AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.3.1

Emission and absorption of infrared radiation

Past-paper questions

Tier	**Foundation**
Question groups	**49**
Available paper years	**2004–2024**

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.

4.6.3.1 Emission and absorption of infrared radiation

Question 01

June 2004 | 3451F | Original Q11 | Legacy

11 The diagram represents the electromagnetic spectrum.

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

(a) Name the type of electromagnetic radiation that is used:

(i) to sterilise surgical instruments;

.....

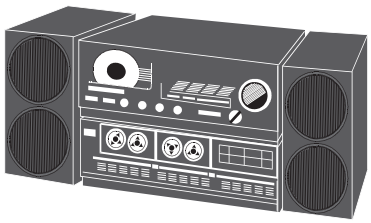
(1 mark)

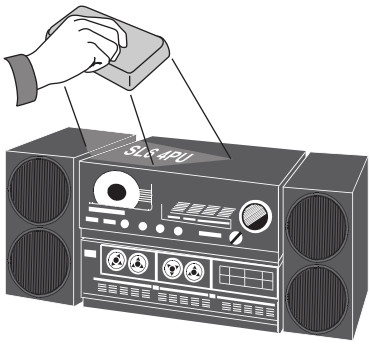
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

(b) Valuable items can be security marked using special ink. The ink can only be seen in ultraviolet radiation.





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.6.3.1 Emission and absorption of infrared radiation

Question 01 · continued

MARGIN BLANK

(c) Explain why skin cells need to be protected from ultraviolet radiation.

.....

.....

.....

.....

(2 marks)

(d) The following information is from an oven that combines a microwave and a grill.

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

(i) Name the **two** types of electromagnetic radiation that the oven can use to cook food.

..... and .....

(1 mark)

(ii) A joint of meat is cooked using both the microwave and the grill. Both are switched on at full power for half an hour.

Use the following equation to calculate the energy transferred, in kilowatt-hours, by the oven. Show clearly how you obtain your answer.

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

9

4.6.3.1 Emission and absorption of infrared radiation

Question 02

June 2004 | 3462F3 | Original Q9 | Legacy

9 The diagram represents the electromagnetic spectrum.

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

(a) Name the type of electromagnetic radiation that is used:

(i) to sterilise surgical instruments;

.....

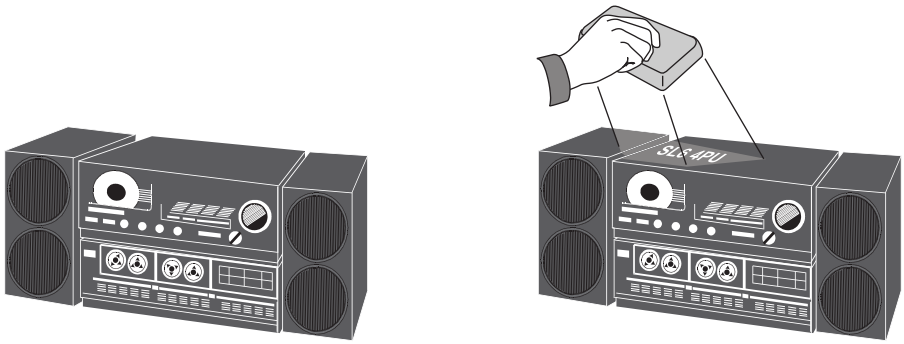
(1 mark)

(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

(b) Valuable items can be security marked using special ink. The ink can only be seen in ultraviolet radiation.



Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.6.3.1 Emission and absorption of infrared radiation

Question 02 · continued

MARGIN
BLANK

(c) Explain why skin cells need to be protected from ultraviolet radiation.

.....

.....

.....

.....

(2 marks)

(d) The following information is from an oven that combines a microwave and a grill.

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

(i) Name the **two** types of electromagnetic radiation that the oven can use to cook food.

..... and .....

(1 mark)

(ii) A joint of meat is cooked using both the microwave and the grill. Both are switched on at full power for half an hour.

Use the following equation to calculate the energy transferred, in kilowatt-hours, by the oven. Show clearly how you obtain your answer.

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

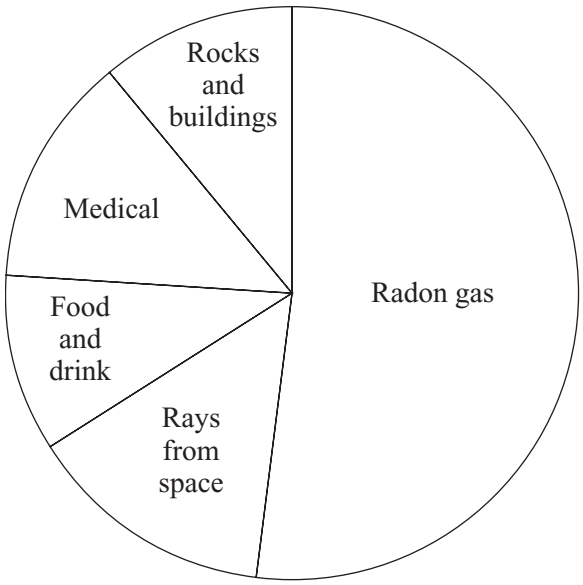
9

4.6.3.1 Emission and absorption of infrared radiation

Question 03

June 2005 | 3451 | Original Q5 | Legacy

5 (a) Radiation is around us all of the time. The pie chart shows the sources of this radiation.



(i) What is the main source of this radiation?

.....

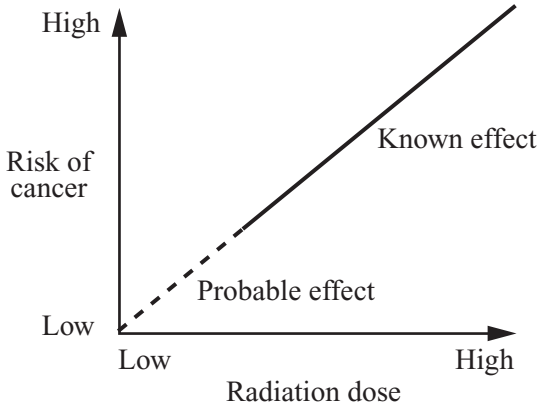
(1 mark)

(ii) What name is given to the radiation that is around us all of the time?

.....

(1 mark)

(b) Radiation can cause cancer. The graph shows that the risk of cancer depends on the radiation dose a person is exposed to.



Complete the following sentence.

The ..... the dose of radiation a person gets, the greater the risk of cancer.

(1 mark)

(c) A worker in a nuclear power station wears a special badge (diagram **1**). Diagram **2** shows what is inside the badge. When the film inside the badge is developed, it will be dark in the places where it has absorbed radiation.

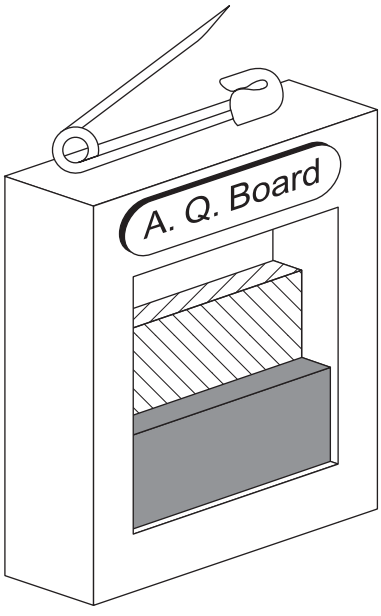


Diagram 1

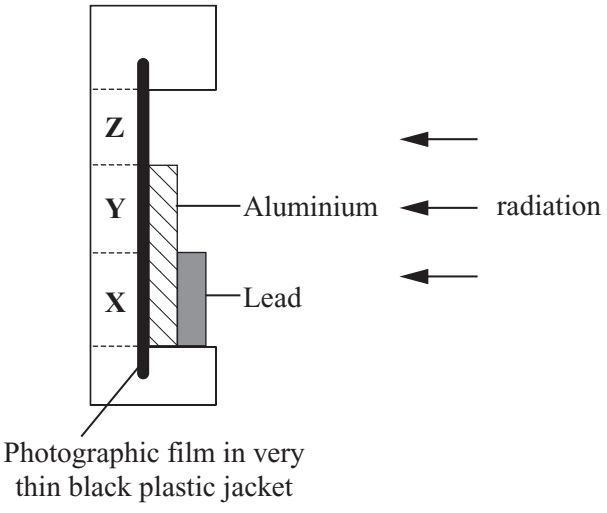


Diagram 2

Which part of the film, **X**, **Y** or **Z**, would darken if the worker had received a dose of alpha radiation?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5

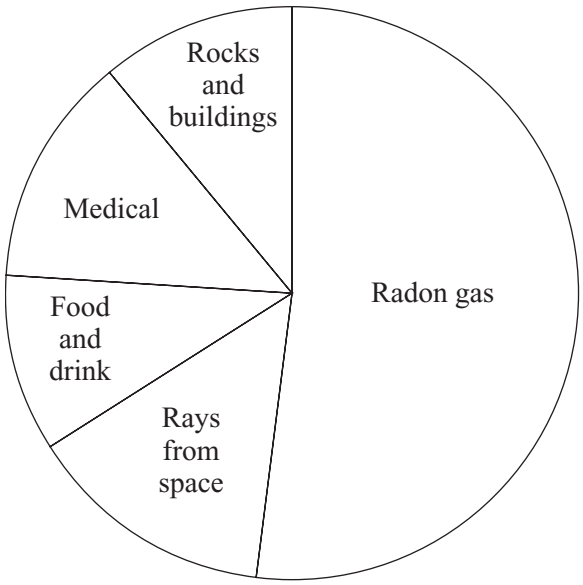
TURN OVER FOR THE NEXT QUESTION

4.6.3.1 Emission and absorption of infrared radiation

Question 04

June 2005 | 3462 | Original Q5 | Legacy

5 (a) Radiation is around us all of the time. The pie chart shows the sources of this radiation.



(i) What is the main source of this radiation?

.....

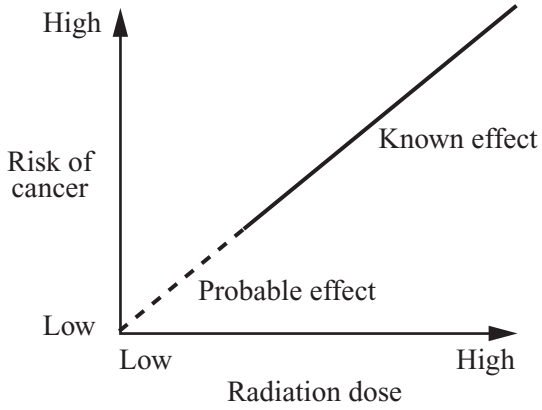
(1 mark)

(ii) What name is given to the radiation that is around us all of the time?

.....

(1 mark)

(b) Radiation can cause cancer. The graph shows that the risk of cancer depends on the radiation dose a person is exposed to.



Complete the following sentence.

The ..... the dose of radiation a person gets, the greater the risk of cancer.

(1 mark)

9

MARGIN BLANK

(c) A worker in a nuclear power station wears a special badge (diagram **1**). Diagram **2** shows what is inside the badge. When the film inside the badge is developed, it will be dark in the places where it has absorbed radiation.

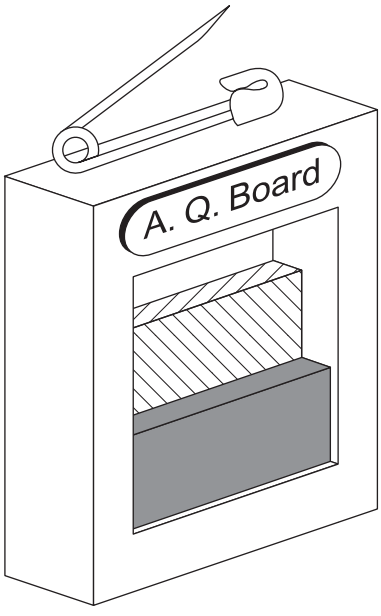


Diagram 1

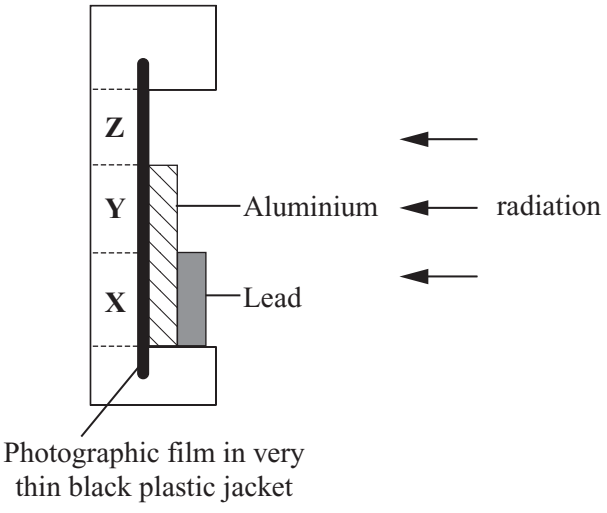


Diagram 2

Which part of the film, **X**, **Y** or **Z**, would darken if the worker had received a dose of alpha radiation?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

4.6.3.1 Emission and absorption of infrared radiation

Question 05

November 2006 | PHY1B | Original Q1 | Legacy

QUESTION ONE

Electromagnetic radiation has many uses.

Match types of electromagnetic radiation, **A**, **B**, **C** and **D**, with the drawings labelled **1–4**.

A infra red rays

B ultraviolet waves

C visible light

D X-rays

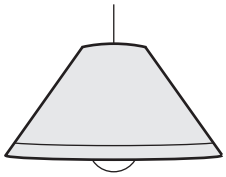
1

Toaster



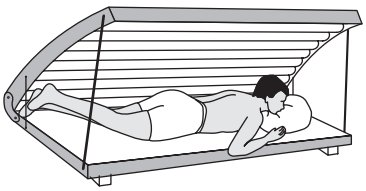
2

Room lamp



3

Sunbed



4

Hospital scanner



4.6.3.1 Emission and absorption of infrared radiation

Question 06

November 2006 | PHY1B | Original Q2 | Legacy

QUESTION TWO

Electromagnetic radiation can be grouped into types, each with a different range of wavelengths.

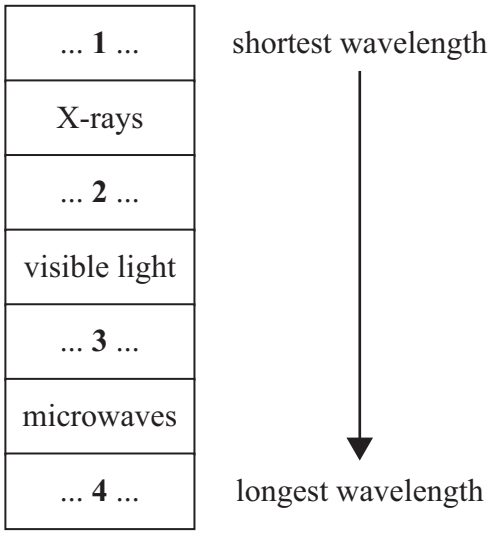
Match types of electromagnetic radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the list.

A gamma rays

B infra red rays

C radio waves

D ultraviolet waves



4.6.3.1 Emission and absorption of infrared radiation

Question 07

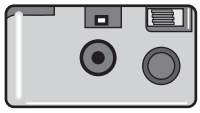
March 2007 | PHY1B | Original Q1 | Legacy

QUESTION ONE

Each of these devices uses electromagnetic radiation.

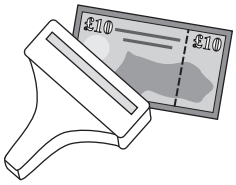
1

Camera



2

Forgery detector



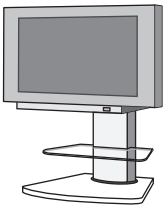
3

Toaster



4

Television



Match the parts of the electromagnetic spectrum, **A**, **B**, **C** and **D**, with the drawings labelled **1–4**.

A infra red

B radio waves

C ultraviolet

D visible light

4.6.3.1 Emission and absorption of infrared radiation

Question 08

March 2007 | PHY1B | Original Q7 | Legacy

QUESTION SEVEN

Electromagnetic radiation fills the Universe

Electromagnetic radiations belong to a spectrum of radiations which have many features in common.

7A In the box, the electromagnetic radiations are meant to be in order of increasing wavelength from left to right. Which one is in the wrong position?

X-rays	Infra red rays	Radio waves	Gamma rays
1	**2**	**3**	**4**

1 X-rays

2 infra red rays

3 radio waves

4 gamma rays

7B Which statement is correct?

1 All electromagnetic radiation can travel through a vacuum.

2 All electromagnetic radiation is visible to the human eye.

3 No electromagnetic radiation can travel through a vacuum.

4 No electromagnetic radiation is visible to the human eye.

4.6.3.1 Emission and absorption of infrared radiation

Question 08 · continued

7C Which statement about the wavelength of microwaves is correct?

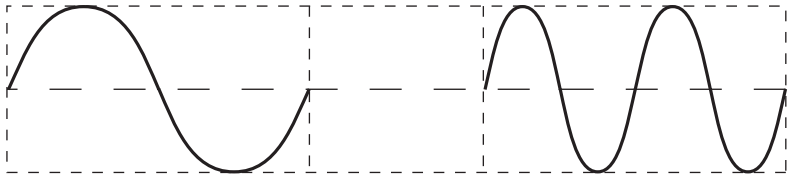
1 longer than both infra red rays and ultraviolet rays

2 longer than infra red rays but shorter than ultraviolet rays

3 shorter than both infra red rays and ultraviolet rays

4 shorter than infra red rays but longer than ultraviolet rays

7D Two electromagnetic waves are shown in the diagrams, which are drawn to the same scale.



X **Y**

Which sentence is correct?

1 The frequency of wave **X** is double that of wave **Y**.

2 The frequency of wave **Y** is double that of wave **X**.

3 The wavelength of wave **Y** is double that of wave **X**.

4 The wavelength of wave **Y** is four times that of wave **X**.

4.6.3.1 Emission and absorption of infrared radiation

Question 09

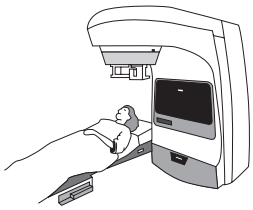
June 2007 | PHY1B | Original Q1 | Legacy

QUESTION ONE

Each of these applications uses electromagnetic radiation.

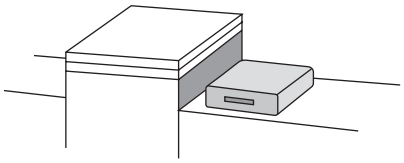
1

Killing cancer cells



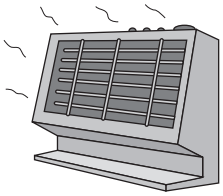
2

Checking bags at an airport



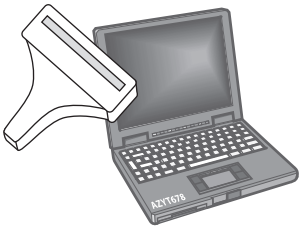
3

In radiant heaters



4

Seeing security markings



Match the parts of the electromagnetic spectrum, **A**, **B**, **C** and **D**, with the drawings labelled **1–4**.

A gamma rays

B infra red rays

C ultraviolet rays

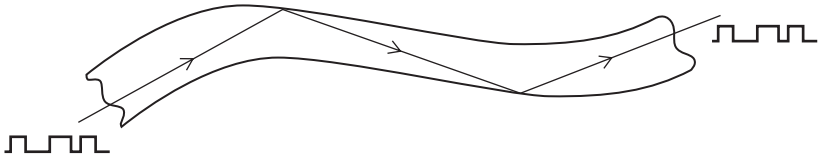
D X-rays

4.6.3.1 Emission and absorption of infrared radiation

Question 10

January 2008 | PHY1F | Original Q2 | Legacy

2 (a) The diagram shows a signal and the path taken by the signal as it travels along an optical fibre.



(i) What name is given to the type of signal shown in the diagram?

.....

(1 mark)

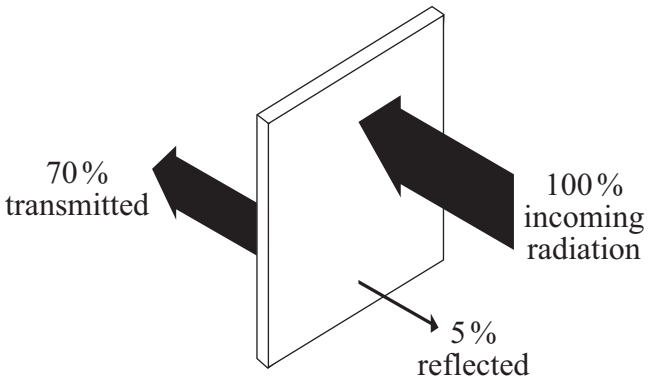
(ii) Name the **two** types of electromagnetic radiation that can be used to send signals along an optical fibre.

1 .....

2 .....

(2 marks)

(b) Infra red radiation can be reflected, absorbed and transmitted by glass.



(i) What percentage of infra red is absorbed by the glass?

.....

(1 mark)

4.6.3.1 Emission and absorption of infrared radiation

Question 10 · continued

BLANK

(ii) Complete the following sentence by drawing a ring around the correct word or phrase.

The absorbed infra red | increases / does not change / decreases | the temperature of the glass.

(1 mark)

(c) **Two** of the following statements are true. **One** of the statements is false.

Tick (✓) the boxes next to the **two** true statements.

All objects absorb infra red radiation.	
Black surfaces are poor emitters of infra red radiation.	
A hot object emits more infra red than a cooler object.	

(1 mark)

(d) The following statement is false.

Black surfaces are good reflectors of infra red radiation.

Change **one** word in this statement to make it true.

Write down your **new** statement.

.....

.....

(1 mark)

7

4.6.3.1 Emission and absorption of infrared radiation

Question 11

January 2008 | PHY1F | Original Q4 | Legacy

4 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.

(a) Large optical telescopes are often positioned high up a mountain.

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

.....

.....

.....

.....

.....

.....

(3 marks)

(b) A new telescope is going to be built in Chile. It will detect electromagnetic waves with a frequency between infra red and radio waves.

What type of waves will this telescope detect?

.....

(1 mark)

(c) Telescopes that detect X-rays are always on satellites in space.

Which statement gives the reason for the telescope to be in space?

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

The atmosphere absorbs X-rays. ☐

X-rays can harm people. ☐

X-rays have a shorter wavelength than light. ☐

(1 mark)

5

4.6.3.1 Emission and absorption of infrared radiation

Question 12

March 2008 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

We use electromagnetic radiation in many different ways.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A infra red radiation

B gamma radiation

C visible light

D ultraviolet radiation

1	is used to send messages using a torch
2	is used in sunbeds
3	is used in heaters
4	is used to treat cancer

4.6.3.1 Emission and absorption of infrared radiation

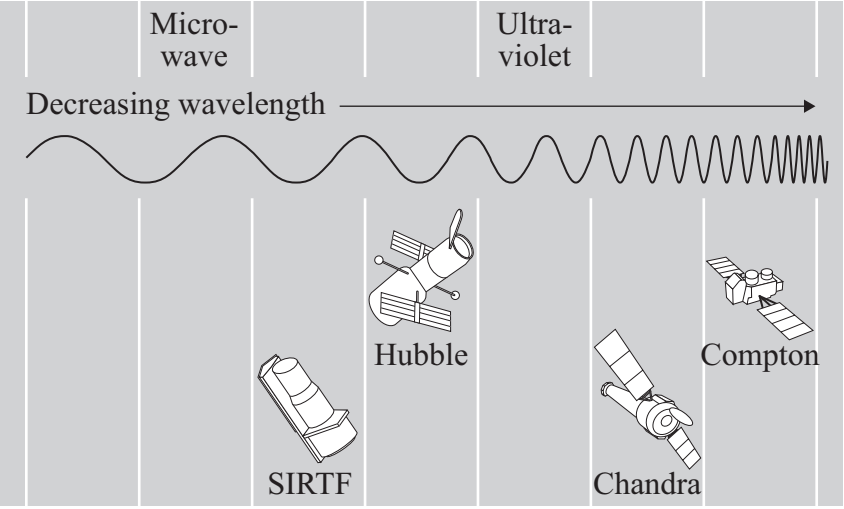
Question 13

March 2008 | PHY1BP | Original Q3 | Legacy

QUESTION THREE

Space telescopes are designed to detect different types of electromagnetic radiation.

The diagram shows part of the electromagnetic spectrum and four different telescopes.



Match telescopes, **A**, **B**, **C** and **D**, with the types of electromagnetic radiation **1–4** in the table that each is designed to detect.

A SIRTF

B Hubble

C Chandra

D Compton

	Type of electromagnetic radiation
1	gamma radiation
2	infra red radiation
3	X-rays
4	visible light

4.6.3.1 Emission and absorption of infrared radiation

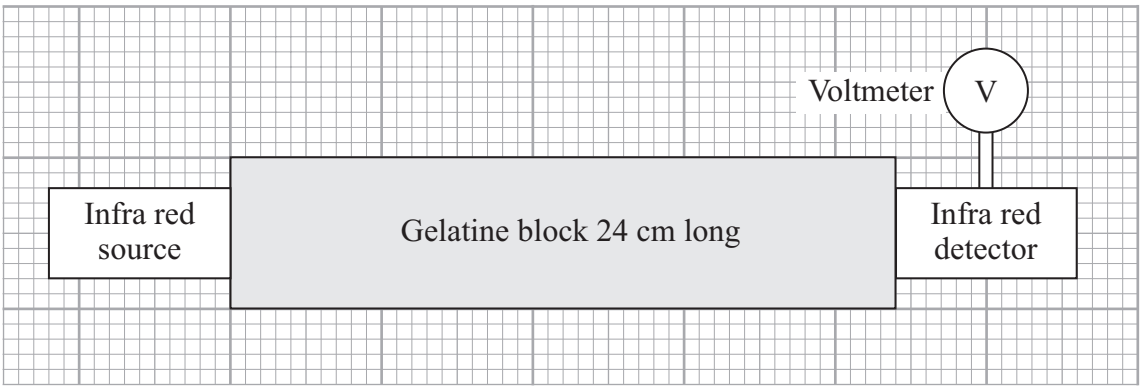
Question 14

March 2008 | PHY1BP | Original Q8 | Legacy

QUESTION EIGHT

A student investigated the absorption of infra red radiation by a block of gelatine.

She placed a block of gelatine on a piece of graph paper and cut the block to a length of 24 cm. She then placed an infra red source touching one end of the block and an infra red detector touching the other end as shown in the diagram.

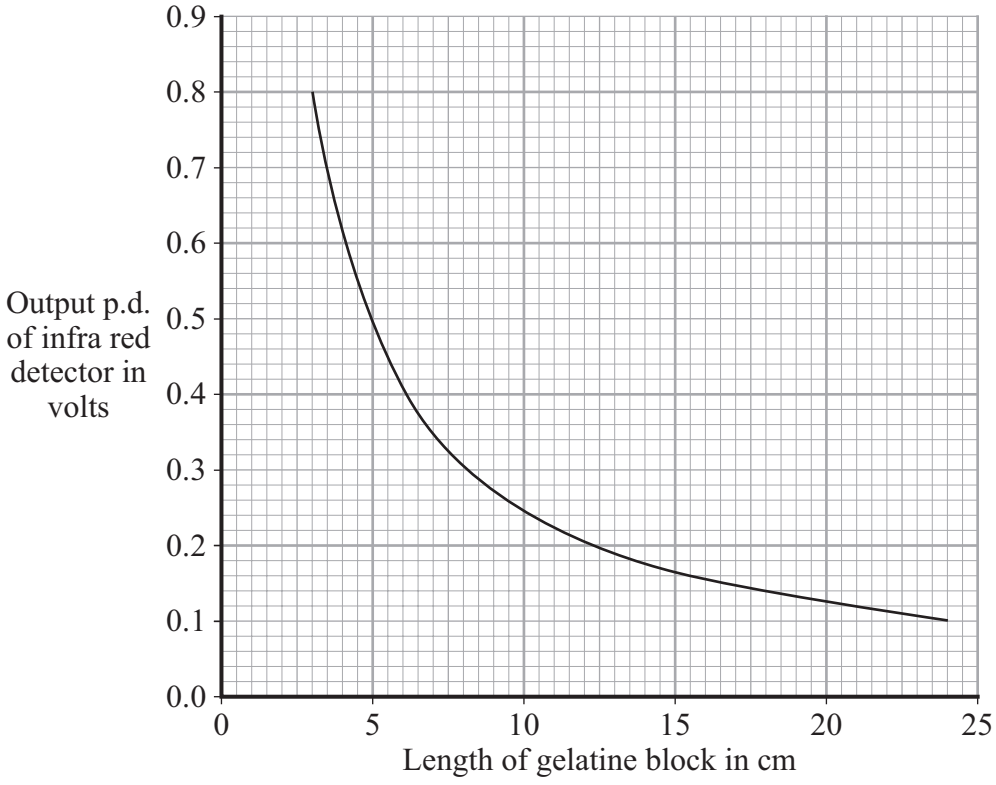


She recorded the output potential difference (p.d.) from the infra red detector.

She then repeated the experiment several times. Each time, she cut 2 cm off the gelatine block and set up the apparatus as shown in the diagram.

The graph shows her results.

The higher the intensity of infra red radiation received by the detector, the greater the output p.d.



4.6.3.1 Emission and absorption of infrared radiation

Question 14 · continued March 2008 | PHY1BP | Original Q8 | Legacy

8A What was the dependent variable in this experiment?

1 the position of the infra red source

2 the length of the gelatine block

3 the position of the infra red detector

4 the output p.d. from the infra red detector

8B Which is the best description of the pattern shown by the graph?

1 As the length of the gelatine block increases, the intensity of infra red radiation received by the detector decreases.

2 As the length of the gelatine block increases, the intensity of infra red radiation received by the detector decreases by a similar amount.

3 The longer the gelatine block, the larger the effect of cutting off 2 cm on the increase in the intensity of infra red radiation received by the detector.

4 There is no relationship between the length of the gelatine block and the intensity of infra red radiation received by the detector.

8C The table shows the student's results.

Length of gelatine block in cm	Output p.d. in V
24.0	0.1
12.0	0.2
6.0	0.4
3.0	0.8

Based on the data that the student recorded, what was the sensitivity of the voltmeter?

1 0.1 V

2 0.2 V

3 0.4 V

4 1.0 V

Question 8 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 14 · continued

8D Scientists carried out a similar investigation using glass optical fibres in place of the gelatine block. They found that there was no significant reduction in the output p.d. of the infra red detector until the fibre was several kilometres long.

This shows that . . .

1 gelatine absorbs infra red radiation much more strongly than glass.

2 glass is more transparent than water.

3 infra red radiation passes through solids faster than through liquids.

4 infra red radiation can pass through bent optical fibres.

4.6.3.1 Emission and absorption of infrared radiation

Question 15

June 2008 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about electromagnetic radiation.

Match types of electromagnetic radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A infra red

B ultraviolet

C visible light

D gamma

can be used to send messages using a torch	**1**
can cause a suntan	**2**
can be used in a television remote control	**3**
can travel through a person's body	**4**

4.6.3.1 Emission and absorption of infrared radiation

Question 16

June 2008 | PHY1BP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows the electromagnetic spectrum.

1	X-rays	**2**	Visible light	**3**	Micro waves	**4**

Increasing wavelength ⟶

Match the types of radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the electromagnetic spectrum.

A gamma

B infra red

C radio waves

D ultraviolet

Turn over for the next question

4.6.3.1 Emission and absorption of infrared radiation

Question 17

November 2008 | PHY1BP | Original Q2 | Legacy

QUESTION TWO

The diagram shows parts of the electromagnetic spectrum.

1	X-rays	**2**	**3**	Infra red rays	Microwaves	**4**

Match types of radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the diagram.

A gamma rays

B radio waves

C ultraviolet rays

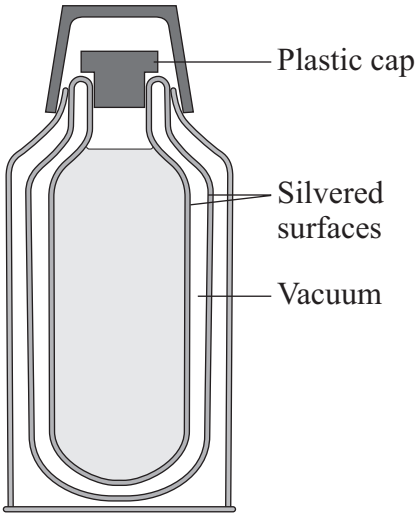
D visible light

4.6.3.1 Emission and absorption of infrared radiation

Question 18

January 2009 | PHY1F | Original Q6 | Legacy

6 A vacuum flask is designed to reduce the rate of heat transfer.



6 (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2 marks)

6 (a) (ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

.....

.....

.....

.....

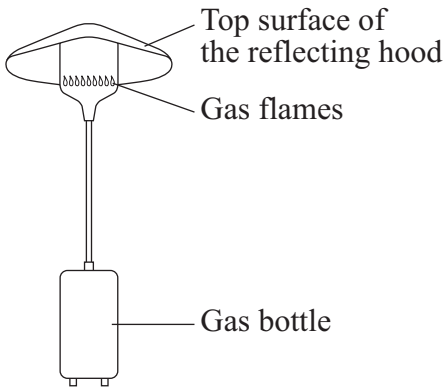
(2 marks)

4.6.3.1 Emission and absorption of infrared radiation

Question 18 · continued

for mark

6 (b) The diagram shows a gas flame patio heater.



6 (b) (i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather than a dark, matt surface.

.....

.....

.....

(2 marks)

6 (b) (ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2 marks)

6 (b) (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

.....

.....

(1 mark)

9

4.6.3.1 Emission and absorption of infrared radiation

Question 19

March 2009 | PHY1BP | Original Q6 | Legacy

QUESTION SIX

The table shows part of the electromagnetic spectrum.

gamma rays	X-rays	ultraviolet	visible light	infra red	microwaves

6A Which one of the following parts of the electromagnetic spectrum has the longest wavelength?

1 gamma rays

2 microwaves

3 ultraviolet

4 visible light

6B Which one of the following parts of the electromagnetic spectrum has the highest frequency?

1 gamma rays

2 microwaves

3 ultraviolet

4 visible light

6C Which part of the electromagnetic spectrum is used to show up invisible security marking on valuable equipment?

1 microwaves

2 ultraviolet

3 visible light

4 X-rays

4.6.3.1 Emission and absorption of infrared radiation

Question 19 · continued

6D Which part of the electromagnetic spectrum is emitted by mobile phone transmitters?

1 microwaves

2 ultraviolet

3 visible light

4 X-rays

Turn over for the next question

4.6.3.1 Emission and absorption of infrared radiation

Question 20

June 2009 | PHY1BP | Original Q5 | Legacy

QUESTION FIVE

Electromagnetic radiation can be grouped into types. Each type has a different range of wavelengths.

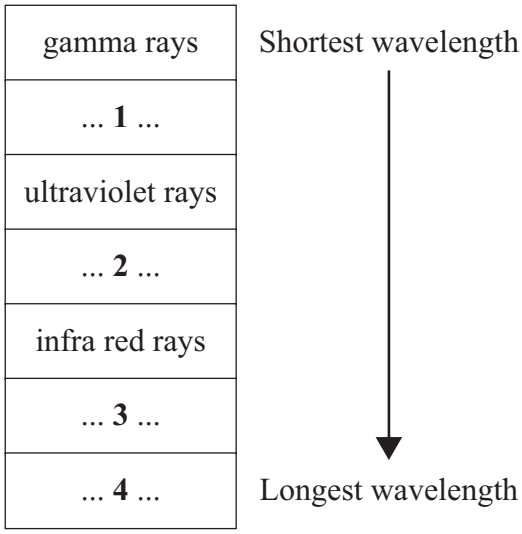
Match types of radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A microwaves

B X-rays

C visible light

D radio waves



4.6.3.1 Emission and absorption of infrared radiation

Question 21

November 2009 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about the uses of some types of electromagnetic radiation.

Match words, **A**, **B**, **C** and **D**, with the uses **1–4** in the table.

A infra red

B microwaves

C ultraviolet

D X-rays

	Use
1	sending signals in mobile phone networks
2	sending signals along optical fibres
3	photographing people's bones in hospital
4	reading 'invisible' security markings on property

4.6.3.1 Emission and absorption of infrared radiation

Question 22

November 2009 | PHY1BP | Original Q2 | Legacy

QUESTION TWO

This question is about four types of electromagnetic radiation.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A gamma

B infra red

C radio

D visible light

The type of electromagnetic radiation with the longest wavelength is . . . **1** . . . .

The type of electromagnetic radiation with the highest frequency is . . . **2** . . . .

The type of electromagnetic radiation that is used to cook food is . . . **3** . . . .

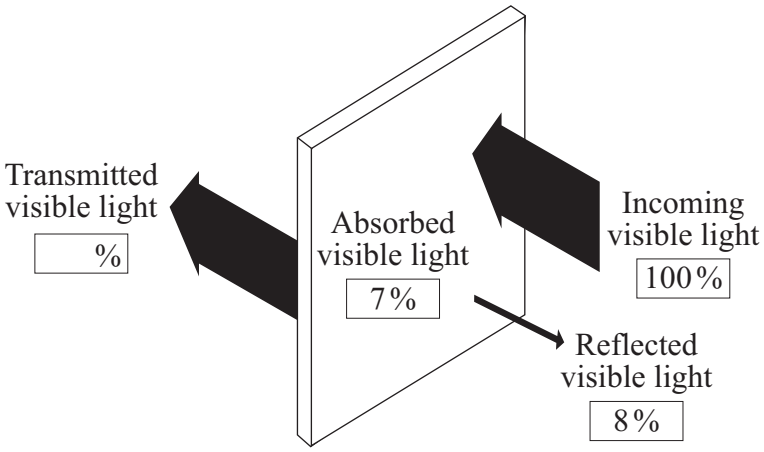
The type of electromagnetic radiation that allows us to see is . . . **4** . . . .

4.6.3.1 Emission and absorption of infrared radiation

Question 23

3 Glass reflects, absorbs and transmits both infra red radiation and visible light.

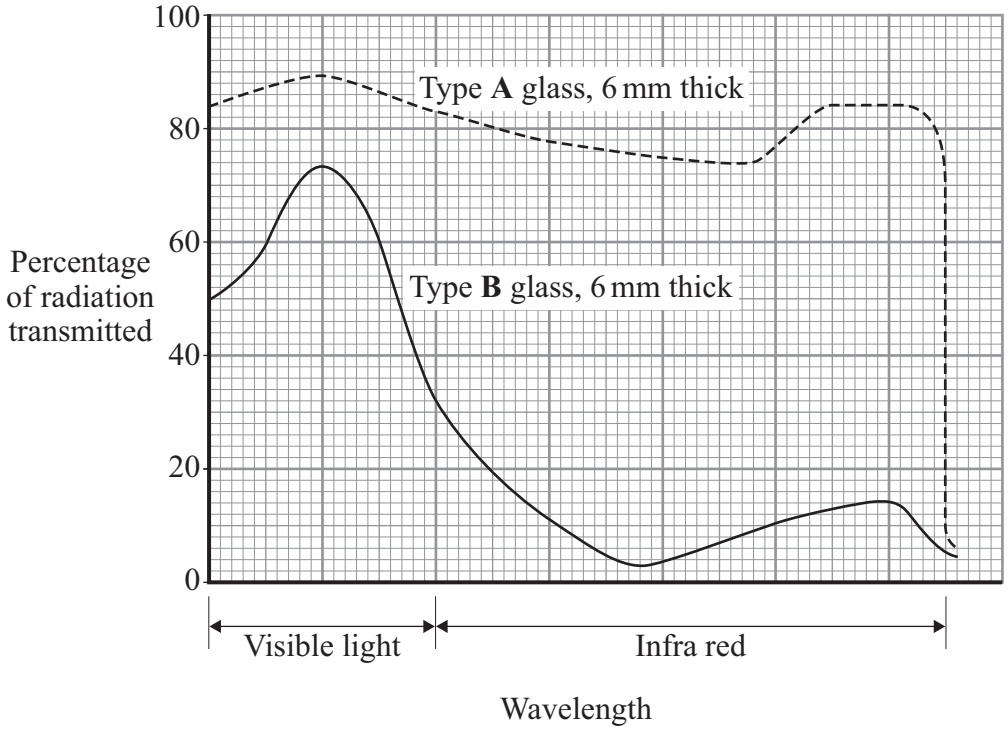
3 (a) The diagram shows the percentages of visible light that are reflected and absorbed by one type of glass.



What percentage of visible light is transmitted by this type of glass?

..... %
(1 mark)

3 (b) The amounts of infra red radiation and visible light transmitted by glass depend on the type and thickness of glass. The data obtained from tests on two different types of glass is displayed in the graph below.



4.6.3.1 Emission and absorption of infrared radiation

Question 23 · continued

for mark

3 (b) (i) To be able to compare the two types of glass, it was important to control one variable.

What variable was controlled in the tests?

.....

(1 mark)

3 (b) (ii) A homeowner has a glass conservatory built on the back of the house. The homeowner tells the builder that the inside of the conservatory should stay as cool as possible throughout the summer.

Explain why the builder uses 'type **B**' glass for the conservatory.

.....

.....

.....

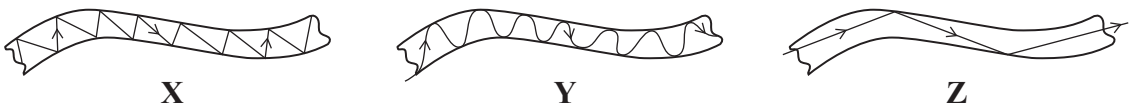
.....

(2 marks)

3 (c) Infra red and visible light can be used to send signals along an optical fibre.

Which **one** of the following diagrams, **X**, **Y** or **Z**, shows the path taken by a signal as it travels along an optical fibre?

Draw a ring around the correct diagram.



X **Y** **Z**

(1 mark)

5

4.6.3.1 Emission and absorption of infrared radiation

Question 24

March 2010 | PHY1BP | Original Q2 | Legacy

QUESTION TWO

The table shows part of the electromagnetic spectrum.

Gamma		Ultraviolet		Infra red		Radio

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A gamma

B infra red

C radio

D ultraviolet

The part of the electromagnetic spectrum with the longest wavelengths is . . . **1** . . . .

Between X-rays and visible light in the electromagnetic spectrum is . . . **2** . . . radiation.

Some radioactive isotopes emit . . . **3** . . . radiation.

Signals can be sent from remote controls to a television by . . . **4** . . . radiation.

4.6.3.1 Emission and absorption of infrared radiation

Question 25

June 2010 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

Electromagnetic radiation can be grouped into types. Each type has a different range of wavelengths.

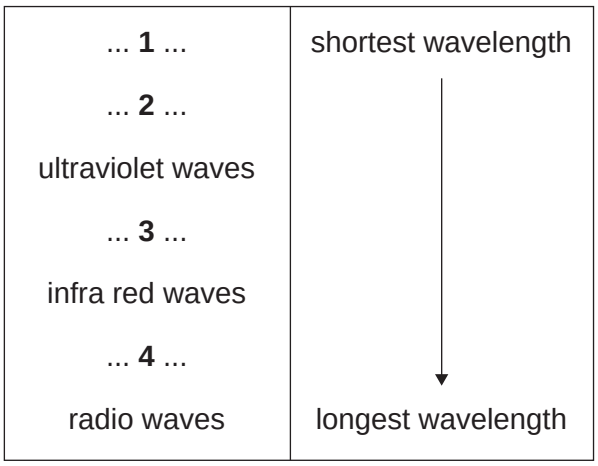
Match types of radiation, **A**, **B**, **C** and **D**, with the numbers **1–4** in the diagram.

A gamma rays

B microwaves

C visible light

D X-rays



4.6.3.1 Emission and absorption of infrared radiation

Question 26

June 2010 | PHY1BP | Original Q6 | Legacy

QUESTION SIX

In 1896, Henri Becquerel was doing an experiment with uranium.

6A Becquerel thought that uranium absorbed energy from the Sun, and then re-emitted the energy as X-rays.

This was . . .

1 a conclusion.

2 an estimate.

3 an observation.

4 a theory.

6B Becquerel found that the uranium emitted radiation even when the sample was sealed in black paper.

He had discovered radioactivity.

Becquerel had to change his ideas because . . .

1 the Sun does not provide energy on a cloudy day.

2 sunlight could not pass through the black paper.

3 X-rays could not pass through the black paper.

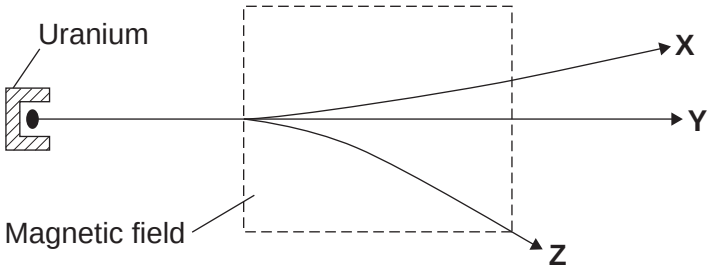
4 radiation could not pass through the black paper.

4.6.3.1 Emission and absorption of infrared radiation

Question 26 · continued

6C When Becquerel passed the radiation emitted by uranium through a magnetic field, he found that there were three different types of radiation.

The diagram shows the paths of the three types of radiation, **X**, **Y** and **Z**, in the magnetic field.



Which of the following is the path of gamma radiation?

1 **X**

2 **Y**

3 **Z**

4 **X** and **Z**

6D Two types of radiation were deflected in the magnetic field.

These two types of radiation were deflected because they are . . .

1 electrically charged.

2 electrically neutral.

3 have a smaller mass than the third type of radiation.

4 have a bigger mass than the third type of radiation.

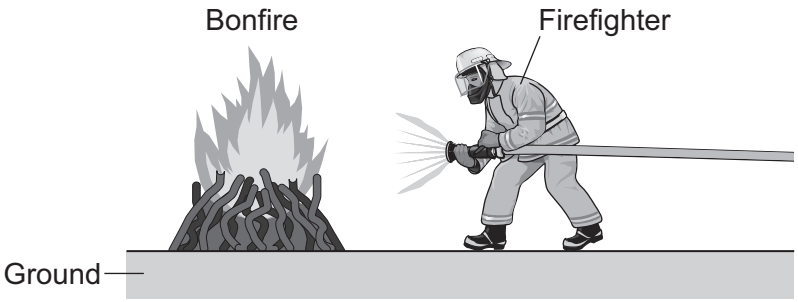
4.6.3.1 Emission and absorption of infrared radiation

Question 27

November 2010 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The drawing shows a firefighter putting out a bonfire. The firefighter wears thick, woollen clothing. The clothing has a light-coloured, shiny surface.



Match words, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A conduction

B insulation

C radiation

D reflection

Heat is transferred from the fire to the firefighter's clothing by . . . **1** . . . .

The ground underneath the fire will get hot when heat is transferred to it by . . . **2** . . . .

The thick, woollen clothing provides good heat . . . **3** . . . .

The light-coloured, shiny surface of the clothing provides good . . . **4** . . . of infra red.

4.6.3.1 Emission and absorption of infrared radiation

Question 28

November 2010 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

Different types of electromagnetic radiation affect living tissue and cells in different ways.

Match types of radiation, **A**, **B**, **C** and **D**, with the descriptions **1**–**4** in the table.

A infra red

B ultraviolet

C visible light

D X-rays

	The radiation . . .
1	can be felt by the skin as heat.
2	can pass through fleshy tissue but is absorbed by bone.
3	can be detected by special cells in the eye.
4	can be absorbed by the skin and cause a suntan.

4.6.3.1 Emission and absorption of infrared radiation

Question 29

November 2010 | PHY1BP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the electromagnetic spectrum.

1	X-rays	**2**	Visible light	**3**	Microwaves	**4**

Match types of radiation, **A**, **B**, **C** and **D**, with the numbers **1**–**4** on the diagram.

A gamma

B infra red

C radio

D ultraviolet

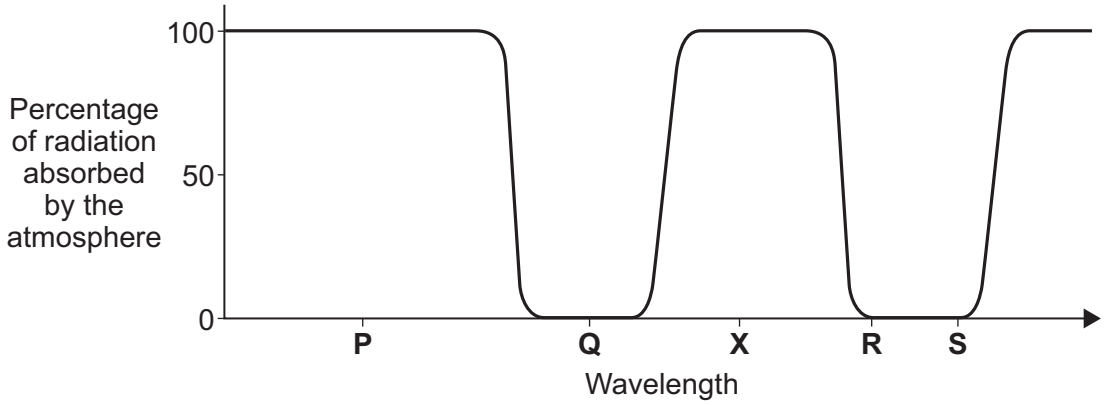
4.6.3.1 Emission and absorption of infrared radiation

Question 30

November 2010 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

The graph shows how the Earth's atmosphere absorbs different wavelengths of electromagnetic waves.



7A Which wavelength, **P**, **Q**, **R** or **S**, does not reach the Earth's surface?

1 **P**

2 **Q**

3 **R**

4 **S**

7B The wavelength labelled **X** is in the infra red region.

Some objects in space emit infra red radiation.

Where would you put a telescope to collect infra red radiation from objects in space?

1 above the Earth's atmosphere

2 on a high mountain

3 at ground level in a hot desert

4 at ground level in the Antarctic

4.6.3.1 Emission and absorption of infrared radiation

Question 30 · continued

- The Hubble Space Telescope (HST) is in orbit around the Earth.
- Astronauts from a space shuttle can repair the HST if it breaks down.
- In 2003, a space shuttle returning to Earth exploded.
- After this explosion it was decided to stop sending astronauts to repair the HST.

7C This decision was later changed and in 2009 it was decided to send another space mission to repair the HST.

What is the most likely reason for this?

1 Space missions are now completely safe.

2 Astronomers want to keep using the HST.

3 The HST has never sent data back to Earth.

4 To give jobs to engineers.

7D The HST sends data back to Earth.

Electromagnetic waves labelled **R** on the graph are used to send the data.

The waves labelled **R** are used because the . . .

1 waves have a shorter wavelength than infra red.

2 atmosphere absorbs the waves.

3 atmosphere does not absorb the waves.

4 waves are in the visible light region.

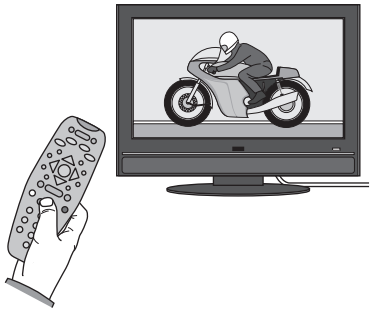
4.6.3.1 Emission and absorption of infrared radiation

Question 31

March 2011 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about electromagnetic radiation and television.



Match types of electromagnetic radiation, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A infra red

B microwaves

C radio waves

D visible light

Television signals from a transmitter on Earth are carried by . . . **1** . . . .

Television signals from a satellite are carried by . . . **2** . . . .

A television remote control uses . . . **3** . . . .

A television screen is designed to produce . . . **4** . . . .

4.6.3.1 Emission and absorption of infrared radiation

Question 32

March 2011 | PHY1BP | Original Q2 | Legacy

QUESTION TWO

Electromagnetic radiation can be absorbed, reflected and transmitted.

Match words, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A infra red

B microwaves

C visible light

D X-rays

A mirror is designed to reflect . . . **1** . . . .

Mobile phone masts are designed to transmit . . . **2** . . . .

The metal surface inside an oven is designed to reflect . . . **3** . . . .

Lead-lined aprons used in hospitals are designed to absorb . . . **4** . . . .

4.6.3.1 Emission and absorption of infrared radiation

Question 33

June 2011 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

Electromagnetic radiation has many uses.

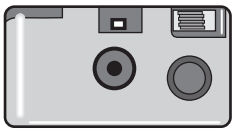
1

Toaster



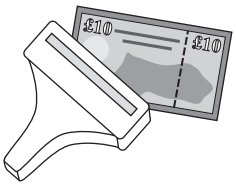
2

Camera



3

Forgery detector



4

Hospital scanner



Match useful types of electromagnetic radiation, **A**, **B**, **C** and **D**, with the drawings labelled **1**–**4**.

A infra red

B ultraviolet

C visible light

D X-rays

4.6.3.1 Emission and absorption of infrared radiation

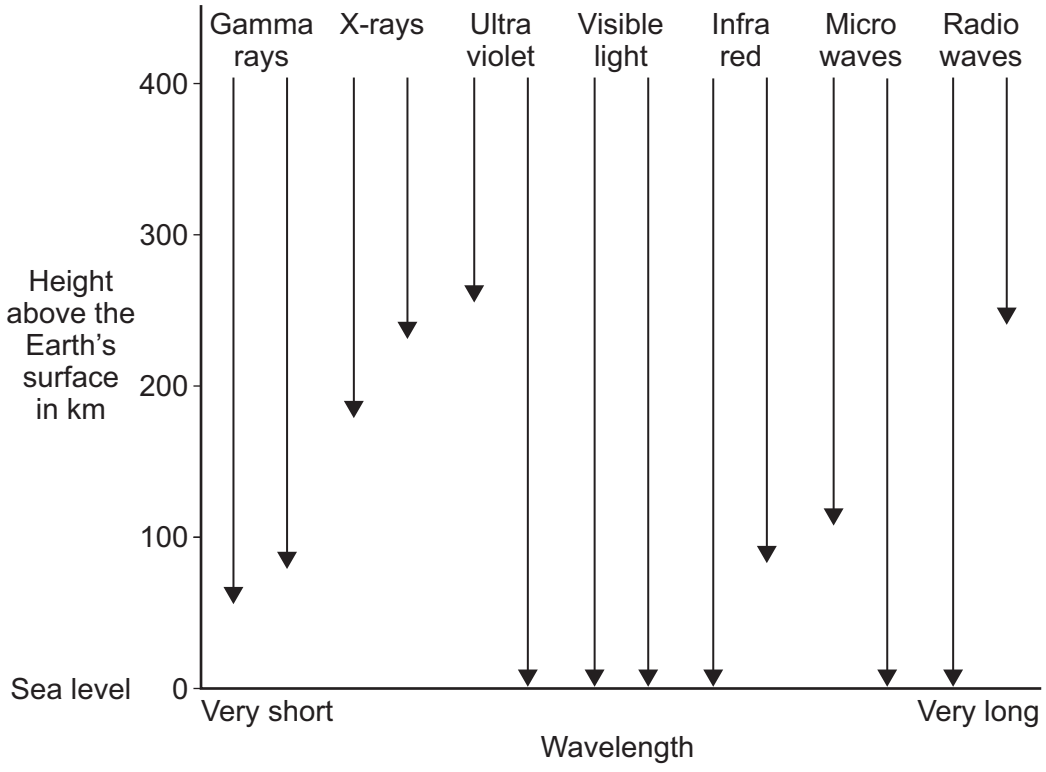
Question 34

June 2011 | PHY1BP | Original Q9 | Legacy

QUESTION NINE

Telescopes can be based on the Earth's surface or put into orbit in space.

The diagram shows how far electromagnetic waves penetrate the Earth's atmosphere. For some types of electromagnetic radiation, longer and shorter waves penetrate the atmosphere to different depths.



9A Telescopes on Earth detect **all** wavelengths of . . .

1 radio waves only.

2 visible light only.

3 radio waves and visible light.

4 visible light and X-rays.

9B Which of the following statements about the use of telescopes in space is true?

1 The atmosphere distorts the image produced by the telescope.

2 The telescopes are affected by light pollution from the Earth.

3 The telescopes can detect electromagnetic waves that cannot reach the Earth's surface.

4 The telescopes are easy to repair and maintain.

4.6.3.1 Emission and absorption of infrared radiation

Question 34 · continued

The table gives information about some space telescopes. Each telescope detects a different type of electromagnetic radiation.

Telescope	Wavelength detected in nanometres
INTEGRAL	less than 0.01
Chandra	0.01 – 20
FUSE	20 – 400
Hubble	400 – 700
Spitzer	1000 – 1 000 000

9C The Hubble telescope detects visible light.

Which telescope detects infra red radiation?

1 Chandra

2 FUSE

3 INTEGRAL

4 Spitzer

9D Which telescope detects X-rays?

1 Chandra

2 FUSE

3 INTEGRAL

4 Spitzer

END OF TEST

4.6.3.1 Emission and absorption of infrared radiation

Question 35

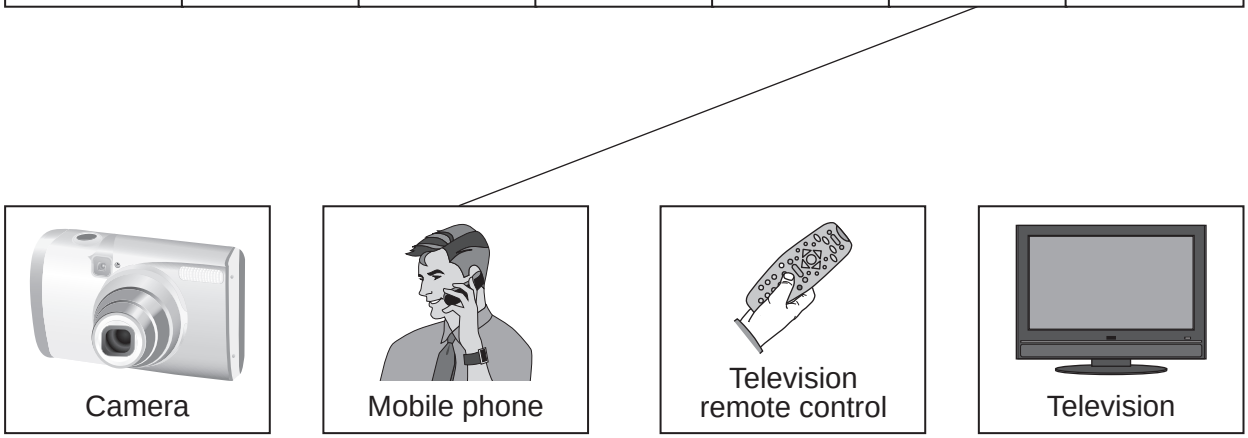
June 2012 | PH1FP | Original Q2 | Legacy

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)

4.6.3.1 Emission and absorption of infrared radiation

Question 35 · continued

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

Diagram A

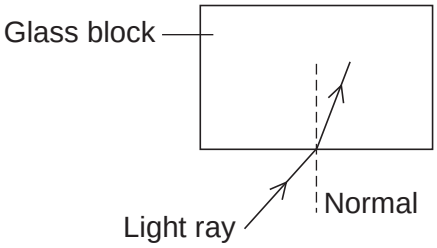
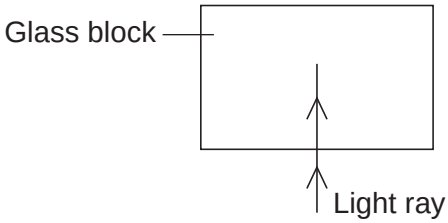


Diagram B



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

4.6.3.1 Emission and absorption of infrared radiation

Question 36

June 2012 | PH1FP | Original Q7 | Legacy

7 A wood burning stove is used to heat a room.



The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

7 (a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

.....

.....

.....

.....

(2 marks)

4.6.3.1 Emission and absorption of infrared radiation

Question 36 · continued

7 (b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Efficiency = ...

(2 marks)

7 (c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name **one** other way energy is wasted by the stove.

.....

(1 mark)

7 (d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

Give **two** environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1 .....

.....

2 .....

.....

(2 marks)

Question 7 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 36 · continued

7 (e) The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

Mass of metal case	100 kg
Starting temperature of metal case	20 °C
Final temperature of metal case	70 °C
Specific heat capacity of metal case	510 J/kg °C

Calculate the energy required to raise the temperature of the metal case to 70 °C.

Use the correct equation from the Physics Equations Sheet.

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

.....

.....

.....

.....

Energy required = ...

(3 marks)

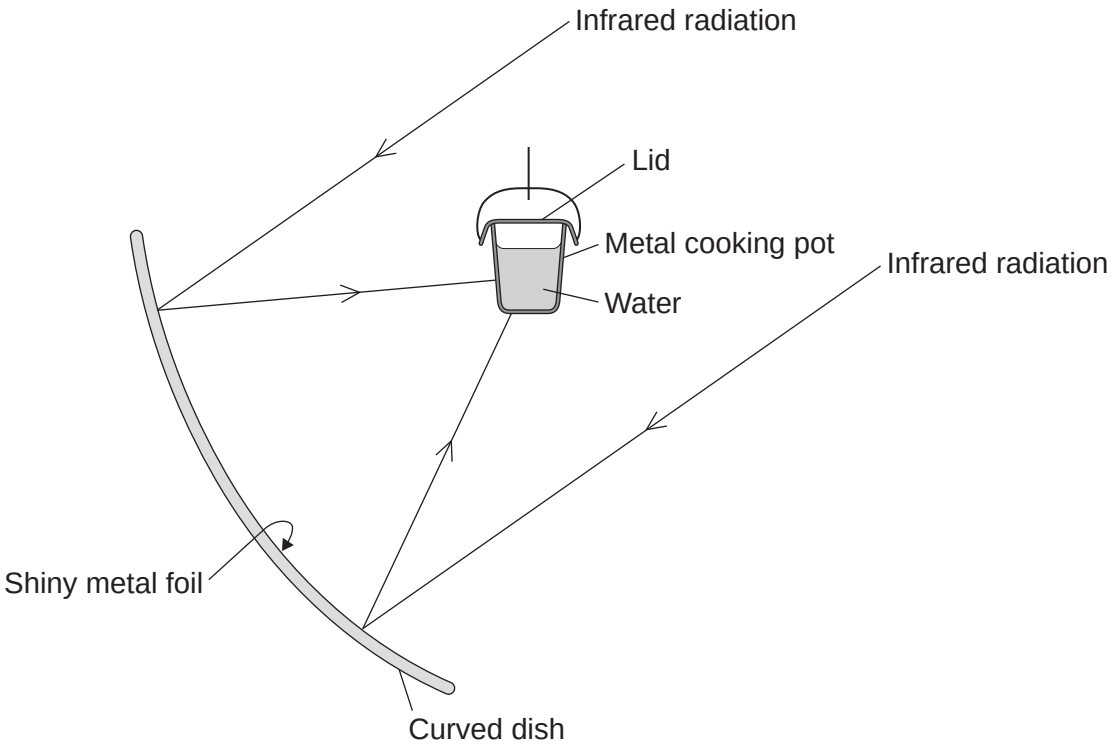
10

4.6.3.1 Emission and absorption of infrared radiation

Question 37

January 2013 | PH1FP | Original Q5 | Legacy

5 The diagram shows the design of a solar cooker. The cooker heats water using infrared radiation from the Sun.



5 (a) Why is the inside of the large curved dish covered with shiny metal foil?

.....

.....

(1 mark)

5 (b) Which would be the best colour to paint the outside of the metal cooking pot?

Draw a ring around the correct answer.

black **silver** **white**

Give a reason for your answer.

.....

.....

.....

(2 marks)

4.6.3.1 Emission and absorption of infrared radiation

Question 37 · continued

5 (c) Why does the cooking pot have a lid?

.....

.....

(1 mark)

5 (d) Calculate how much energy is needed to increase the temperature of 2 kg of water by 80 °C.

The specific heat capacity of water = 4200 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy = ... J

(2 marks)

6

4.6.3.1 Emission and absorption of infrared radiation

Question 38

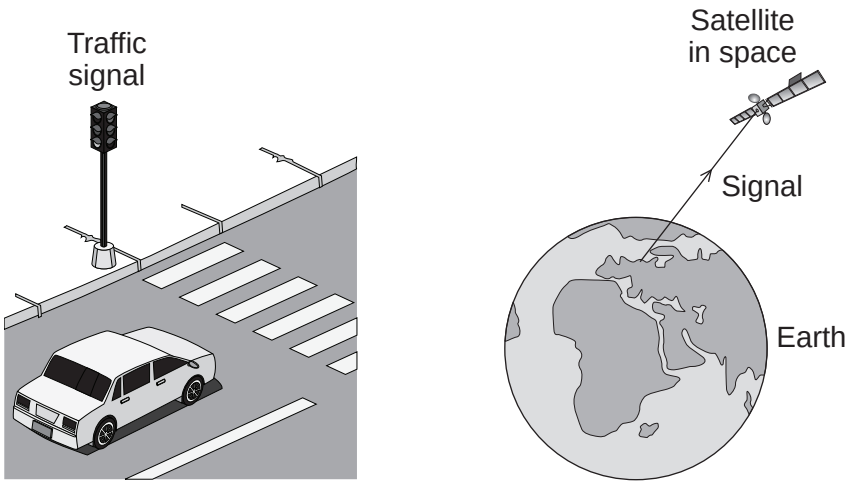
June 2013 | PH1FP | Original Q2 | Legacy

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

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



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

.....

(1 mark)

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

.....

(1 mark)

2 (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**

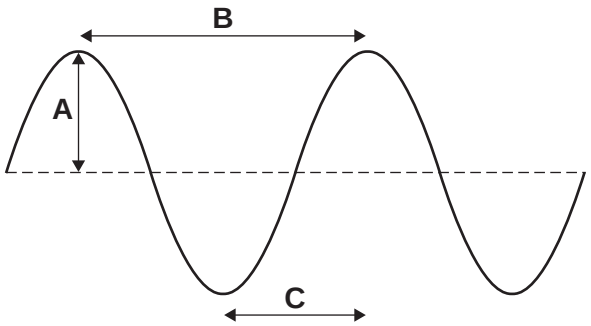
(1 mark)

4.6.3.1 Emission and absorption of infrared radiation

Question 38 · continued

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

Diagram 2



2 (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)

2 (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)

Question 2 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 38 · continued

2 (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.

2 (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)

2 (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)

8

4.6.3.1 Emission and absorption of infrared radiation

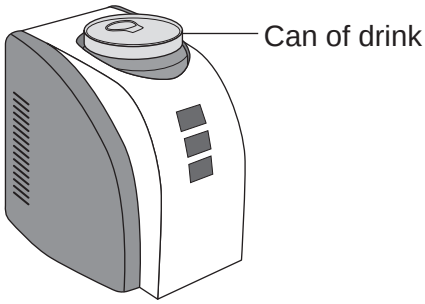
Question 39

June 2015 | PH1FP | Original Q4 | Legacy

4 A 'can-chiller' is used to make a can of drink colder.

Figure 6 shows a can-chiller.

Figure 6



4 (a) The can-chiller decreases the temperature of the liquid in the can by 15 °C.
The mass of liquid is 0.33 kg.
The specific heat capacity of the liquid is 4200 J/kg °C.

Calculate the energy transferred from the liquid as it cools.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... J

4 (b) Complete the following sentence.

[1 mark]

The specific heat capacity of a substance is the amount of energy required to change the ..... of one kilogram of the substance by one degree Celsius.

4.6.3.1 Emission and absorption of infrared radiation

Question 39 · continued

4 (c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

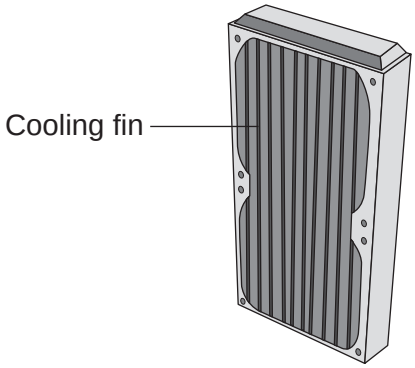
State the name of a measuring instrument used to measure mass.

[1 mark]

.....

4 (d) The back of the can-chiller has cooling fins, as shown in **Figure 7**.

Figure 7



The cooling fins increase the rate of energy transfer from the can-chiller to the surroundings.

Complete the following sentences.

[2 marks]

The cooling fins are a ..... colour because that makes them good emitters of infrared radiation.

The large surface area of the cooling fins allows the air around the can-chiller to gain energy quickly and rise, transferring energy by ..... .

Question 4 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 39 · continued

4 (e) (i) The energy input to the can-chiller is the same as the energy output. This shows that energy is conserved.

Complete the following sentence.

[1 mark]

Energy can be transferred usefully, stored or dissipated, but cannot be

..... or destroyed.

4 (e) (ii) The temperature of the can of drink decreases while it is in the can-chiller.

What happens to the temperature of the air around the cooling fins?

[1 mark]

.....

8

4.6.3.1 Emission and absorption of infrared radiation

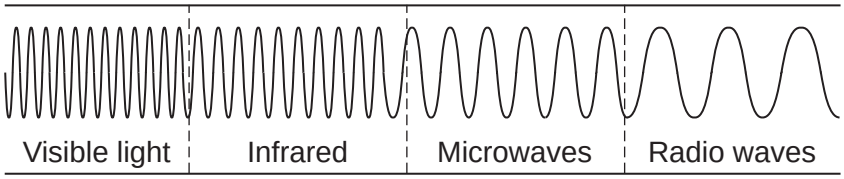
Question 40

June 2016 | PH1FP | Original Q3 | Legacy

3 Infrared and microwaves are two types of electromagnetic radiation.

Figure 4 shows the positions of the two types of radiation within part of the electromagnetic spectrum.

Figure 4



3 (a) (i) Name **one** type of electromagnetic radiation which has more energy than infrared.

[1 mark]

_____

3 (a) (ii) Use the correct answer from the box to complete each sentence.

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

[3 marks]

greater than	**less than**	**the same as**

The wavelength of infrared is _____ the wavelength of microwaves.

The frequency of microwaves is _____ the frequency of infrared.

The speed of microwaves in a vacuum is _____ the speed of infrared in a vacuum.

4.6.3.1 Emission and absorption of infrared radiation

Question 40 · continued

3 (b) Cosmic Microwave Background Radiation (CMBR) is electromagnetic radiation that fills the universe.

Only one theory about the origin of the universe can explain the presence of CMBR.

3 (b) (i) Give the name of this theory.

[1 mark]

_____

3 (b) (ii) Which other piece of evidence supports this theory?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
the diffraction of sound waves	
the electromagnetic spectrum	
the red-shift of light from distant galaxies	

6

4.6.3.1 Emission and absorption of infrared radiation

Question 41

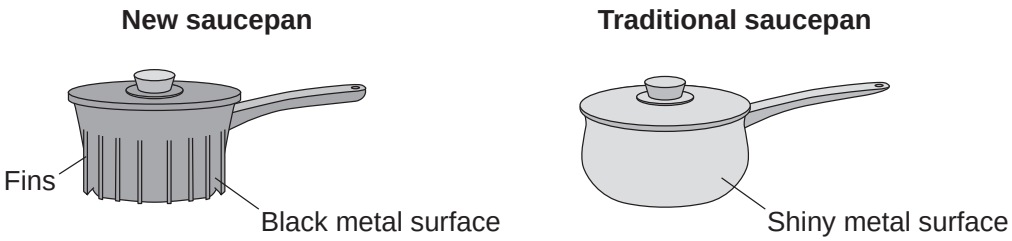
June 2016 | PH1FP | Original Q8 | Legacy

8 (a) Heating food in a saucepan over a gas flame is inefficient.
Suggest why.

[2 marks]

8 (b) A new saucepan has been designed that heats up food much faster than a traditional saucepan. **Figure 13** shows the two saucepans.

Figure 13



Describe how the features of the new saucepan cause the food to heat up faster than when the food is heated in the traditional saucepan.

[2 marks]

Fins

Black metal surface

8 (c) State the relationship between the temperature of the saucepan and the rate at which the saucepan emits infrared radiation.

[1 mark]

5

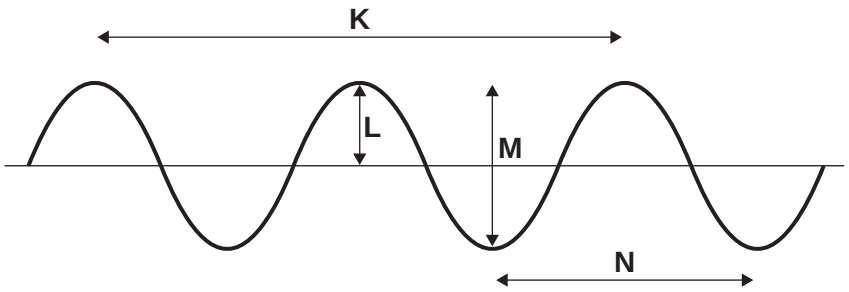
4.6.3.1 Emission and absorption of infrared radiation

Question 42

June 2017 | PH1FP | Original Q3 | Legacy

3 (a) **Figure 4** shows an electromagnetic wave.

Figure 4



3 (a) (i) Which arrow, **K**, **L**, **M** or **N**, shows the wavelength of the wave?

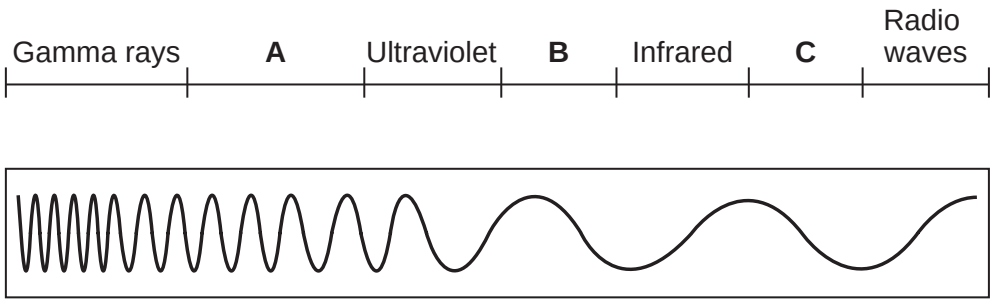
[1 mark]

3 (a) (ii) Which arrow, **K**, **L**, **M** or **N**, shows the amplitude of the wave?

[1 mark]

3 (b) **Figure 5** shows the electromagnetic spectrum.

Figure 5



A laser emits visible light.

Which letter, **A**, **B** or **C**, on **Figure 5** shows the position of visible light?

[1 mark]

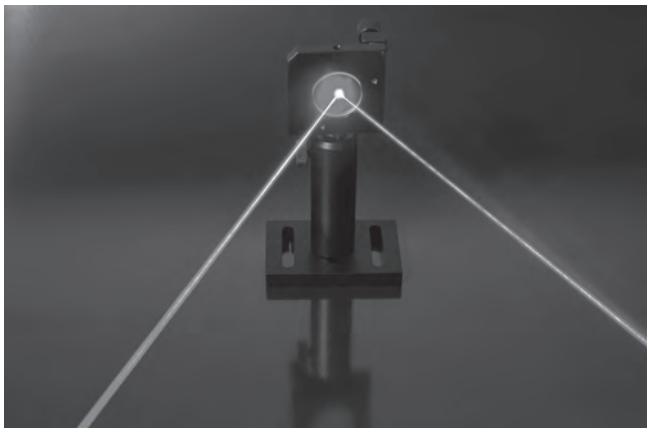
4.6.3.1 Emission and absorption of infrared radiation

Question 42 · continued

3 (c) Laser light is used in some burglar alarms.

Figure 6 shows laser light being reflected by a mirror. The light then reaches a detector.

Figure 6



3 (c) (i) How does the size of the angle of incidence compare with the size of the angle of reflection?

[1 mark]

_____

_____

3 (c) (ii) When a burglar gets in the way of the laser light, the light no longer reaches the detector.

Suggest **one** reason why.

[1 mark]

_____

_____

5

4.6.3.1 Emission and absorption of infrared radiation

Question 43

June 2018 | 8463/2F | Original Q5

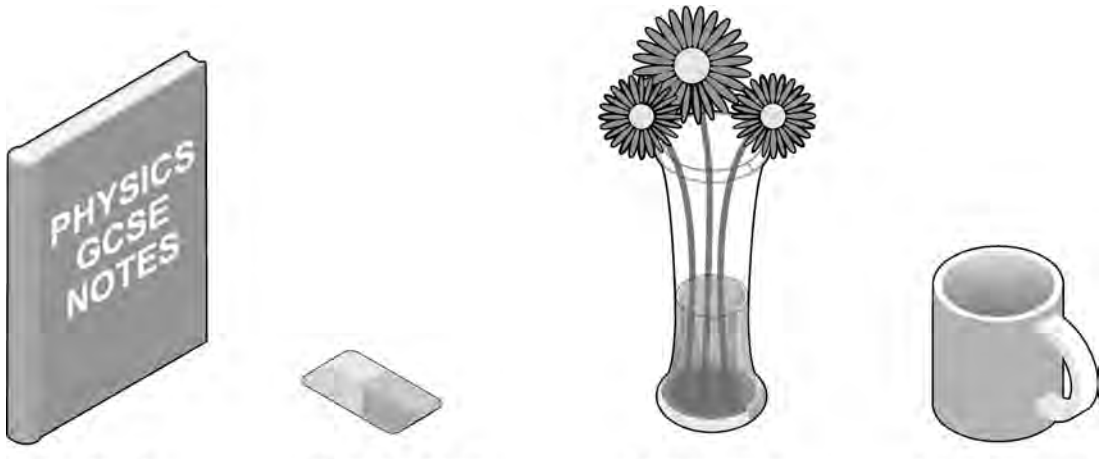
0 5 Some objects are transparent and some objects are opaque.

0 5 . 1 Which **one** of the objects in **Figure 5** is transparent?

Tick **one** box.

[1 mark]

Figure 5



Book ☐ Pencil rubber ☐ Glass vase ☐ Ceramic mug ☐

0 5 . 2 Complete the sentence.

Choose an answer from the box.

[1 mark]

absorb	**reflect**	**transmit**

An opaque object does not _____ light.

4.6.3.1 Emission and absorption of infrared radiation

Question 43 · continued

June 2018 | 8463/2F | Original Q5

A student wears a white T-shirt and a red baseball cap to a party.

0 5 . 3 Why does the T-shirt look white in white light?

[1 mark]

0 5 . 4 Explain how the colour of the baseball cap appears to change when the room lights at the party change from white to blue.

[2 marks]

Question 5 continues on the next page

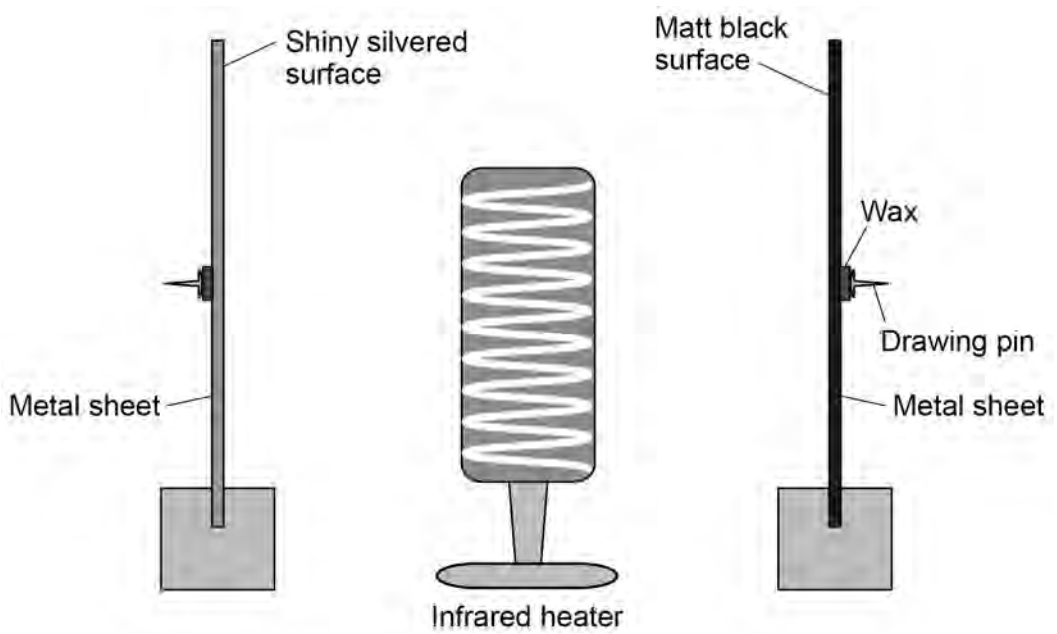
4.6.3.1 Emission and absorption of infrared radiation

Question 43 · continued

A student investigated how the type of surface affects the amount of infrared radiation the surface absorbs.

Figure 6 shows the equipment that the student used.

Figure 6



The metal sheets absorb infrared radiation. The wax melts and the drawing pins fall off the surfaces.

0 5 . 5 In the investigation there are several variables.

Draw **one** line from each variable to the correct description of that variable.

[2 marks]

Variable	Description
Control	Distance from the metal sheets to the infrared heater.
Dependent	The surface colour of the metal sheets.
Independent	Time taken for the drawing pins to fall off.

4.6.3.1 Emission and absorption of infrared radiation

Question 43 · continued

0 5 . 6 What is the main hazard in this investigation?

[1 mark]

0 5 . 7 The drawing pin attached to the matt black metal sheet fell off first.

What can be concluded from this result?

[1 mark]

9

Turn over for the next question

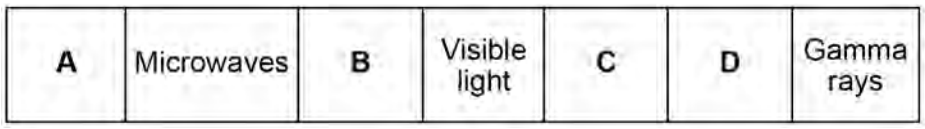
4.6.3.1 Emission and absorption of infrared radiation

Question 44

June 2019 | 8463/2F | Original Q4

0 4 . 1 **Figure 11** shows the position of three types of wave in the electromagnetic spectrum.

Figure 11



Which letter represents infrared in the electromagnetic spectrum?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 4 . 2 What is infrared used for?

[1 mark]

Tick (✓) **one** box.

Electrical heating ☐

Energy efficient lamps ☐

Satellite communications ☐

Sun tanning ☐

Question 4 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

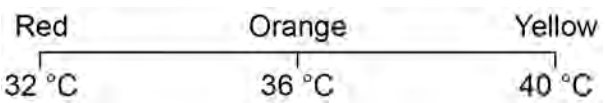
Question 44 · continued

June 2019 | 8463/2F | Original Q4

An infrared camera produces a colour image. Different colours show different temperatures.

People emit infrared radiation. **Figure 12** shows how the colour of the image of a person on an infrared camera depends on the person's body temperature.

Figure 12



0 4 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

orange	**red**	**yellow**

The image produced by an infrared camera of a person with a body temperature of 37 °C is mainly _____ .

0 4 . 4 Rescue workers use infrared cameras to search for people trapped under rubble after an earthquake.

How does the image of a trapped person change if the person's body temperature drops from 37 °C to 33 °C?

[1 mark]

_____

_____

_____

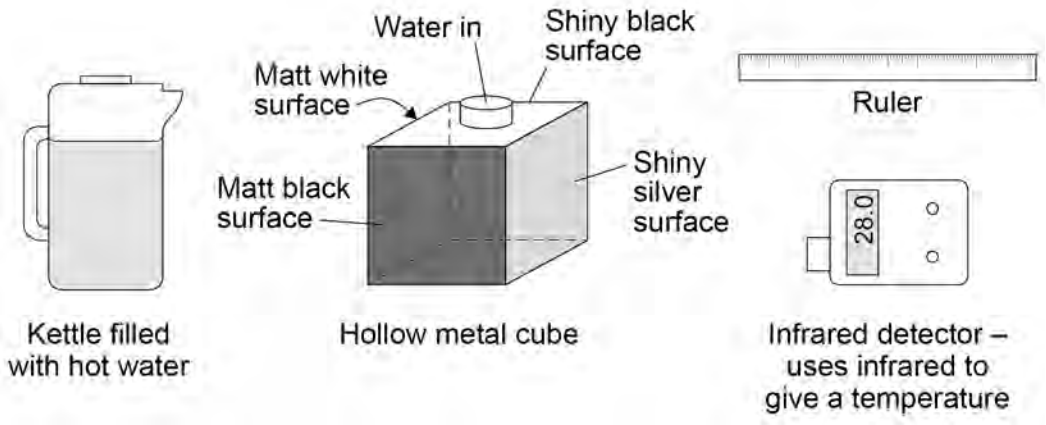
4.6.3.1 Emission and absorption of infrared radiation

Question 44 · continued

A student investigated how the type of surface affects the amount of infrared the surface radiates.

Figure 13 shows the equipment used.

Figure 13



0 4 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

a control	**the dependent**	**the independent**

In this investigation the type of surface is _____ variable.

0 4 . 6 Describe how the equipment shown in **Figure 13** would be used to compare the infrared radiation emitted from the vertical surfaces of the cube.

[3 marks]

4.6.3.1 Emission and absorption of infrared radiation

Question 44 · continued

Table 1 shows the results.

Table 1

Type of surface	Temperature in °C
Matt black	68.0
Matt white	65.5
Shiny black	66.3
Shiny silver	28.0

0 4 . 7 What is the resolution of the infrared detector?

[1 mark]

Tick (✓) **one** box.

- 0.1 °C ☐
- 1.0 °C ☐
- 1.7 °C ☐
- 68.0 °C ☐

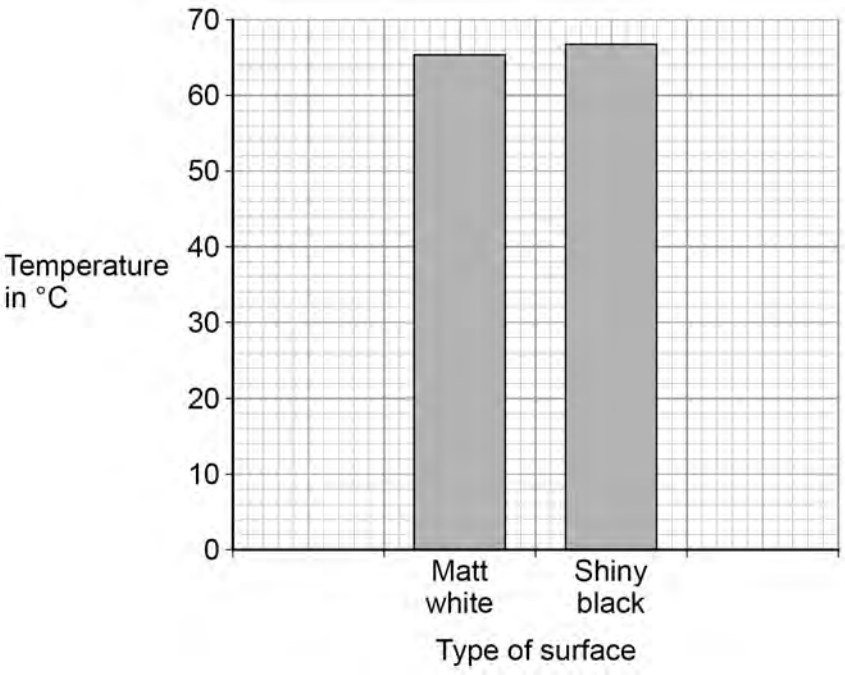
4.6.3.1 Emission and absorption of infrared radiation

Question 44 · continued

June 2019 | 8463/2F | Original Q4

The bar chart in **Figure 14** shows two of the results.

Figure 14



0 4 . 8 Complete the bar chart to show all of the results.

[3 marks]

0 4 . 9 Give **one** conclusion that can be made from the results.

[1 mark]

13

4.6.3.1 Emission and absorption of infrared radiation

Question 45

November 2021 | 8463/2F | Original Q3

0 3 There are different groups of waves in the electromagnetic spectrum.

0 3 . 1 **Figure 8** shows the position of three groups of the waves.

Figure 8

A	Microwaves	**B**	Visible light	**C**	**D**	Gamma rays

Which letter shows the position of infrared?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 3 continues on the next page

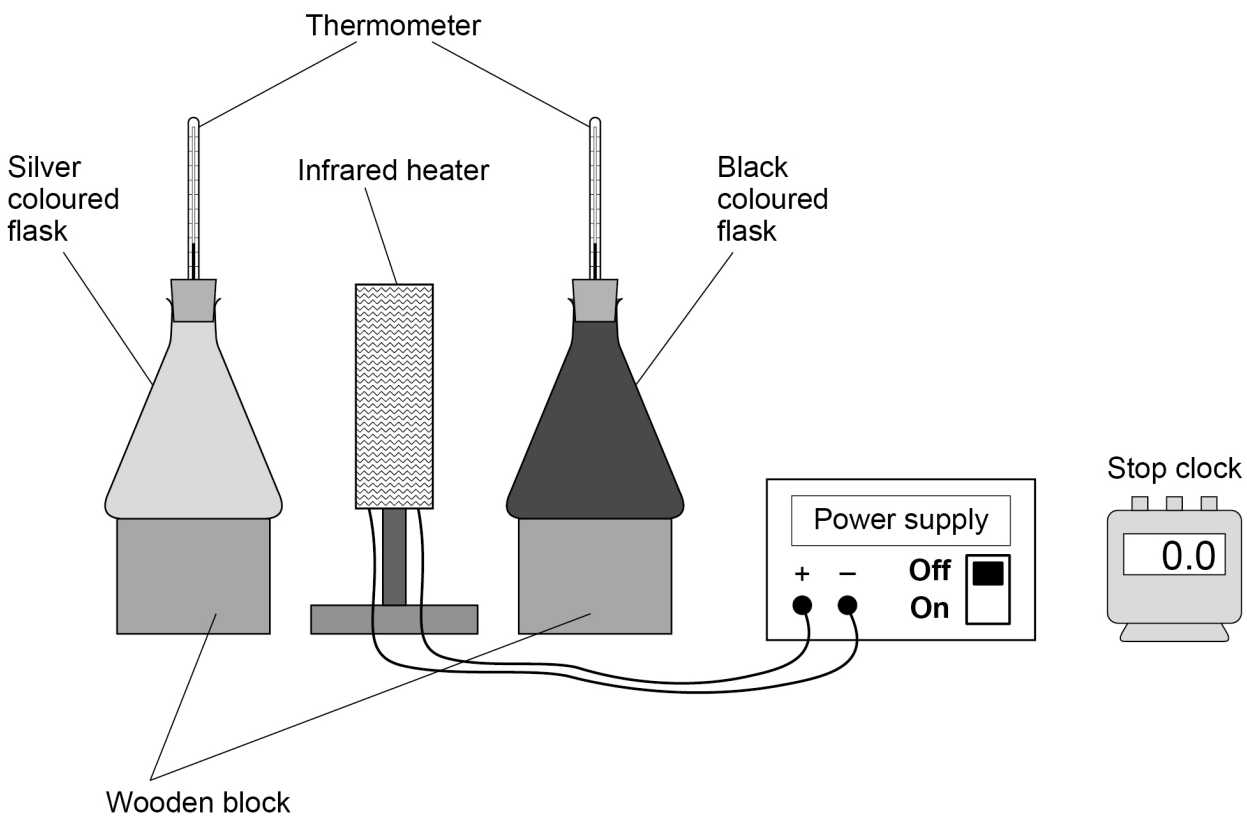
4.6.3.1 Emission and absorption of infrared radiation

Question 45 · continued

A student investigated how the colour of a surface affects the amount of infrared the surface absorbs.

Figure 9 shows the equipment used.

Figure 9



4.6.3.1 Emission and absorption of infrared radiation

Question 45 · continued

0 3 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a control	**the dependent**	**the independent**

In this investigation the distance between each flask and the infrared heater

is _____ variable.

0 3 . 3 The student wrote the hypothesis:

‘Surface colour of the flask affects the amount of infrared absorbed when the heater is switched on for five minutes.’

Describe how the equipment in **Figure 9** could be used to test this hypothesis.

[4 marks]

Question 3 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 45 · continued

Table 1 shows the results.

Table 1

Colour of flask	Temperature increase in °C		
	Test 1	Test 2	Test 3
Black	19	17	27
Silver	10	12	11

0 3 . 4 Which **one** of the results for the black flask is anomalous?

[1 mark]

0 3 . 5 The anomalous result was caused by reading the thermometer incorrectly.

What should the student do with the anomalous result?

[1 mark]

0 3 . 6 Calculate the mean temperature increase for the silver flask.

[1 mark]

Mean temperature increase = _____ °C

4.6.3.1 Emission and absorption of infrared radiation

Question 45 · continued

0 3 . 7 What conclusion can be made from **Table 1?**

[1 mark]

Tick (✓) **one** box.

Both flasks absorbed the same amount of infrared during the five minutes. ☐

The black flask absorbed the most infrared during the five minutes. ☐

The silver flask absorbed the most infrared during the five minutes. ☐

10

Turn over for the next question

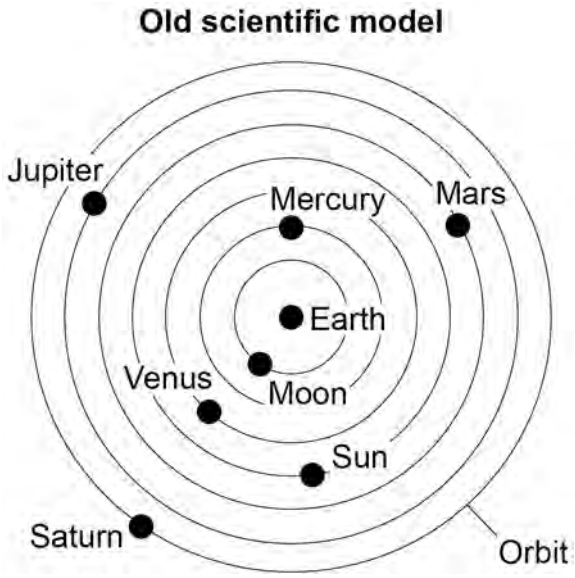
4.6.3.1 Emission and absorption of infrared radiation

Question 46

June 2023 | 8463/2F | Original Q4

0 4 **Figure 10** shows an old scientific model of the solar system that has now been replaced.

Figure 10



0 4 . 1 Which statement is a reason for replacing an old scientific model with a newer scientific model?

[1 mark]

Tick (✓) **one** box.

The old model cannot explain new observations. ☐

The old model has been used by scientists for a long time. ☐

The old model is too simple. ☐

4.6.3.1 Emission and absorption of infrared radiation

Question 46 · continued

0 4 . 2 Compare the model of the solar system used now with the old model of the solar system shown in **Figure 10**.

[4 marks]

Question 4 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 46 · continued

Table 1 shows data about four planets.

Table 1

Planet	Mean distance from the Sun in millions of kilometres	Time taken for one orbit in Earth years
Mercury	58	0.25
Venus	108	0.60
Earth	150	1.00
Mars	228	1.90

0 4 . 3 How does the time taken for one orbit change as the mean distance from the Sun increases?

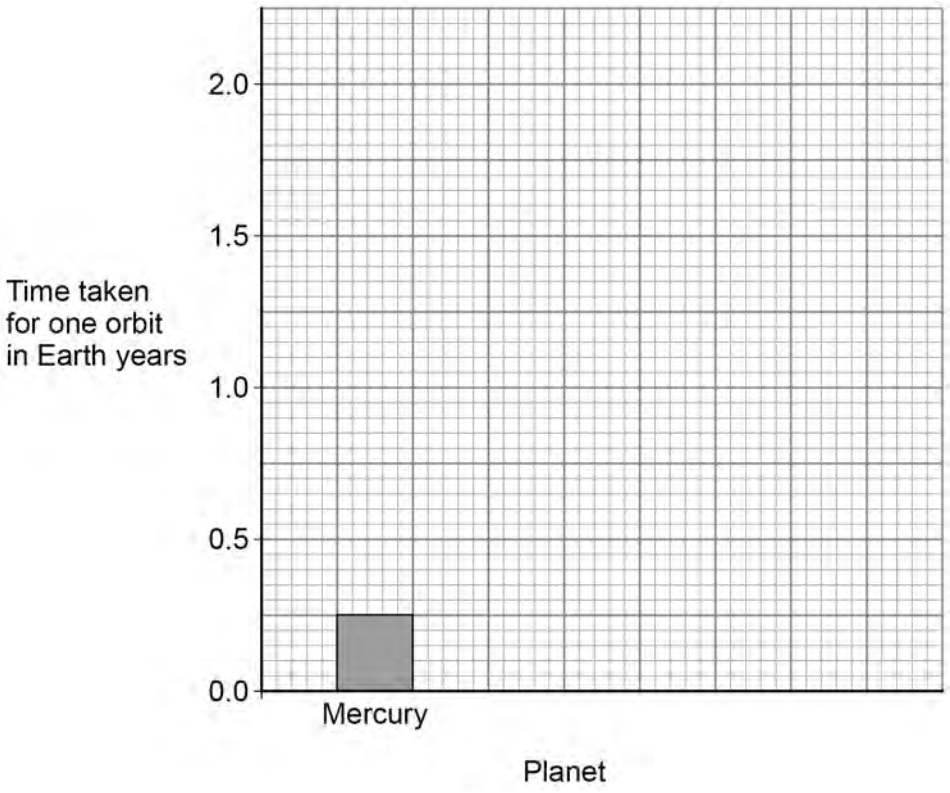
[1 mark]

4.6.3.1 Emission and absorption of infrared radiation

Question 46 · continued

0 4 . 4 The bar chart in **Figure 11** shows some of the data from **Table 1**.

Figure 11



Complete the bar chart.

Use data from **Table 1**.

[2 marks]

Question 4 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 46 · continued

0 4 . 5 All stars have a life cycle.

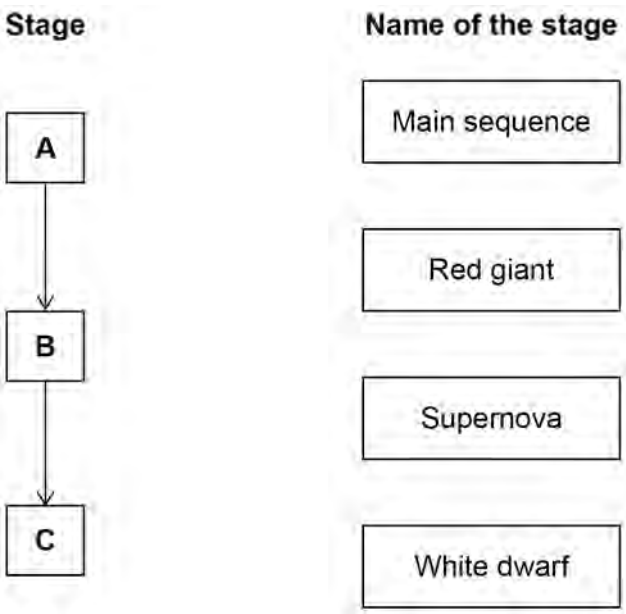
A, **B** and **C** in **Figure 12** represent three stages in the life cycle of the Sun.

The stages are in the correct order.

Draw **one** line from each stage to the name of the stage.

[2 marks]

Figure 12



0 4 . 6 Stars act like black bodies.

Which statement is true for perfect black bodies?

[1 mark]

Tick (✓) **one** box.

They are good reflectors of radiation. ☐

They are the best emitters of radiation. ☐

They easily transmit radiation. ☐

11

4.6.3.1 Emission and absorption of infrared radiation

Question 47

0 9 Infrared waves are transverse waves.

0 9 . 1 Complete the sentence.

[1 mark]

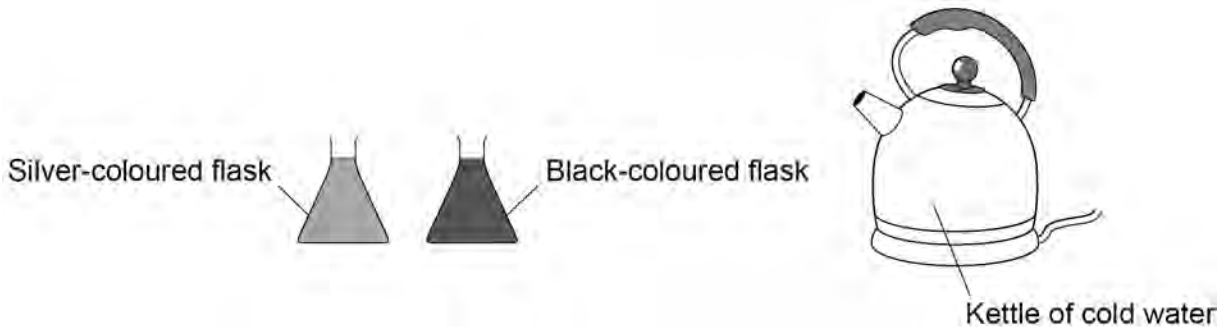
In a transverse wave, the direction of oscillation is _____

to the direction of energy transfer by the wave.

A student investigated how the colour of a surface affects the rate at which the surface emits infrared radiation.

Figure 23 shows some of the equipment used.

Figure 23



4.6.3.1 Emission and absorption of infrared radiation

Question 47 · continued

0 9 . 2 The student wrote the following hypothesis:

‘The black-coloured flask will emit more infrared radiation than the silver-coloured flask during 10 minutes of cooling.’

Describe a method to test this hypothesis.

[6 marks]

Question 9 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 47 · continued

June 2023 | 8463/2F | Original Q9

0 9 . 3 When will the flasks emit infrared radiation at the greatest rate?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

During the 1st minute ☐

During the 5th minute ☐

During the 9th minute ☐

Reason _____

_____

4.6.3.1 Emission and absorption of infrared radiation

Question 47 · continued

Another student investigated the absorption of infrared radiation by different surface colours.

The student filled four hollow metal cubes with cold water.

Each cube was the same size but had a different surface colour.

The cubes were then placed the same distance from an infrared heater.

After 10 minutes, the student measured the temperature increase of the water inside each cube.

0 9 . 4 What was the dependent variable in this investigation?

[1 mark]

0 9 . 5 **Table 2** shows the results.

Table 2

Surface colour of the cube	Temperature increase after 10 minutes in °C
Matt white	3.0
Shiny white	2.0
Matt black	6.5
Shiny black	4.0

Give **two** conclusions that can be made from the results in **Table 2**.

[2 marks]

1

2

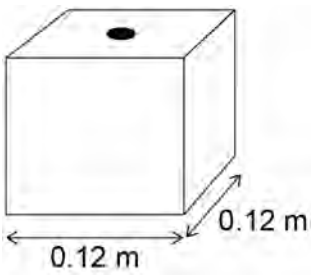
4.6.3.1 Emission and absorption of infrared radiation

Question 47 · continued

Figure 24 shows one of the cubes. The cube is filled with water.

The weight of the water exerts a pressure on the bottom of the cube.

Figure 24



Use the Physics Equations Sheet to answer questions **09.6** and **09.7**.

0 9 . 6 Which equation correctly links area, force and pressure?

[1 mark]

Tick (✓) **one** box.

pressure = force × area^2 ☐

pressure = force × area ☐

pressure = $\frac{\text{force}}{\text{area}}$ ☐

pressure = $\frac{\text{area}}{\text{force}}$ ☐

4.6.3.1 Emission and absorption of infrared radiation

Question 47 · continued

0 9 . 7 The water pressure at the bottom of the cube is 1500 Pa.

Calculate the force of the water on the bottom of the cube.

[4 marks]

Force = _____ N

17

Turn over for the next question

4.6.3.1 Emission and absorption of infrared radiation

Question 48

June 2024 | 8463/2F | Original Q1

0 1 A group of stars is called a galaxy.

0 1 . 1 What is the name of our galaxy?

[1 mark]

Tick (✓) **one** box.

- Black Eye ☐
- Hockey Stick ☐
- Milky Way ☐
- Sculptor Dwarf ☐

0 1 . 2 The Sun is one of the stars in our galaxy.

What was the Sun originally formed from?

[1 mark]

Tick (✓) **one** box.

- Dust and gas ☐
- Heavy elements ☐
- Oxygen ☐

4.6.3.1 Emission and absorption of infrared radiation

Question 48 · continued

0 1 . 3 Which of the following forces was involved in the formation of the Sun?

[1 mark]

Tick (✓) **one** box.

- Electrostatic force ☐
- Gravitational force ☐
- Magnetic force ☐

0 1 . 4 Stars produce light because they release energy.

Complete the sentence.

Choose the answer from the box.

[1 mark]

combustion	**conduction**	**fusion**

The process which releases energy inside stars is _____.

0 1 . 5 Visible light and infrared radiation travel from the Sun to the Earth.

Which statement describes the time taken for visible light and infrared radiation to travel from the Sun to the Earth?

[1 mark]

Tick (✓) **one** box.

- Visible light takes less time than infrared radiation ☐
- Visible light takes the same time as infrared radiation ☐
- Visible light takes more time than infrared radiation ☐

4.6.3.1 Emission and absorption of infrared radiation

Question 48 · continued

0 1 . 6 Infrared radiation has a longer wavelength than visible light.

Complete the sentence.

Choose the answer from the box.

[1 mark]

smaller	**the same**	**greater**

Compared with the frequency of infrared radiation, the frequency of visible light is _____.

0 1 . 7 The Sun and the Earth both emit infrared radiation.

How does the rate of infrared radiation emitted by the Sun compare with the rate of infrared radiation emitted by the Earth?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Lower rate than the Earth ☐

Same rate as the Earth ☐

Greater rate than the Earth ☐

Reason _____

_____

8

4.6.3.1 Emission and absorption of infrared radiation

Question 49

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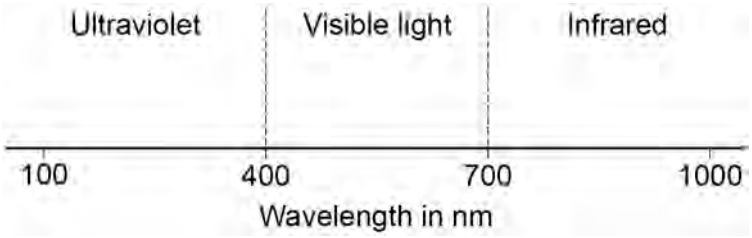
0 6 **Figure 10** shows the wavelengths of some types of electromagnetic radiation.

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 ☐

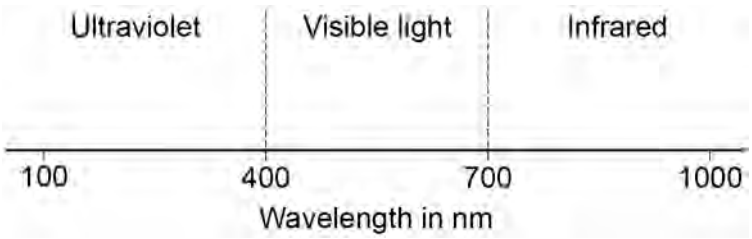
Question 6 continues on the next page

4.6.3.1 Emission and absorption of infrared radiation

Question 49 · 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 _____.

4.6.3.1 Emission and absorption of infrared radiation

Question 49 · continued

June 2024 | 8463/2F | Original Q6

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