PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 5: LIGHT AND THE ELECTROMAGNETIC SPECTRUM (PAPER 1)

SCORE	PERCENTAGE
/98	%

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Q1.

A student investigates what happens when light travels from air to glass.

Figure 15 shows some of the apparatus used in the investigation.

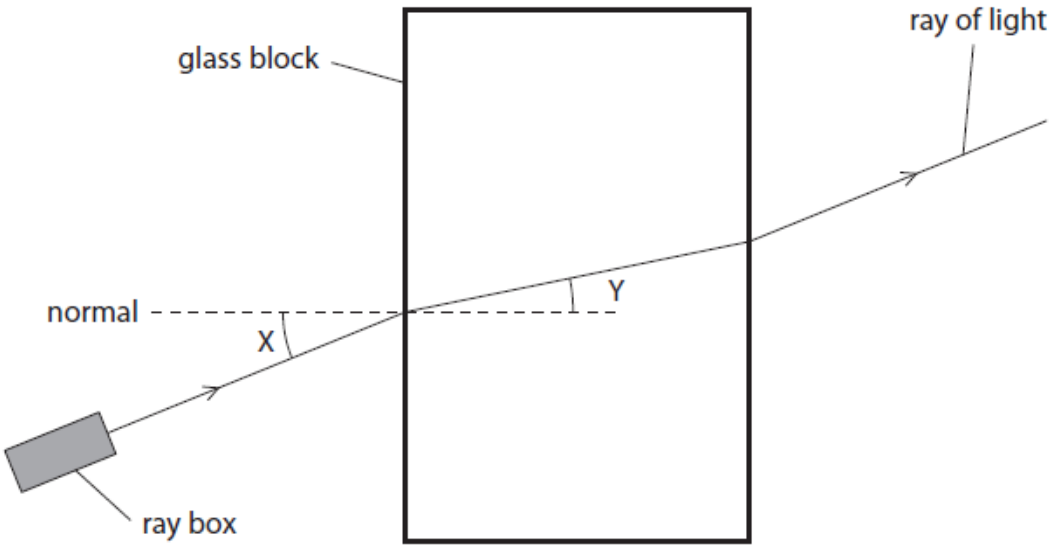


Figure 15

(i) In Figure 15, angle Y is the angle of

(1)

☒ **A** deflection

☒ **B** incidence

☒ **C** reflection

☒ **D** refraction

(ii) Figure 16 is a graph of the student's results.

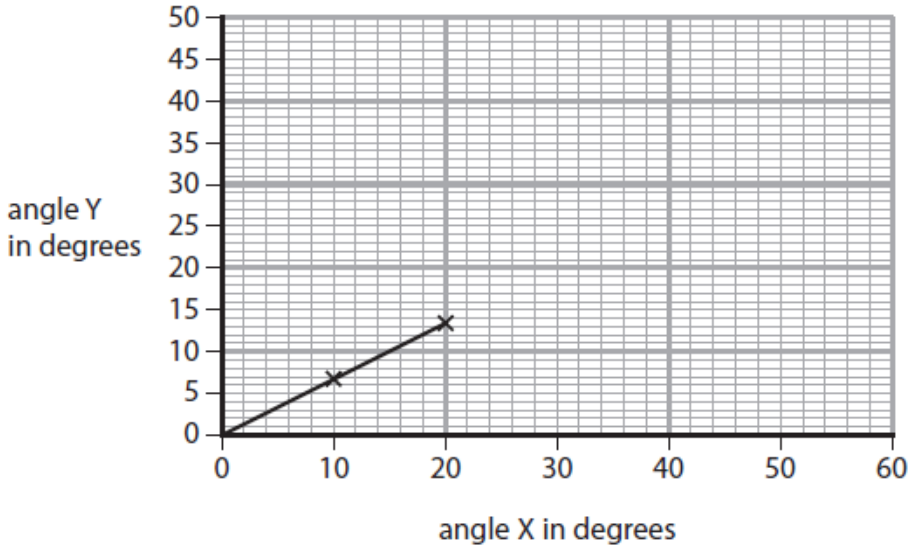


Figure 16

Use the graph to calculate a value for

$$\frac{\text{angle Y}}{\text{angle X}}$$

(2)

$$\frac{\text{angle Y}}{\text{angle X}} = \text{.....}$$

(iii) The student concludes that angle Y is directly proportional to angle X.

Explain what the student must do to test this conclusion in more detail.

(3)

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(Total for question = 6 marks)

(**Q15 1SC0/1PF, June 2018**)

Q2.

A student investigates what happens when light travels from air to glass.

Figure 2 shows some of the apparatus used in the investigation.

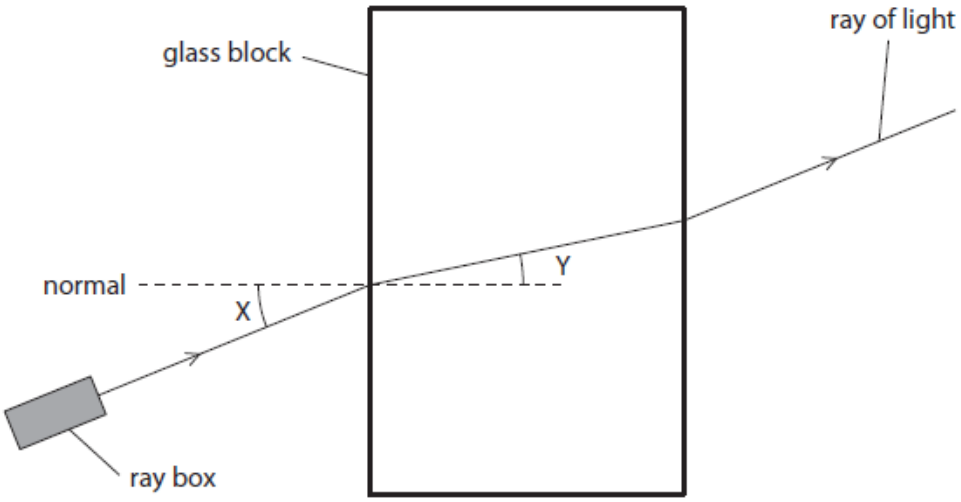


Figure 2

(i) In Figure 2, angle Y is the angle of

(1)

- ☒ **A** deflection
- ☒ **B** incidence
- ☒ **C** reflection
- ☒ **D** refraction

(ii) Figure 3 is a graph of the student's results.

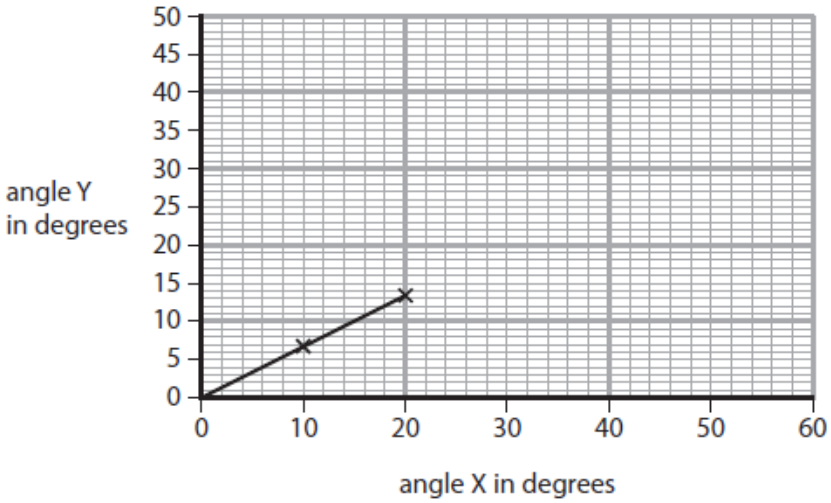


Figure 3

Use the graph to calculate a value for

$$\frac{\text{angle Y}}{\text{angle X}}$$

(2)

$$\frac{\text{angle Y}}{\text{angle X}} = \text{.....}$$

(iii) The student concludes that angle Y is directly proportional to angle X.

Explain what the student must do to test this conclusion in more detail.

(3)

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(Total for question = 6 marks)

(**Q01 1SC0/1PH, June 2018**)

Q3.

Radio waves from Jupiter take 40 minutes to reach Earth.

Light waves from the Sun take 8 minutes to reach Earth.

Calculate how many times further it is from Earth to Jupiter than from Earth to the Sun.

State the property of electromagnetic radiation that is used in your answer.

(2)

..... times

property .....

.....

(Total for question = 2 marks)

(**Q06b 1SC0/1PH, June 2019**)

Q4.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 1 shows how the visible spectrum of white light is shown on a screen.

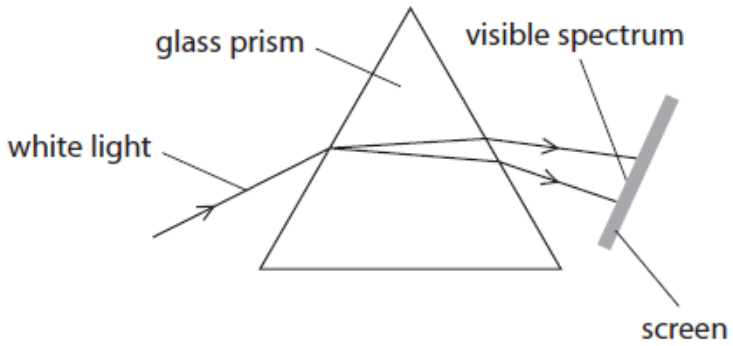


Figure 1

(i) Which of these is the best piece of equipment to produce the white light?

(1)

☒ **A** ray box

☒ **B** ruler

☒ **C** measuring cylinder

☒ **D** ammeter

(ii) Which colour is seen between yellow and blue in the spectrum on the screen?

(1)

☒ **A** red

☒ **B** orange

☒ **C** green

☒ **D** violet

(Total for question = 2 marks)

(**QU01a 1SC0/1PF, June 2022**)

Q5.

Radio waves and gamma radiation are at opposite ends of the electromagnetic spectrum.

Compare how these two electromagnetic radiations are produced.

(6)

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(Total for question = 6 marks)

(**Q06d 1SC0/1PH, June 2019**)

Q6.

* X-rays and radio waves are part of the electromagnetic spectrum and have different uses.

These radiations are produced in different ways.

X-rays are emitted when electrons within an atom go through energy changes.

Radiowaves are produced by electrons in circuits.

Compare X-rays with radio waves.

Your answer should refer to

- the uses of both types of radiation
- the different ways that electrons are involved in producing X-rays and radio waves.

(6)

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(Total for question = 6 marks)

(**QU06c 1SC0/1PH, June 2022**)

Q7.

A person warms their hands in front of a hot fire as shown in Figure 2.



(Source: © Andreas Saldavs/Shutterstock)

Figure 2

Use words from the box to complete the following sentences.

chemical	infrared	radio	thermal	ultraviolet

(2)

The electromagnetic waves that the fire mostly emits are ..... waves.

These waves transfer ..... energy to the hands.

(Total for question = 2 marks)

(**Q01c 1SC0/1PF, Nov 2021**)

Q8.

Figure 2 shows the main parts of the electromagnetic spectrum.

radio	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays

Figure 2

Complete the following sentences using information from Figure 2. Each part of the electromagnetic spectrum may be used once, more than once or not at all.

(i) The part of the electromagnetic spectrum used to detect broken bones is

(1)

.....

(ii) The part of the electromagnetic spectrum used in thermal imaging is

(1)

.....

(iii) The part of the electromagnetic spectrum that

- is used to cook food

AND

- has a shorter wavelength than microwaves is

(1)

.....

(iv) The part of the electromagnetic spectrum that

- is used to sterilise medical equipment

AND

- has a shorter wavelength than x-rays is

(1)

.....

(Total for question = 4 marks)

(**QU01b 1SC0/1PF, June 2022**)

Q9.

Light is one example of an electromagnetic wave.

Light can transfer energy from a lamp to the leaf of a plant, causing chemical reactions in the leaf.

Describe examples of **two** other electromagnetic waves transferring energy.

(4)

1 .....

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2 .....

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(Total for question = 4 marks)

(**QU04c 1SC0/1PH, June 2023**)

Q10.

Figure 1 shows how the brightness of a source of light changes with wavelength.

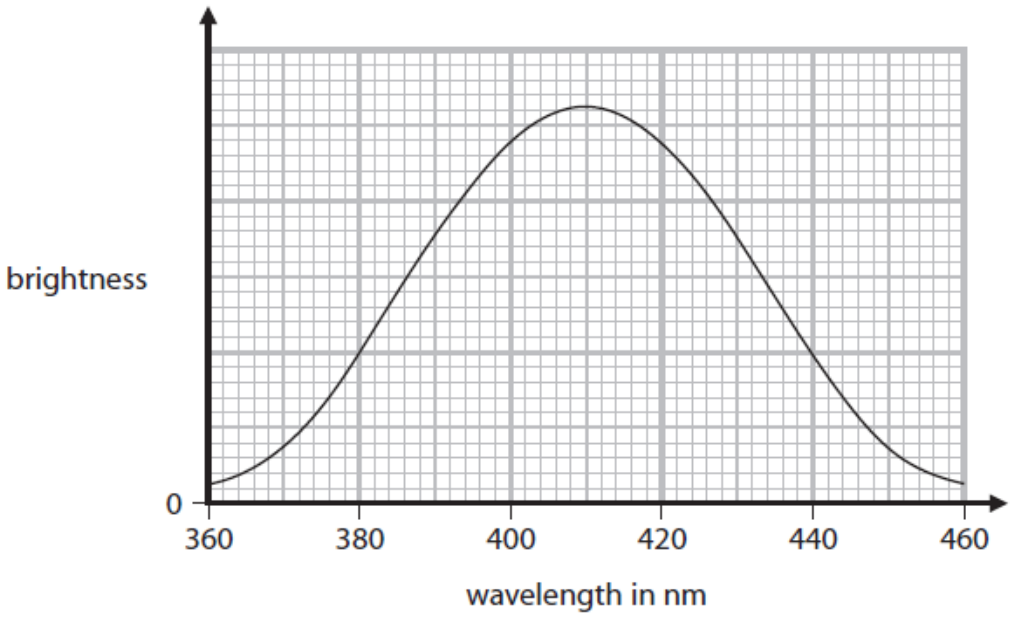


Figure 1

Describe how the brightness changes with wavelength.

(2)

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(Total for question = 2 marks)

(**Q01c 1SC0/1PF, Nov 2020**)

Q11.

Ultraviolet waves cover a range of frequencies.

Scientists divide this range into three types, UVA, UVB and UVC.

The table in Figure 11 shows the frequency range for each type.

type	frequency range in Hz
UVA	7.5×10^{14} to 9.4×10^{14}
UVB	9.4×10^{14} to 10×10^{14}
UVC	10×10^{14} to 30×10^{14}

Figure 11

Figure 12 is a diagram about the effect that the Earth's atmosphere has on three types of ultraviolet radiation.

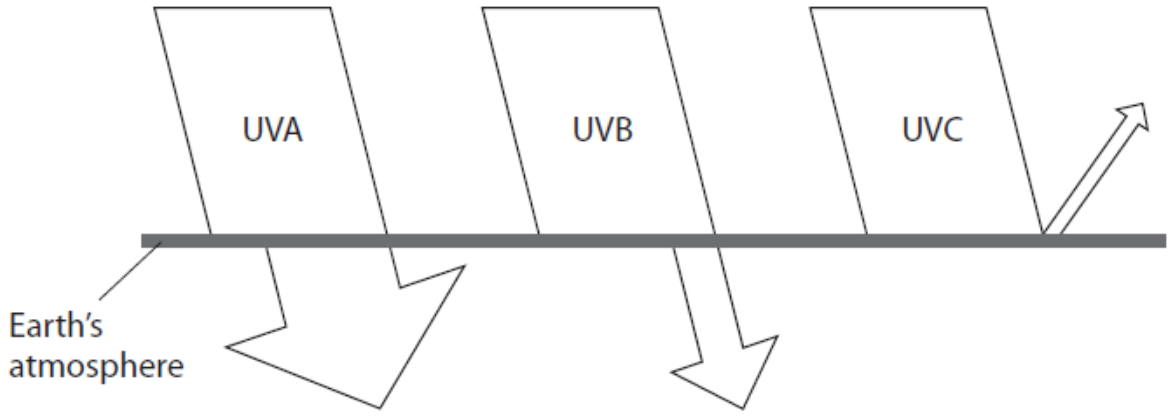


Figure 12

Describe how the effects change with **wavelength**, using information from Figure 11 and Figure

12.

The width of the arrows drawn indicates the amount of radiation that is involved.

Calculations are **not** required.

(4)

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(Total for question = 4 marks)

(**Q06c 1SC0/1PH, June 2019**)

Q12.

To investigate refraction in a rectangular glass block a student uses the apparatus shown in Figure 3.

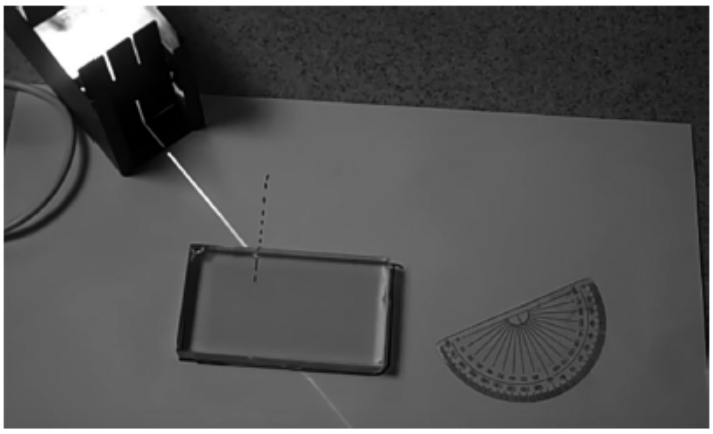


Figure 3

Describe how the student should measure the angle of refraction.

(2)

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.....

.....

(Total for question = 2 marks)

(**Q03b 1SC0/1PH, Nov 2020**)

Q13.

When light travels from air into glass, it is refracted.

To investigate this, a student has a rectangular glass block and a ray box.

The ray box produces a ray of light.

Describe how the student should use the glass block and ray box to produce a refracted ray and mark its position.

You may draw a diagram to help your answer.

(4)

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(Total for question = 4 marks)

(**QU03a 1SC0/1PH, June 2025**)

Q14.

The electromagnetic spectrum has many parts.

One of these parts is called visible light.

Images of hands can be made using different parts of the electromagnetic spectrum.



Infrared image



X-ray image

Both images give information about a hand.

(i) Suggest what information the infrared image gives about a hand.

(2)

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(ii) Explain why taking an X-ray image of a hand is more dangerous than taking an infrared image.

(2)

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(**Q05 1SC0/1PF, June 2013**)

Q15.

The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.

* Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

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(**Q35 1SC0/1PH, June 2013**)

Q16.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

This question is about waves in the electromagnetic (e-m) spectrum.

(i) Figure 1 shows some types of radiation that form part of the e-m spectrum and some uses of e-m radiation.

Draw **one** straight line from each type of e-m radiation to its use.

One line has been drawn for you.

(3)

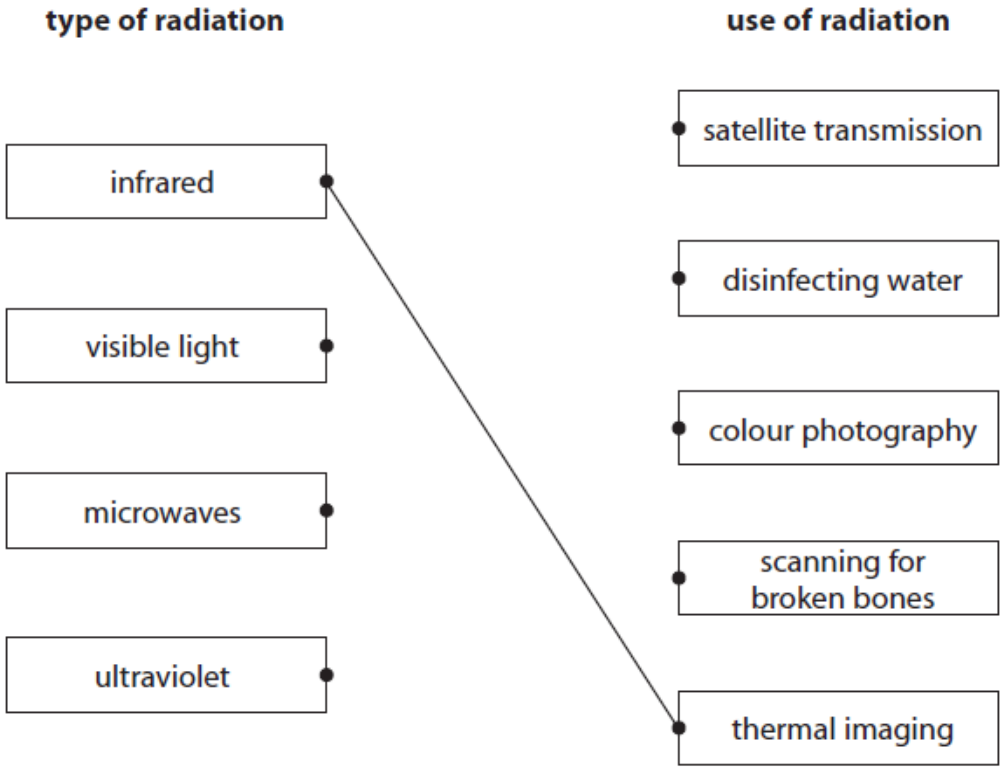


Figure 1

(ii) Which of these waves has the highest frequency?

(1)

☒ **A** infrared

☒ **B** microwaves

☒ **C** ultraviolet

☒ **D** visible light

(Total for question = 4 marks)

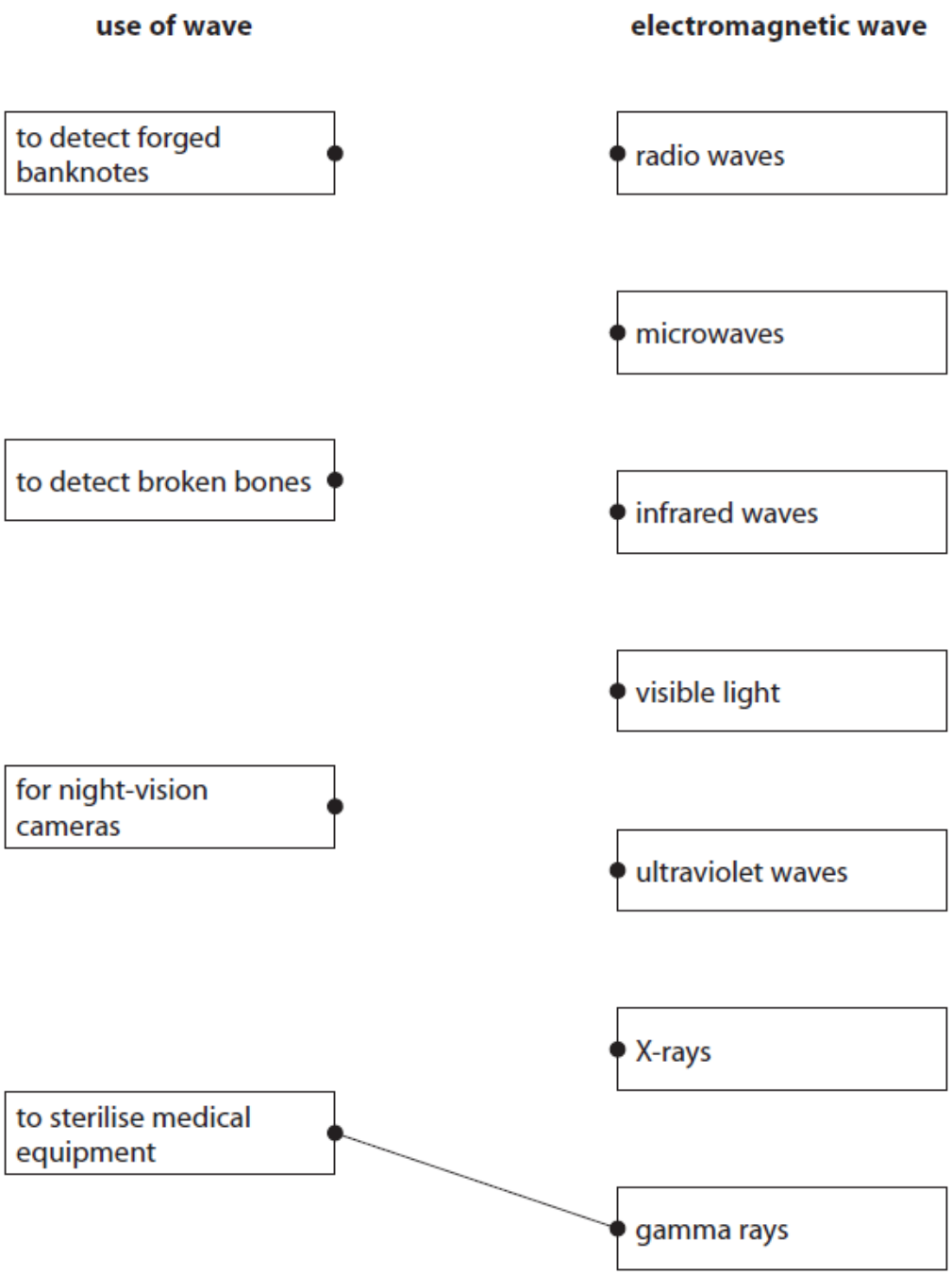
(QU01a 1SC0/1PF, June 2023)

Q17.

Draw one line from each **use of wave** to the matching **electromagnetic wave**.

One line has been drawn for you.

(3)



(Total for question = 3 marks)

(Q01a 1SC0/1PF, Nov 2020)

Q18.

Draw **one** straight line from each electromagnetic radiation to its correct description.

(3)

electromagnetic radiation	description
infrared	used in night vision cameras
gamma	the least dangerous radiation
ultraviolet	may damage eyes, so sunglasses worn as protection
radio waves	the most dangerous radiation

(Total for question = 3 marks)

(QU01a 1SC0/1PF, June 2025)

Q19.

The electromagnetic spectrum has many parts.

One of these parts is called visible light.

(a) (i) How many different colours are there in visible light?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** five

☒ **B** seven

☒ **C** nine

☒ **D** eleven

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Three colours of the spectrum of visible light in the correct order are

(1)

☒ **A** green, red, yellow

☒ **B** blue, red, green

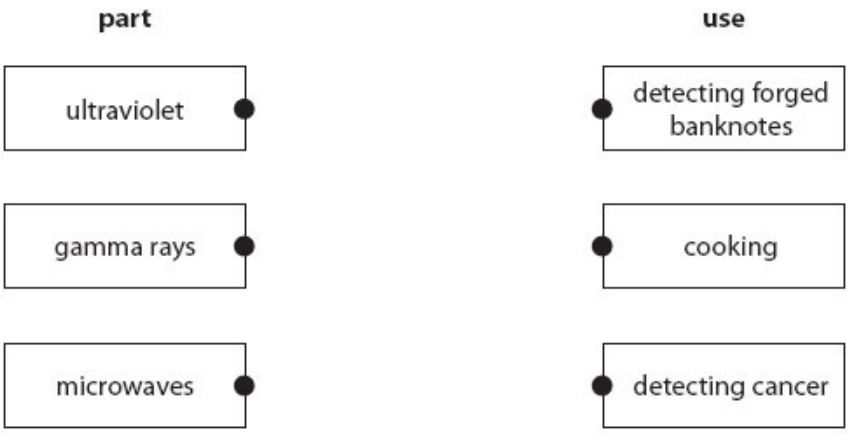
☒ **C** red, orange, yellow

☒ **D** violet, orange, green

(b) Different parts of the electromagnetic spectrum have different uses.

Draw **one** straight line from each part to its use.

(2)



(c) Images of hands can be made using different parts of the electromagnetic spectrum.



Infrared image



X-ray image

Both images give information about a hand.

(i) Suggest what information the infrared image gives about a hand.

(2)

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.....

.....

.....

(ii) Explain why taking an X-ray image of a hand is more dangerous than taking an infrared image.

(2)

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(Total for Question = 8 marks)

(**Q01 1SC0/1PF, June 2013**)

Q20.

The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.

(a) (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

.....

(ii) Genuine banknotes contain a special ink.
This ink is invisible under normal light.

Suggest why the ink glows when ultraviolet radiation is shone on it.

(2)

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(b) An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ...m

*(c) Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

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(Total for Question = 12 marks)

(**Q28 1SC0/1PH, June 2013**)

Q21.

(a) The table shows most of the waves in the electromagnetic spectrum.
One type of wave is missing.

gamma rays
.....
ultraviolet
visible light
infrared
microwaves
radio waves

(i) Write the missing wave in the space in the table.

(1)

(ii) State which type of wave can be split into different colours.

(1)

.....

(iii) State which type of wave has the longest wavelength.

(1)

.....

(iv) State **one** type of wave that is ionising.

(1)

.....

(b) The Sun emits all the waves in the electromagnetic spectrum.
Explain why all these waves take the same time to travel to Earth from the Sun.

(2)

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*(c) Infrared and ultraviolet waves have different frequencies.
Both types of wave can have harmful effects on human beings.

Describe the harmful effects of infrared and ultraviolet waves, relating them to the frequencies of the waves.

(6)

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(Total for Question = 12 marks)

(**Q01 1SC0/1PF, June 2014**)

Q22.

Which of these is correct for all electromagnetic waves in a vacuum?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** they have the same frequency

☒ **B** they have the same wavelength

☒ **C** they are transverse waves

☒ **D** they are longitudinal waves

(**Q18 1SC0/1PF, Mar 2013**)

Q23.

(a) Microwaves and X-rays are both electromagnetic waves.

(i) Which row of the table is correct for microwaves and X-rays in a vacuum?

Put a cross (☒) in the box next to your answer.

(1)

	their speeds are	their frequencies are
☒ **A**	different	different
☒ **B**	different	the same
☒ **C**	the same	different
☒ **D**	the same	the same

(ii) State **one** harmful effect of X-rays on living matter.

(1)

.....

.....

(b) X-rays are ionising radiation.

(i) State **one** other ionising radiation in the electromagnetic spectrum.

(1)

.....

.....

(ii) State **one** use of an ionising radiation.

(1)

.....

.....

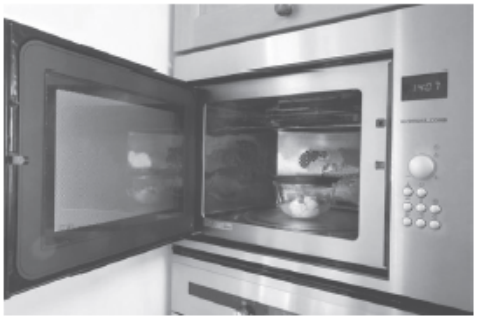
(c) (i) State **one** way in which microwave radiation can be harmful to people.

(1)

.....

.....

The microwaves used in ovens have a frequency of about 2450 MHz.
Mobile phones emit microwaves with a frequency of about 2000 MHz.





Microwave ovens have shielding to protect people from the microwave radiation.

(ii) Suggest why the same shielding is **not** necessary for mobile phones.

(3)

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(Total for Question = 8 marks)

(**Q02 1SC0/1PF, June 2014**)

Q24.

A student is investigating the refraction of light.

Figure 4 shows part of the apparatus and the angles to be measured.

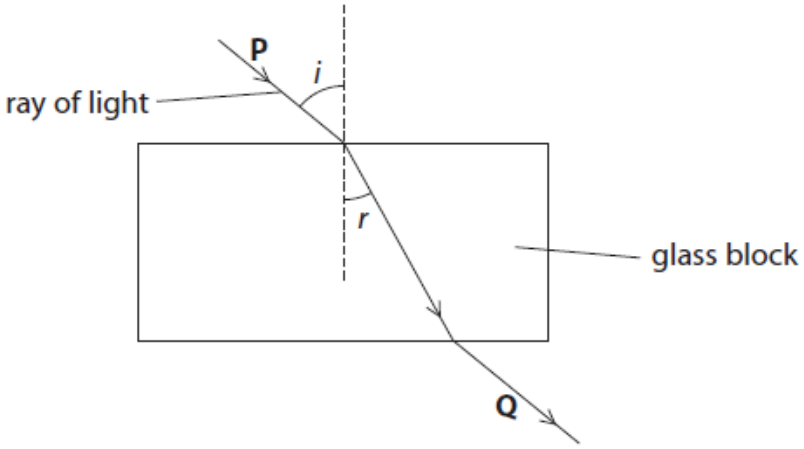


Figure 4

The student measures angle *r* for several different values of angle *i*.

Figure 5 shows the student's results.

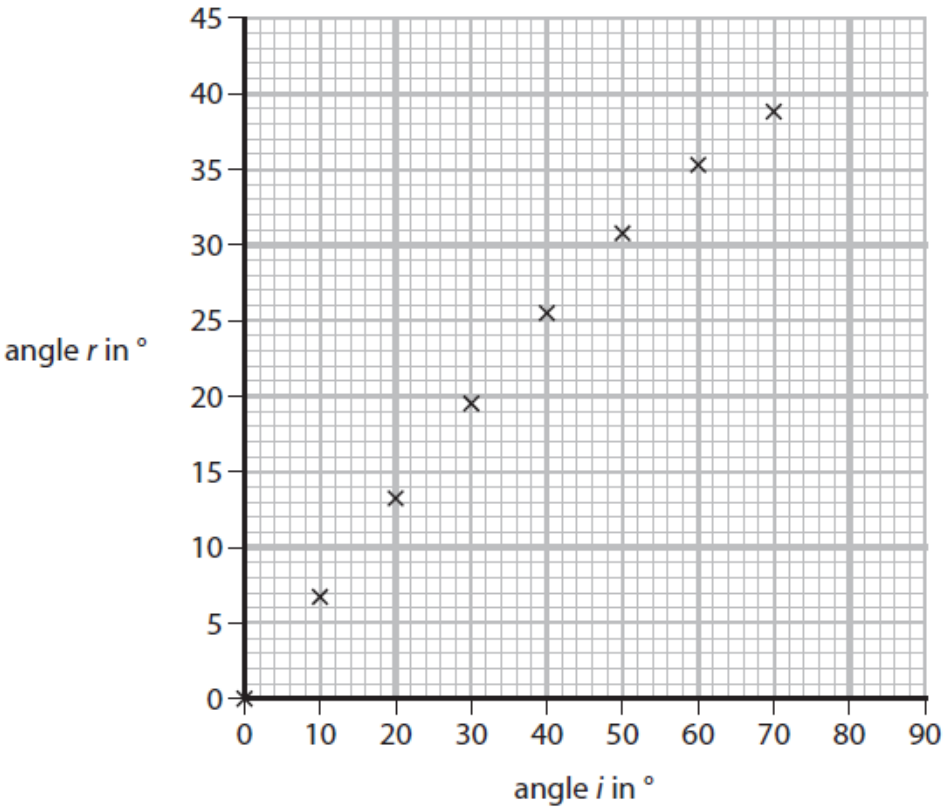


Figure 5

(i) On the graph in Figure 5, draw the best fit curve.

(1)

(ii) Use the graph in Figure 5 to estimate the value of angle *r* when angle *i* is 80°.

(1)

angle *r* = ... °

(iii) Describe how angle *r* changes with angle *i* for the results shown on the graph in Figure 5.

(2)

.....

.....

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.....

(Total for question = 4 marks)

(**Q03a 1SC0/1PH, Nov 2021**)

Q25.

Ultraviolet (UV) waves from the Sun travel towards the Earth.

Ultraviolet waves can be grouped by wavelength.

The three groups of wavelengths are UVA, UVB and UVC.

Figure 4 shows, for each group,

- the wavelength range
- the effect of the Earth's atmosphere on each type of UV wave.

	UVA	UVB	UVC
wavelength range	400 nm to 315 nm	314 nm to 280 nm	279 nm to 100 nm
% energy absorbed by the Earth's atmosphere	5%	95%	100%

Figure 4

(i) Explain why UVC is potentially the most dangerous ultraviolet radiation but does not cause harm to people.

(2)

.....

.....

.....

.....

(ii) The speed of electromagnetic radiation is 3.00×10^8 m/s.

Calculate the frequency of the shortest wavelength of UVB radiation.

(3)

frequency = ... Hz

(Total for question = 5 marks)

(**QU03a 1SC0/1PH, June 2024**)

Q26.

Explain what happens to a wavelength of light when it passes from air into glass.

(2)

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(Total for question = 2 marks)

(**Q06a 1SC0/1PH, SAM 2016**)

Q27.

In Figure 6, only refraction of light is shown.

Other things happen to the light as it travels from **P** to **Q**.

The intensity (brightness) of the light at **Q** is less than the intensity of the light at **P**.

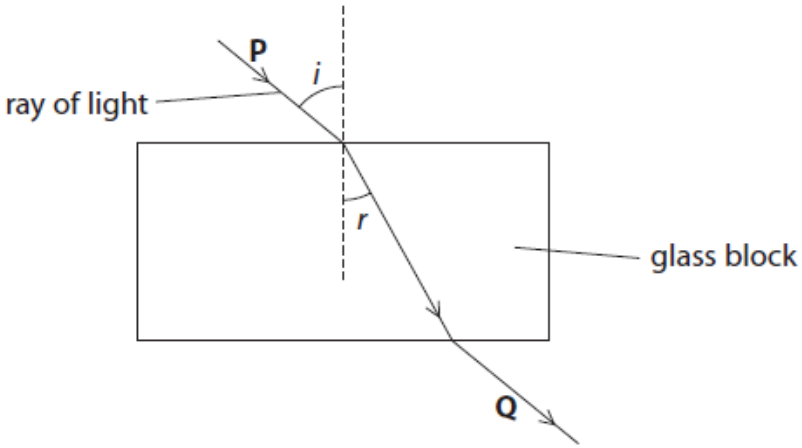


Figure 6

Explain the decrease in intensity as the light travels from **P** to **Q**.

You may add to Figure 6 to help your answer.

(3)

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(Total for question = 3 marks)

(**Q03c 1SC0/1PH, Nov 2021**)

Q28.

Explain what can happen to the body if a person has a prolonged exposure to gamma rays.

(2)

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(Total for question = 2 marks)

(**Q05d 1SC0/1PH, Nov 2020**)

Q29.

Figure 4 is a simplified diagram to show radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.

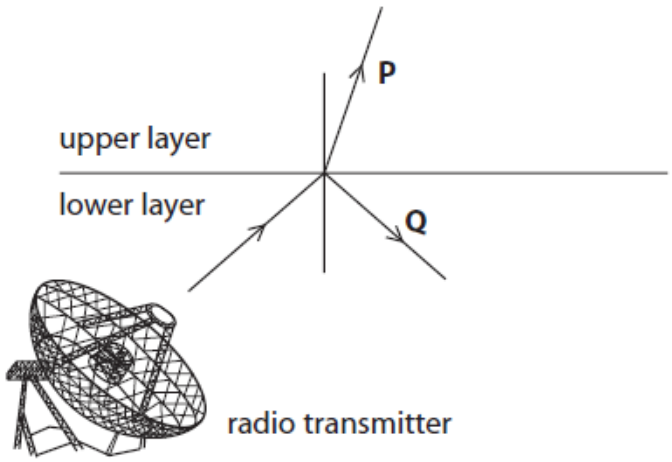


Figure 4

Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 4.

Your explanation should refer to changes in direction and speed of the waves.

(4)

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(Total for question = 4 marks)

(**Q03c 1SC0/1PH, Nov 2020**)

Q30.

Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q01b 1SC0/1PH, June 2019**)

Q31.

Some television remote controls use infrared radiation and other remote controls use radio

waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will.

(2)

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(Total for question = 2 marks)

(**Q05b 1SC0/1PF, June 2019**)

Q32.

Mobile phones emit microwaves.

Microwave ovens emit microwaves.

Explain why a mobile phone does not have the same heating effect as a microwave oven.

(2)

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(Total for question = 2 marks)

(**Q01b 1SC0/1PF, SAM 2016**)

Q33.

Gamma radiation can be used in food processing to irradiate food.

Explain why some food is irradiated with gamma radiation.

(2)

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(Total for question = 2 marks)

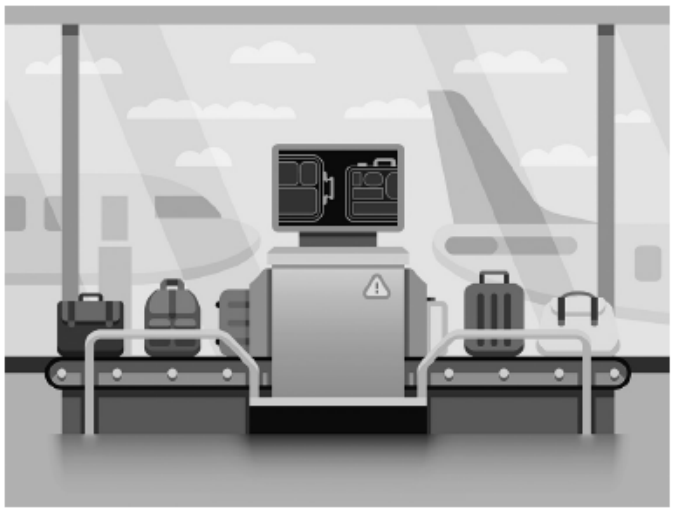
(**Q06b 1SC0/1PH, Nov 2021**)

Q34.

This question is about waves in the electromagnetic (e-m) spectrum.

X-rays are also part of the e-m spectrum.

Figure 2 shows an airport security scanner using X-rays to scan passengers' bags.



(Source: © Net Vector / Shutterstock)

Figure 2

(i) Explain why X-rays are used to scan passengers' bags.

(2)

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(ii) Explain why passengers are **not** scanned with X-rays.

(2)

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(Total for question = 4 marks)

(**QU01b 1SC0/1PF, June 2023**)

Q35.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about waves in the electromagnetic (e.m.) spectrum.

The potential danger associated with the waves of the e.m. spectrum increases as

(1)

☐ **A** frequency decreases

☐ **B** frequency increases

☐ **C** velocity decreases

☐ **D** velocity increases

(Total for question = 1 mark)

(**QU06a 1SC0/1PH, June 2022**)

Q36.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A student is investigating the refraction of light.

Figure 4 shows part of the apparatus and the angles to be measured.

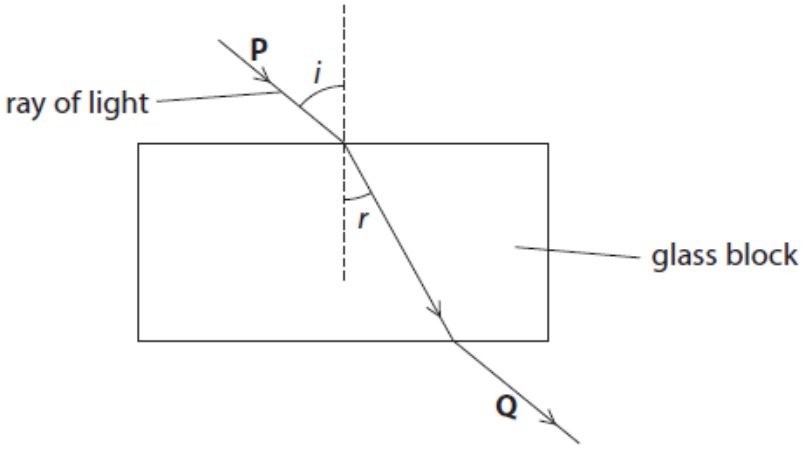


Figure 4

In Figure 4, the frequency of the light remains the same in glass as in air.

Which row of the table describes what happens to the wave velocity and to the wavelength of the light when the light travels from air to glass?

(1)

		wave velocity	wavelength
☒	**A**	decreases	decreases
☒	**B**	decreases	increases
☒	**C**	increases	decreases
☒	**D**	increases	increases

(Total for question = 1 mark)

(**Q03b 1SC0/1PH, Nov 2021**)

Q37.

Which colour of visible light has the longest wavelength?

(1)

☒ **A** blue

☒ **B** green

☒ **C** red

☒ **D** yellow

(Total for question = 1 mark)

(**Q05a 1SC0/1PF, June 2019**)

Q38.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Different colours of light have different frequencies.

Which of these colours has the highest frequency?

(1)

☒ **A** blue

☒ **B** green

☒ **C** red

☒ **D** yellow

(Total for question = 1 mark)

(**QU01b 1SC0/1PF, June 2025**)

Q39.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Ultraviolet light has a higher frequency than infrared light.

Which of these colours of visible light has the highest frequency?

(1)

☒ **A** blue

☒ **B** green

☒ **C** orange

☒ **D** yellow

(Total for question = 1 mark)

(**Q01b 1SC0/1PF, Nov 2020**)

Q40.

Which of the following does **not** use microwaves ?

(1)

☒ **A** a mobile phone

☒ **B** Wifi

☒ **C** a speed camera

☒ **D** a TV remote control

(Total for question = 1 mark)

(**Q01b 1SC0/1PH, SAM**)