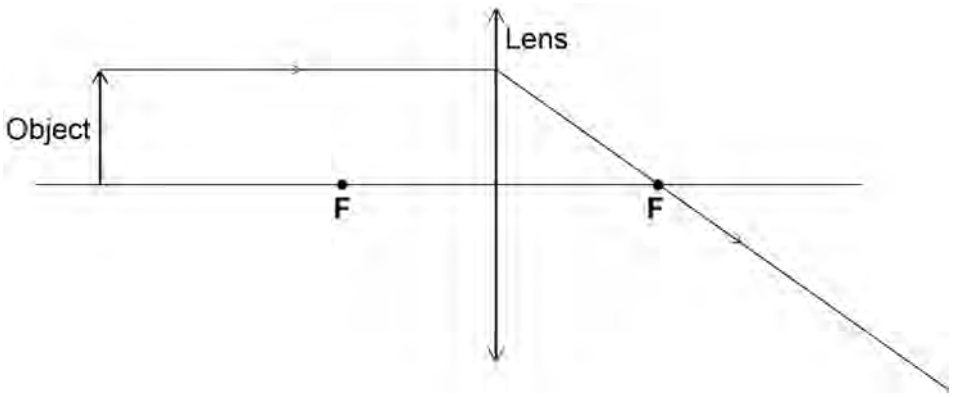
0 8 . 2 Lenses can be used to form the image of an object.

Complete the ray diagram in **Figure 21** to show how a **convex** lens forms the image of the object.

Use an arrow to represent the image.

[2 marks]

Figure 21

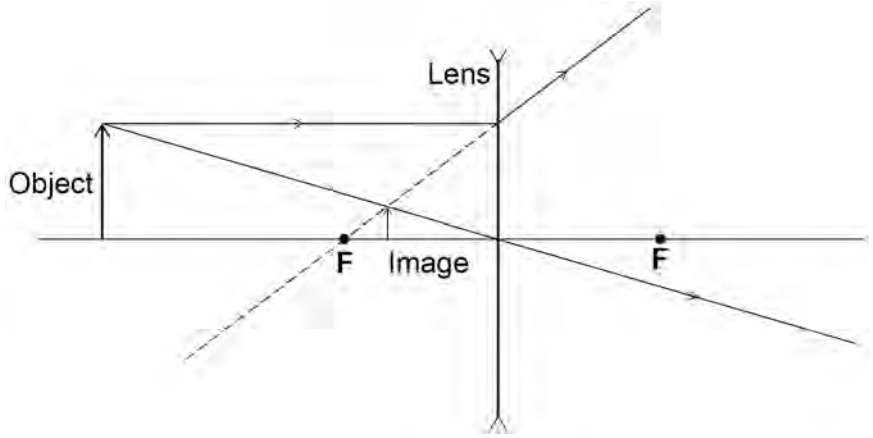


4.6.2.2 Properties of electromagnetic waves 1

Question 11 · continued

Figure 22 shows how a **concave** lens forms the image of an object.

Figure 22



0 8 . 3 Give **one** similarity and **one** difference between the image formed by the convex lens and the image formed by the concave lens.

[2 marks]

Similarity _____

_____

Difference _____

_____

0 8 . 4 A person uses a lens to read the letters on the back of a coin.

The image height of the letters on the coin is 9.0 mm

The magnification produced by the lens is 6.0

Calculate the height of the letters on the coin.

Use the Physics Equations sheet.

[3 marks]

_____

_____

_____

_____

Height = _____ mm

8

4.6.2.2 Properties of electromagnetic waves 1

Question 12

November 2020 | 8463/2F | Original Q4

0 4 . 1 Visible light is used for communications.

Which other parts of the electromagnetic spectrum are used for communications?

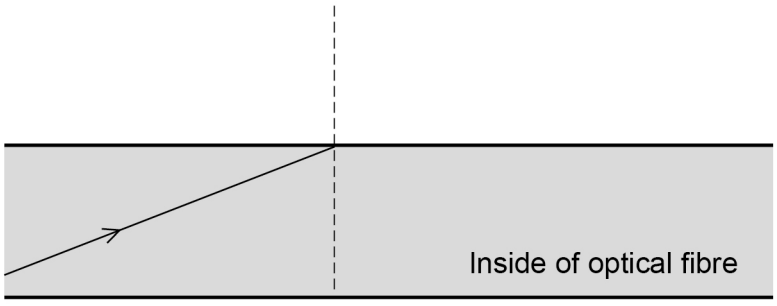
[2 marks]

Tick (✓) **two** boxes.

- Gamma rays ☐
- Microwaves ☐
- Radio waves ☐
- Ultraviolet ☐
- X-rays ☐

Figure 5 shows a ray of light in an optical fibre.

Figure 5



0 4 . 2 What is the name given to the dotted line on **Figure 5**?

[1 mark]

0 4 . 3 Where the ray of light touches the edge of the optical fibre it is reflected.

Draw the reflected ray on **Figure 5**.

[2 marks]

Question 4 continues on the next page

4.6.2.2 Properties of electromagnetic waves 1

Question 12 · continued

0 4 . 4 Optical fibres need to be able to bend around corners without breaking.

Suggest the property that optical fibres must have to allow them to bend around corners.

[1 mark]

0 4 . 5 The appearance of visible light can change when it interacts with different objects.

Complete the sentences.

Choose the answers from the box.

Each answer may be used once, more than once or not at all.

[3 marks]

absorbed	**reflected**	**refracted**	**transmitted**

When white light is incident on a green filter, only green light passes through the filter.

This is because green light is _____ by the filter.

All other colours of light are _____ by the filter.

When red light shines on a blue object the red light is _____.

9

4.6.2.2 Properties of electromagnetic waves 1

Question 13

June 2022 | 8463/2F | Original Q5

0 5 Ultraviolet and visible light are both parts of the electromagnetic spectrum.

0 5 . 1 How does the speed of ultraviolet in a vacuum compare to the speed of visible light in a vacuum?

[1 mark]

Tick (✓) **one** box.

- Ultraviolet travels at a faster speed than visible light. ☐
- Ultraviolet travels at a slower speed than visible light. ☐
- Ultraviolet travels at the same speed as visible light. ☐

0 5 . 2 **Figure 9** shows parts of the electromagnetic spectrum.

Figure 9

Radio waves	A	B	C	D	X-rays	Gamma rays

Which letters represent the positions of ultraviolet and visible light in the electromagnetic spectrum?

[2 marks]

Ultraviolet _____

Visible light _____

4.6.2.2 Properties of electromagnetic waves 1

Question 13 · continued

0 5 . 3 **Table 3** shows the range of wavelengths for different types of ultraviolet.

Table 3

Type	Range of wavelength in nanometres
Ultraviolet **A** (UVA)	315–400
Ultraviolet **B** (UVB)	280–315
Ultraviolet **C** (UVC)	100–280

Determine which type of ultraviolet shown in **Table 3** has the largest range of wavelengths.

To gain full marks you must calculate the range of wavelengths for each type of ultraviolet.

[3 marks]

Type of ultraviolet with the largest range of wavelengths _____

Question 5 continues on the next page

4.6.2.2 Properties of electromagnetic waves 1

Question 13 · continued

Figure 10 shows how different types of ultraviolet are absorbed by the ozone layer in the Earth's atmosphere.

Table 4 shows the relative ionising power from each type of ultraviolet.

Figure 10

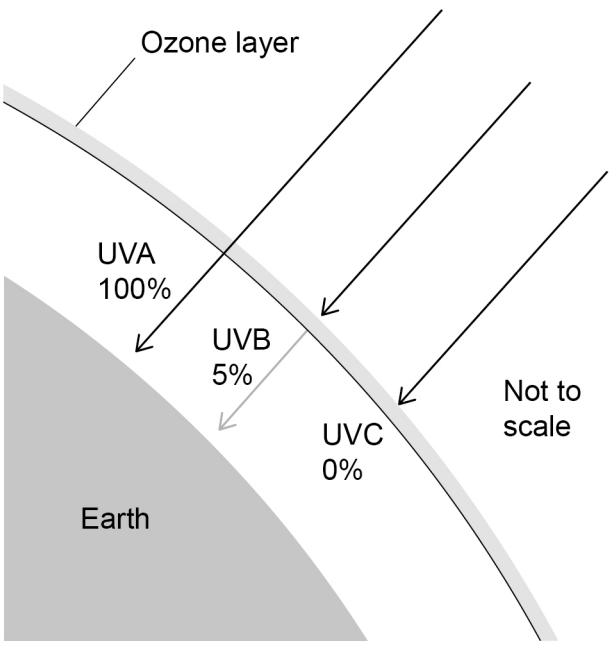


Table 4

Type	Relative ionising power
UVA	Low
UVB	Medium
UVC	High

0 5 . 4 Explain the importance of the ozone layer in reducing the risk to people from all types of ultraviolet.

Use **Figure 10** and **Table 4**.

[4 marks]

4.6.2.2 Properties of electromagnetic waves 1

Question 13 · continued

0 5 . 5 The Sun emits visible light.

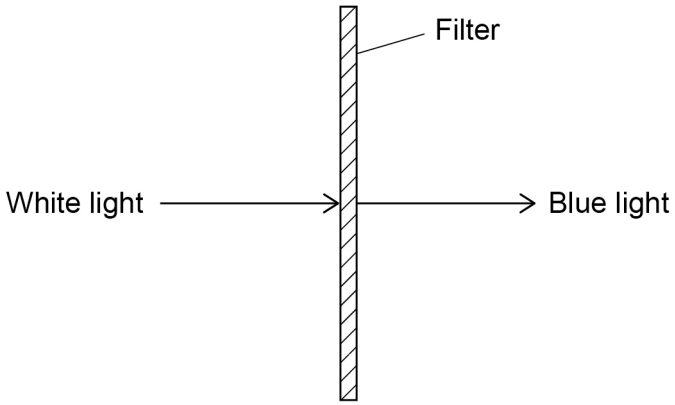
A student concludes that visible light is **not** absorbed by the ozone layer.

Give **one** piece of evidence that shows the student's conclusion is correct.

[1 mark]

0 5 . 6 **Figure 11** shows white light incident on a colour filter.

Figure 11



Complete the sentence.

Choose the answers from the box.

[2 marks]

absorbed	**radiated**	**reflected**	**refracted**	**transmitted**

When white light is incident on the filter, only blue light is _____

and all other colours of light are _____ .

13

4.6.2.2 Properties of electromagnetic waves 1

Question 14

June 2022 | 8463/2F | Original Q9

0 9 A student used a ray box to shine a ray of light through air into a glass block.

The student investigated how the angle of refraction varied with the angle of incidence.

Table 5 shows the results.

Table 5

Angle of incidence in degrees	Angle of refraction in degrees
10	5
20	10
30	14
40	19
50	23
60	26
70	28
80	29

0 9 . 1 Describe a method the student could have used to obtain the results in **Table 5**.

Your answer may include a labelled diagram.

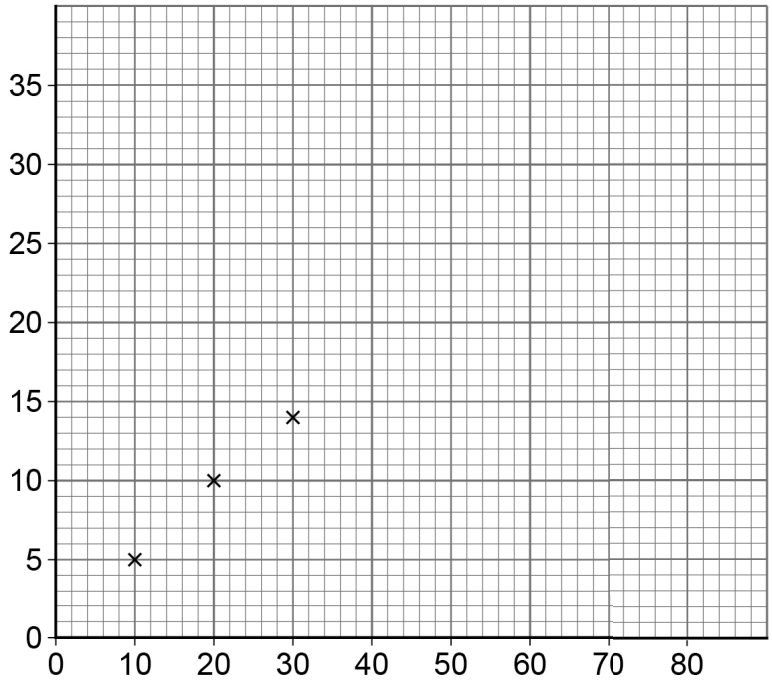
[6 marks]

4.6.2.2 Properties of electromagnetic waves 1

Question 14 · continued

0 9 . 2 **Figure 16** is an incomplete graph of the results.

Figure 16



Complete **Figure 16** using data from **Table 5**.

- Label the axes.
- Plot the remaining data.
- Draw a line of best fit.

[4 marks]

Question 9 continues on the next page

4.6.2.2 Properties of electromagnetic waves 1

Question 14 · continued

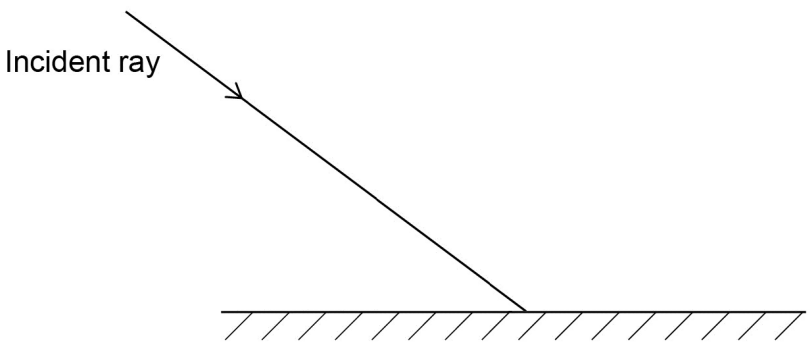
0 9 . 3 Complete the ray diagram in **Figure 17** to show the reflection of light from the surface of a plane mirror.

You should:

- draw the normal line
- draw the reflected ray.

[2 marks]

Figure 17



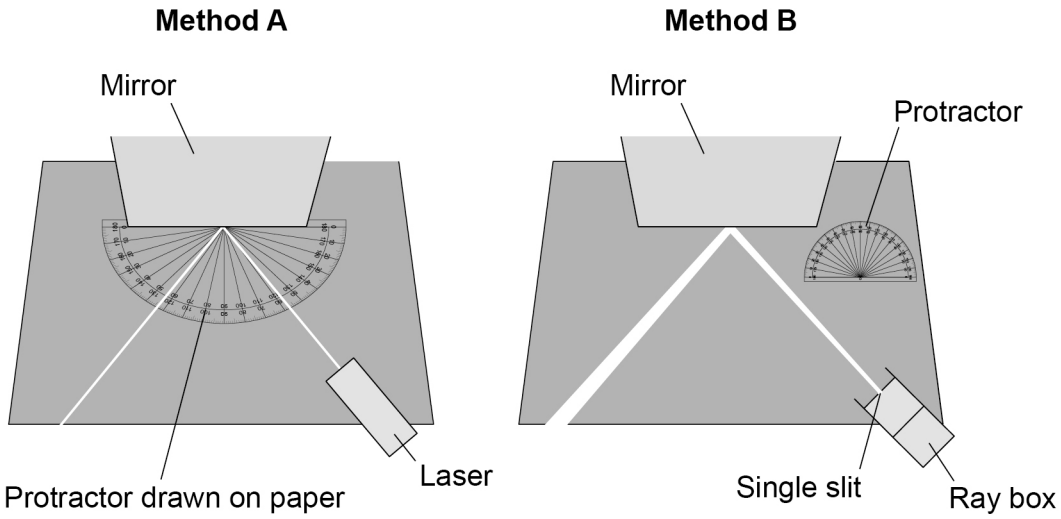
4.6.2.2 Properties of electromagnetic waves 1

Question 14 · continued

0 9 . 4 Two students investigated the reflection of light by a plane mirror.

Figure 18 shows the different equipment the students used.

Figure 18



Explain **two** ways that **Method A** is better than **Method B**.

[4 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

16

4.6.2.2 Properties of electromagnetic waves 1

Question 15

June 2023 | 8463/2F | Original Q6

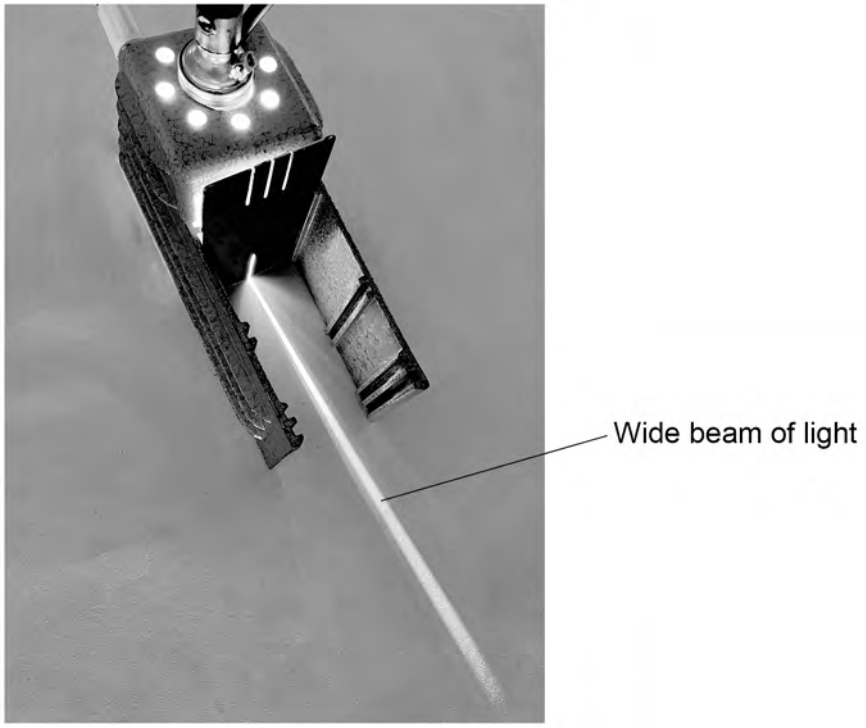
0 6 A student investigated the refraction of light through a glass block.

Figure 14 shows the ray box used.

The student aimed the beam of light from the ray box towards a glass block.

The student measured the angle of incidence at the point where the light entered the glass block.

Figure 14



0 6 . 1 Why is using a wide beam of light less likely to give accurate results than using a narrow beam?

[1 mark]

Tick (✓) **one** box.

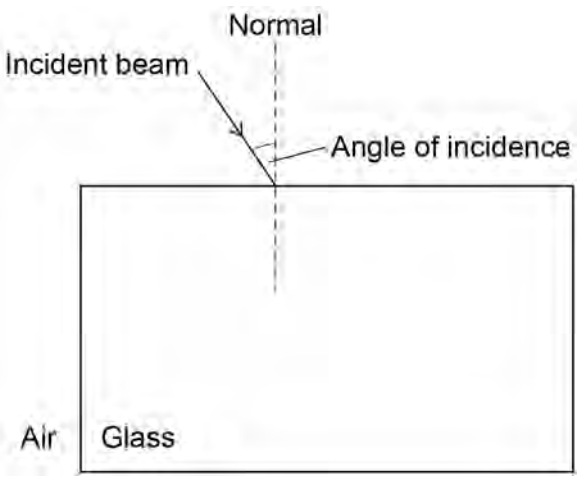
- It will be harder to judge where the centre of the beam is. ☐
- It will cause a smaller uncertainty in the measurements. ☐
- The angle of refraction will be larger than it should be. ☐

4.6.2.2 Properties of electromagnetic waves 1

Question 15 · continued

0 6 . 2 **Figure 15** shows the beam of light incident on the glass block.

Figure 15



Complete **Figure 15** to show the path taken by the beam of light through the glass block and back into the air.

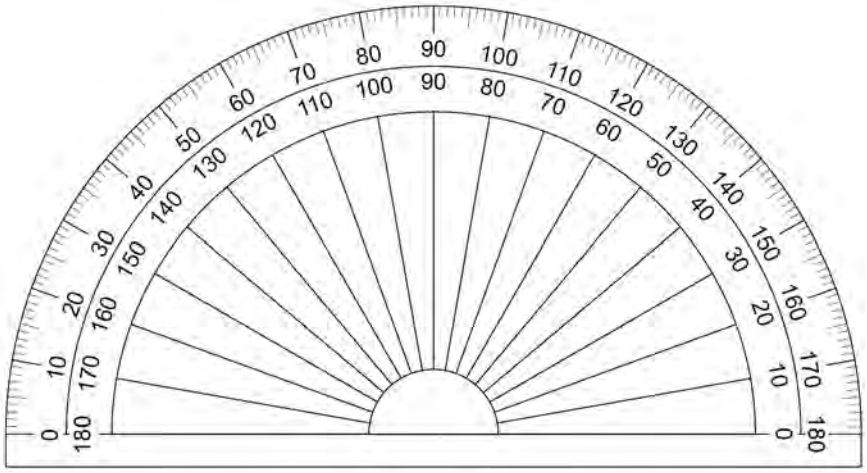
[3 marks]

4.6.2.2 Properties of electromagnetic waves 1

Question 15 · continued

Figure 16 shows the protractor used by the student.

Figure 16



0 6 . 3 What is the resolution of the protractor?

[1 mark]

Tick (✓) **one** box.

1 degree ☐

10 degrees ☐

180 degrees ☐

0 6 . 4 For one angle of incidence the student measured the angle of refraction three times.

The three measurements were:

35° 31° 33°

Calculate the mean angle of refraction.

[1 mark]

Mean angle of refraction = _____ °

4.6.2.2 Properties of electromagnetic waves 1

Question 15 · continued

The student placed a red filter in front of the white beam of light.

Only red light passes through the filter.

0 6 . 5 Complete the sentence.

[1 mark]

When white light is incident on the red filter, all colours except for red are

_____ by the filter.

Use the Physics Equations Sheet to answer questions **06.6** and **06.7**.

0 6 . 6 Write down the equation which links frequency (f), wave speed (v) and wavelength (λ).

[1 mark]

_____

0 6 . 7 Light has a wave speed of 3.0×10^8 m/s in air.

The frequency of the red light is 4.0×10^{14} Hz.

Calculate the wavelength of the red light in air.

[3 marks]

_____

_____

_____

_____

_____

Wavelength = _____ m

11

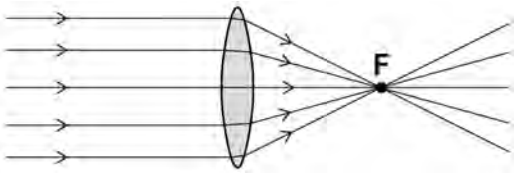
4.6.2.2 Properties of electromagnetic waves 1

Question 16

0 8 Lenses can be used to form an image of an object.

0 8 . 1 **Figure 20** shows parallel rays of light being refracted by a **convex** lens.

Figure 20



What is the position marked '**F**' called?

[1 mark]

Tick (✓) **one** box.

Focal length ☐

Focus point ☐

Principal focus ☐

4.6.2.2 Properties of electromagnetic waves 1

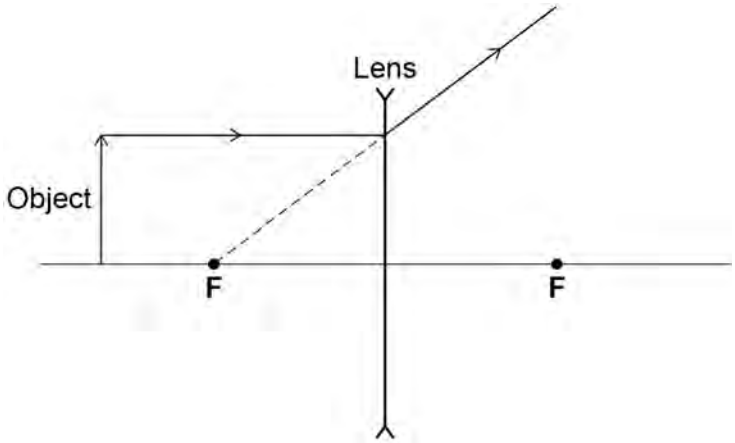
Question 16 · continued

0 8 . 2 Complete the ray diagram in **Figure 21** to show how a **concave** lens forms the image of the object.

Use an arrow to represent the image.

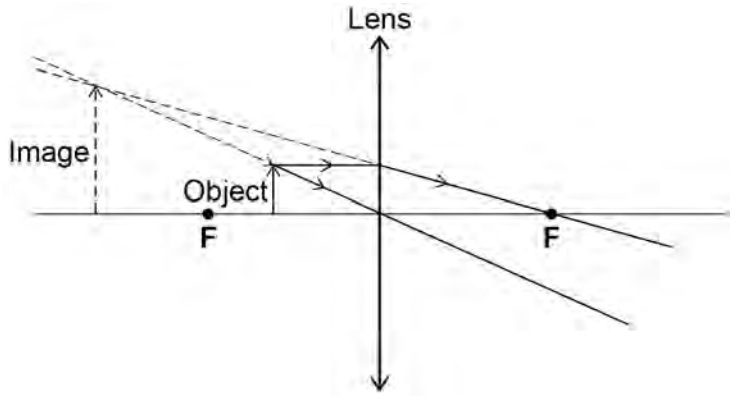
[2 marks]

Figure 21



0 8 . 3 **Figure 22** shows how a **convex** lens can be used to form a magnified image of an object.

Figure 22



Give **two** ways that the image formed by the convex lens in **Figure 22** is similar to the image formed by the concave lens.

[2 marks]

1 _____

2 _____

4.6.2.2 Properties of electromagnetic waves 1

Question 16 · continued

0 8 . 4 A convex lens is used as a magnifying glass to identify a symbol on the back of a silver spoon.

The symbol has an actual height of 1.6 mm.

The magnification produced by the lens is 3.5

Calculate the image height of the symbol when viewed through the magnifying glass.

Use the Physics Equations Sheet.

[3 marks]

Image height = _____ mm

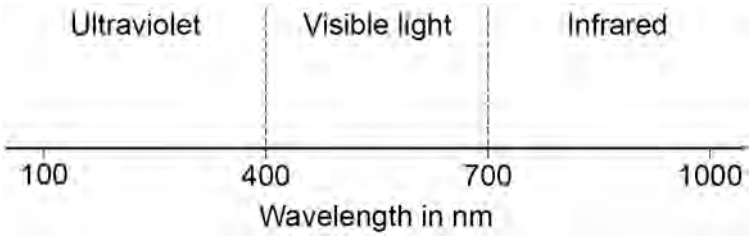
8

4.6.2.2 Properties of electromagnetic waves 1

Question 17

0 6 **Figure 10** shows the wavelengths of some types of electromagnetic radiation.

Figure 10



0 6 . 1 Suggest **one** piece of equipment that can be used to detect infrared radiation.

[1 mark]

0 6 . 2 Which of the following values is a wavelength of red light?

[1 mark]

Tick (✓) **one** box.

320 nm ☐

410 nm ☐

690 nm ☐

750 nm ☐

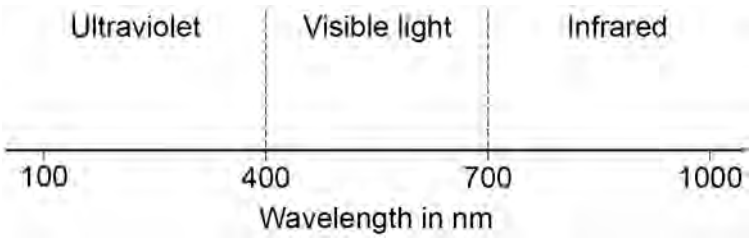
Question 6 continues on the next page

4.6.2.2 Properties of electromagnetic waves 1

Question 17 · continued

Figure 10 is repeated below.

Figure 10



0 6 . 3 The eyes of a bee can detect electromagnetic radiation with wavelengths between 300 nm and 600 nm.

Give **two** ways the radiation detected by the eyes of a bee is different from the radiation detected by human eyes.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 4 Complete the sentences.

Choose the answers from the box.

[2 marks]

absorbed	**emitted**	**reflected**	**refracted**

When sunlight shines on a red flower, the red light

is _____.

All other colours of light shining on the red flower

are _____.

4.6.2.2 Properties of electromagnetic waves 1

Question 17 · continued

0 6 . 5 A gardener looks at a red flower through a green filter.

How does the flower appear to the gardener?

[1 mark]

Tick (✓) **one** box.

Black ☐

Green ☐

Red ☐

White ☐

0 6 . 6 The leaves of the plant reflect light.

The leaves have a rough surface.

What type of reflection happens at the leaf surface?

[1 mark]

_____

8

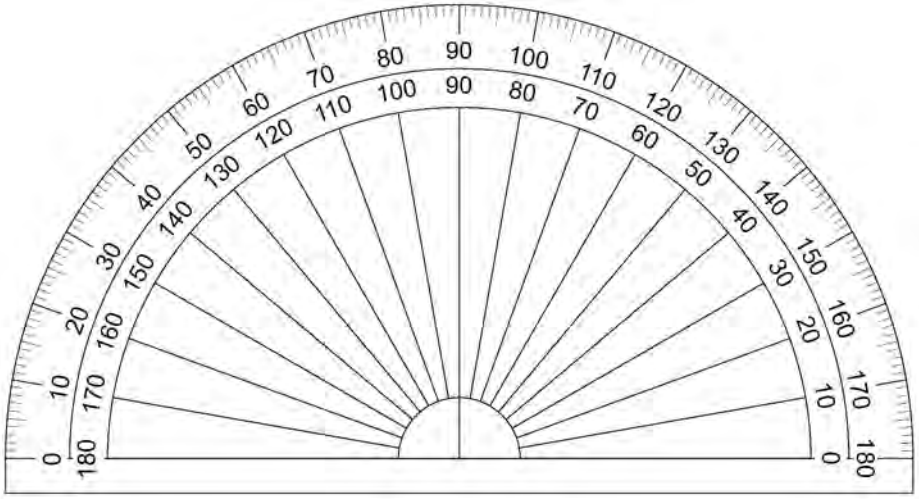
4.6.2.2 Properties of electromagnetic waves 1

Question 18

0 8 A student investigated the refraction of light by a glass block.

Figure 13 shows the protractor used to measure the angles of incidence and the angles of refraction.

Figure 13



0 8 . 1 What is the resolution of the protractor used to measure the angles?

[1 mark]

Resolution = _____ °

Table 1 shows the results.

Table 1

Angle of incidence in degrees	Angle of refraction in degrees
10	6
20	12
30	18
40	23
50	28
60	32

4.6.2.2 Properties of electromagnetic waves 1

Question 18 · continued

0 8 . 2 Describe a method the student could have used to obtain the data in **Table 1**.

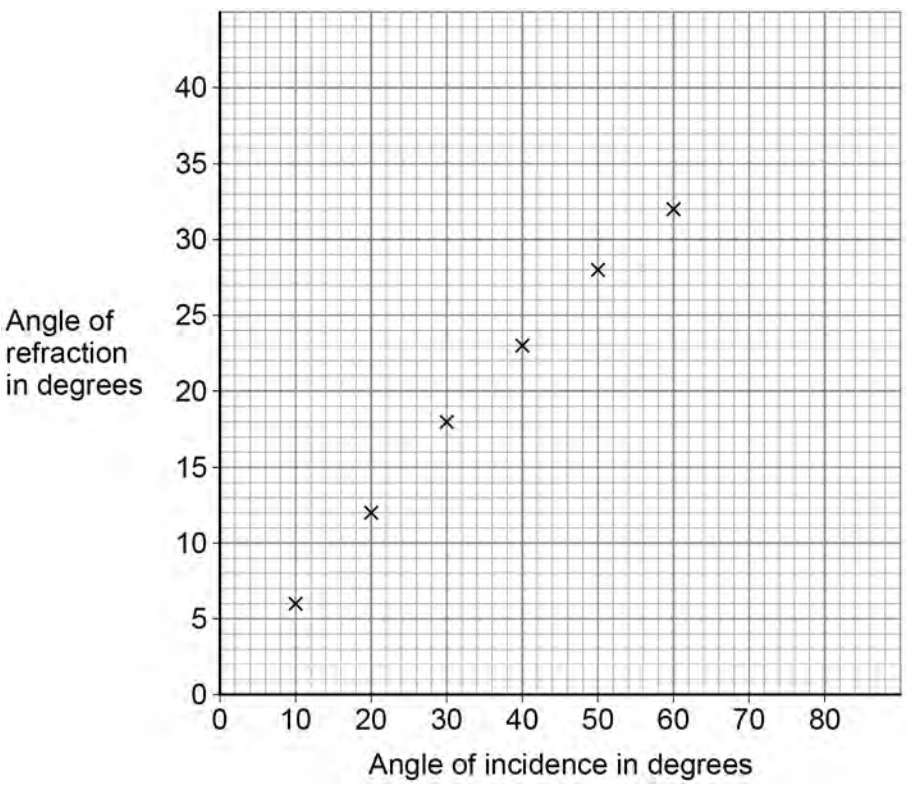
You may include a labelled diagram.

[6 marks]

Question 18 · continued

Figure 14 shows some of the results.

Figure 14



The student measured the angles of refraction for two additional angles of incidence.

Table 2 shows the additional results.

Table 2

Angle of incidence in degrees	Angle of refraction in degrees
70	35
80	37

4.6.2.2 Properties of electromagnetic waves 1

Question 18 · continued

0 8 . 3 Complete **Figure 14**.

You should:

- plot the results from **Table 2**
- draw the line of best fit.

[2 marks]

0 8 . 4 How does **Figure 14** show that the angle of refraction is **not** directly proportional to the angle of incidence?

[1 mark]

Question 8 continues on the next page

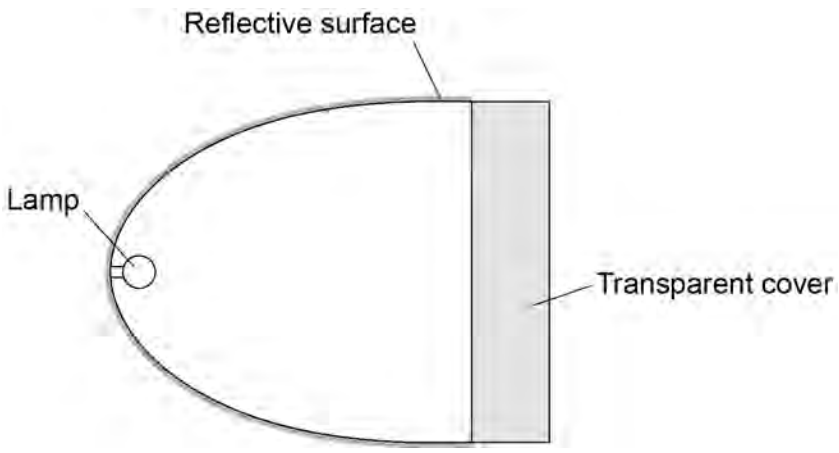
4.6.2.2 Properties of electromagnetic waves 1

Question 18 · continued

Figure 15 shows a diagram of a car headlight.

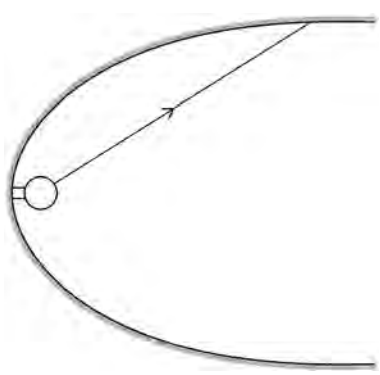
The headlight has a lamp, a reflective surface and a transparent cover.

Figure 15



0 8 . 5 **Figure 16** shows a ray of light incident on the reflective surface.

Figure 16



Complete **Figure 16** to show the reflected ray of light.

You should include the normal line at the point where the incident ray meets the reflecting surface.

[2 marks]

4.6.2.2 Properties of electromagnetic waves 1

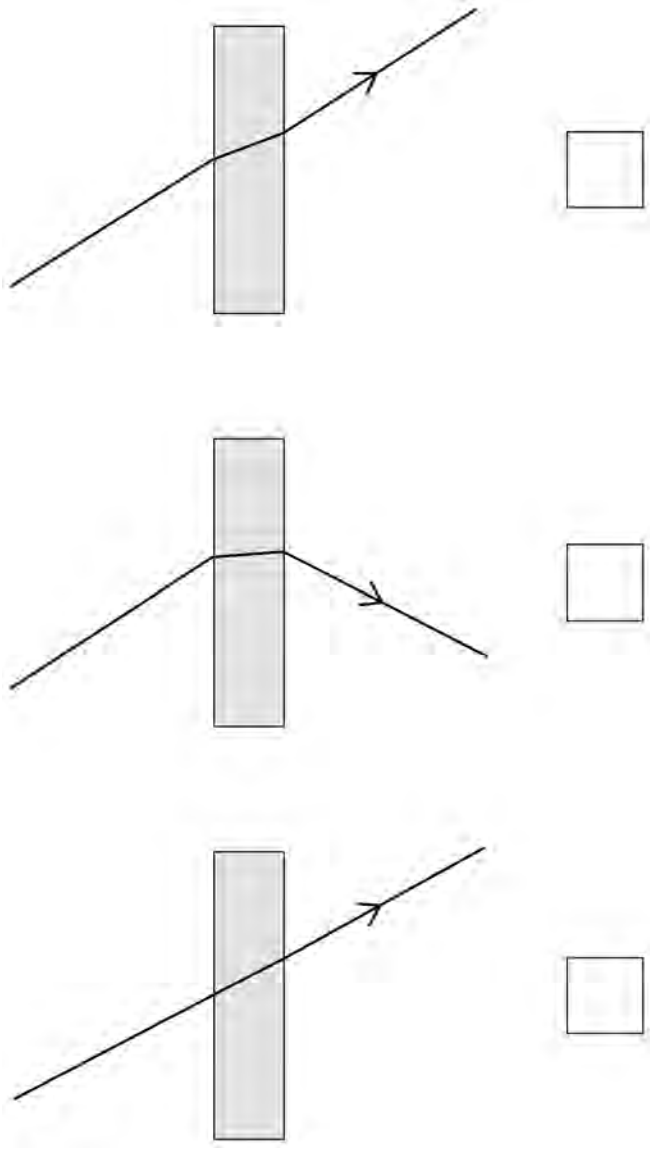
Question 18 · continued

0 8 . 6 Rays of light pass through the transparent cover of the headlight.

Which diagram shows how a ray of light passes through the transparent cover?

[1 mark]

Tick (✓) **one** box.



13