AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.3.2

Perfect black bodies and radiation

Past-paper questions

Tier	**Higher**
Question groups	**15**
Available paper years	**2006–2023**

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.

4.6.3.2 Perfect black bodies and radiation

Question 01

November 2006 | PHY1B | Original Q2 | Legacy

QUESTION TWO

Electromagnetic radiation is often absorbed.

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

A current

B energy

C frequency

D substance

When electromagnetic radiation is absorbed, the . . . **1** . . . which absorbs it becomes hotter. This is because the radiation carries . . . **2** . . . . The radiation may create an alternating . . . **3** . . . with the same . . . **4** . . . as the radiation itself.

Turn over for the next question

4.6.3.2 Perfect black bodies and radiation

Question 02

June 2007 | PHY1A | Original Q3 | Legacy

QUESTION THREE

A student investigated the question: Does the type of surface affect how an object loses or gains heat? She carried out two experiments.

In her first experiment, she filled two cans with boiling water. One can had a dull, black surface. The other can had a shiny, silver surface.

Later, she measured the temperature of the water in each can.

These are her results.

	Starting temperature of the water	Temperature of the water 15 minutes later
Can with dull, black surface	100 °C	74 °C
Can with shiny, silver surface	100 °C	93 °C

3A The student wanted her experiment to be a fair test.

Which row of the table is most likely to give a fair test?

	Volume of cans	Volume of water	Metal of the cans	Shape of cans
1	same	different	same	same
2	same	same	different	same
3	same	same	same	different
4	same	same	same	same

3B If her results are reliable, the experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

1 better absorber of thermal radiation.

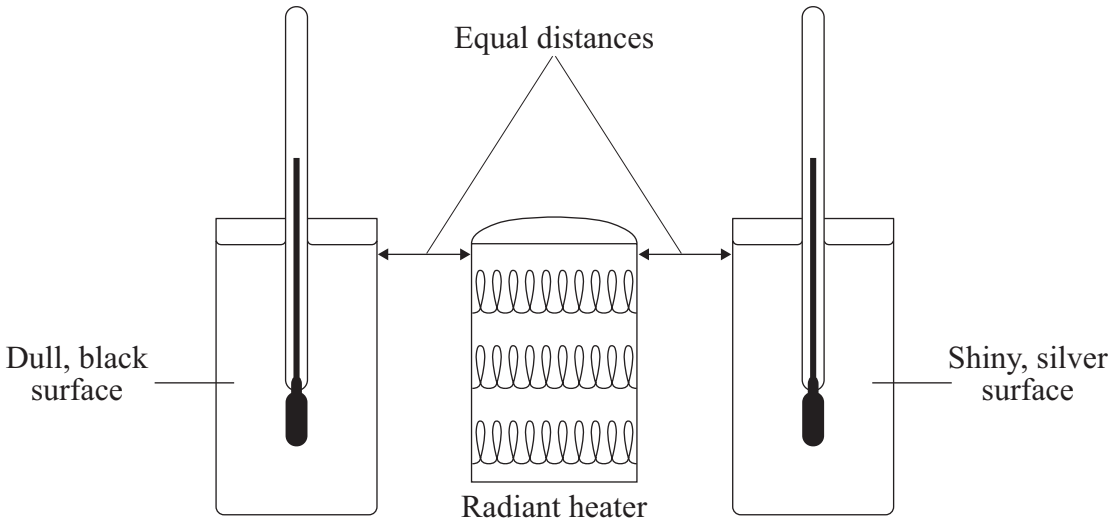
2 better conductor of thermal radiation.

3 better emitter of thermal radiation.

4 better reflector of thermal radiation

4.6.3.2 Perfect black bodies and radiation

Question 02 · continued



In her second experiment, the student put cold water in each can. She put a heater (which is a source of thermal radiation) between the cans. She switched the heater on and, ten minutes later, she measured the temperature of the water in each can.

These are the results of her second experiment.

	Starting temperature of the water	Temperature of the water 10 minutes later
Can with dull, black surface	16 °C	37 °C
Can with shiny, silver surface	16 °C	23 °C

3C If her results are reliable, the second experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

1 better absorber of thermal radiation.

2 better conductor of thermal radiation.

3 better emitter of thermal radiation.

4 better reflector of thermal radiation.

3D What was the average (mean) rate of the rise in temperature of the water in the can with a dull, black surface?

1 0.9 °C per minute

2 2.1 °C per minute

3 9 °C per minute

4 21 °C per minute

4.6.3.2 Perfect black bodies and radiation

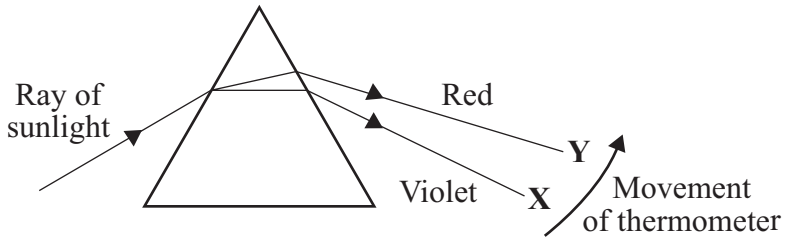
Question 03

June 2007 | PHY1B | Original Q6 | Legacy

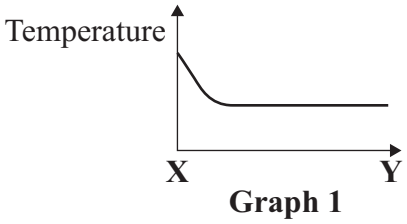
QUESTION SIX

When electromagnetic radiation is absorbed, the energy it carries makes the substance which absorbs it hotter and may create an alternating current of electricity.

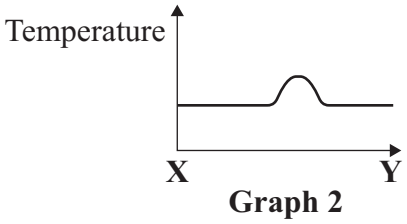
6A When sunlight passes through a prism, a visible spectrum forms. A thermometer is moved slowly from **X** to **Y**.



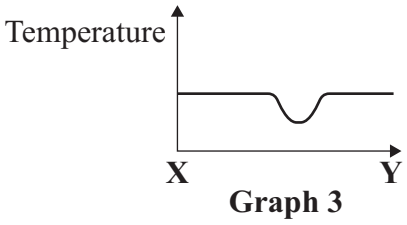
Which sketch graph shows the temperature change as the thermometer moves from **X** to **Y**?



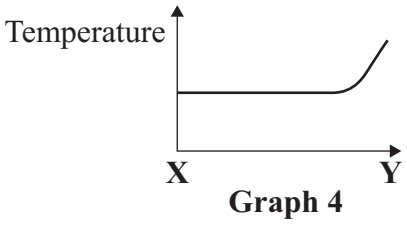
Graph 1



Graph 2



Graph 3



Graph 4

6B The absorption of electromagnetic radiation can create an alternating current in a wire.

This alternating current will have . . .

1 the same frequency as the electromagnetic radiation.

2 the same ionising power as the electromagnetic radiation.

3 the same speed as the electromagnetic radiation.

4 the same wavelength as the electromagnetic radiation.

4.6.3.2 Perfect black bodies and radiation

Question 03 · continued

6C Which factors most affect the absorption of electromagnetic radiation by living cells?

1 speed and wavelength

2 speed, wavelength and size of dose

3 wavelength and size of dose

4 size of dose

6D During the solar eclipse of 2001, four students shared their observations.

Which student's observation was correct?

Student	Observation
1	"It went both cold and dark at the same time."
2	"It went cold, then it went dark."
3	"It went cold, then warm again, then dark."
4	"It went dark, then light again, then cold."

4.6.3.2 Perfect black bodies and radiation

Question 04

November 2008 | PHY1BP | Original Q8 | Legacy

QUESTION EIGHT

This question is about two space telescopes.

The Hubble space telescope orbits the Earth at a distance of 569 km and detects visible light.

The James Webb space telescope is planned to be launched some time after 2013 and will orbit at about 1.5 million kilometres from the Earth and will detect infra red frequencies (rays).

8A The main advantage of the Hubble telescope being so far from Earth is the improvement in image quality.

This improvement is because . . .

1 there is little atmosphere to distort the data being received.

2 there is no light pollution from cities.

3 there is no gravity to distort the mirror in the telescope.

4 there is no need for access for service or repairs to the mirror in the telescope.

8B The James Webb space telescope should be able to receive data from distant galaxies billions of light years away from the Earth. It is shielded from the Sun to keep it at a temperature of –225°C and will contain a large mirror.

The reason that it is designed to detect infra red frequencies is that . . .

1 all the radiation emitted by the galaxies is in the infra red region of the spectrum.

2 infra red radiation can be detected in the dark.

3 much of the radiation we receive from galaxies is at infra red frequencies due to a significant red-shift.

4 we receive only infra red radiation from the galaxies.

8C The major reason for keeping the mirror so cold is to . . .

1 avoid the need to carry extra fuel to heat it.

2 keep it rigid.

3 minimise the infra red radiation from it which would confuse the data being collected.

4 stop it from melting.

4.6.3.2 Perfect black bodies and radiation

Question 04 · continued

8D There are also radio telescopes on Earth.
The longer the wavelength of the radiation being absorbed, the larger a telescope needs to be.

Which row in the table gives the correct order of size for the telescopes?

	Smallest ← → Largest		
1	James Webb telescope	Hubble telescope	Radio telescope
2	Radio telescope	James Webb telescope	Hubble telescope
3	Hubble telescope	James Webb telescope	Radio telescope
4	Hubble telescope	Radio telescope	James Webb telescope

Turn over for the next question

4.6.3.2 Perfect black bodies and radiation

Question 05

June 2009 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Some types of electromagnetic radiation from space are absorbed by the Earth's atmosphere.

	Short wavelength radio	Short wavelength microwaves	Infra red	Visible light	Ultraviolet	X-rays	Gamma rays
Percentage absorbed by atmosphere	0	95	96	5	98	100	100

Different objects or events in the universe emit different types of electromagnetic radiation.

	Gamma ray bursts	Nebulae	Pulsars	Stars	Universe background radiation
Radiation emitted	gamma rays	infra red	radio	all types	short wavelength microwaves

The planets and moons of the solar system reflect light from the Sun.

7A Early civilisations observed the sky with the naked eye.

Which objects did they see?

1 moons, nebulae and pulsars

2 gamma ray bursts, moons and planets

3 nebulae and pulsars

4 moons, planets and stars

7B Telescopes that could detect electromagnetic waves of the lowest frequency were built in the 20th century. These telescopes are on the surface of the Earth.

From the information in the tables, which of the following, which could not have been observed before, could then be easily observed from the Earth's surface?

1 pulsars

2 gamma ray bursts

3 nebulae

4 stars

4.6.3.2 Perfect black bodies and radiation

Question 05 · continued June 2009 | PHY1BP | Original Q7 | Legacy

7C In 1989, the background radiation from the universe was mapped from a telescope in space.

Why was this **not** done with telescopes based on Earth?

1 Because only 2% of ultraviolet radiation penetrates Earth's atmosphere.

2 Because only 4% of infra red radiation penetrates Earth's atmosphere.

3 Because only 5% of short wavelength microwave radiation penetrates Earth's atmosphere.

4 Because only 95% of visible radiation penetrates Earth's atmosphere.

7D The first table suggests that, with the exception of . . .

1 radio, the percentage of radiation absorbed by the atmosphere, increases with increasing wavelength.

2 radio, the percentage of radiation absorbed by the atmosphere, decreases with increasing wavelength.

3 visible light, the percentage of radiation absorbed by the atmosphere, increases with increasing wavelength.

4 visible light, the percentage of radiation absorbed by the atmosphere, decreases with increasing wavelength.

4.6.3.2 Perfect black bodies and radiation

Question 06

November 2009 | PHY1BP | Original Q5 | Legacy

QUESTION FIVE

The Sun emits different types of radiation. These types of radiation travel from the Sun until they reach the Earth's atmosphere. In the atmosphere, some types of radiation are reflected, some are absorbed and some are transmitted to the Earth's surface, where they cause the Earth to warm up.

Human activity has produced large amounts of carbon dioxide gas which has increased the amount of carbon dioxide in the atmosphere. The carbon dioxide helps to trap the Earth's heat and so contributes to the 'greenhouse' effect, which results in the Earth becoming hotter.

5A On their journey from the Sun to the Earth, all the types of radiation travel with the same . . .

1 energy.

2 frequency.

3 speed.

4 wavelength.

5B The ozone layer in the Earth's atmosphere absorbs some of the Sun's ultraviolet radiation.

Ultraviolet radiation can . . .

1 be detected by your eyes.

2 give your skin a suntan.

3 cool your skin.

4 pass through flesh but not bone.

5C Most of the Sun's infra red radiation is emitted with a wavelength of about 0.5 micrometres. Most of the Earth's infra red radiation is emitted with a wavelength of about 10 micrometres.

Carbon dioxide molecules in the atmosphere can absorb infra red radiation with wavelengths between 2 micrometres and 17 micrometres.

1 micrometre = 1 millionth of a metre

Therefore, the carbon dioxide will . . .

1 absorb the Sun's infra red radiation and absorb the Earth's infra red radiation.

2 absorb the Sun's infra red radiation and transmit the Earth's infra red radiation.

3 transmit the Sun's infra red radiation and absorb the Earth's infra red radiation.

4 transmit the Sun's infra red radiation and transmit the Earth's infra red radiation.

4.6.3.2 Perfect black bodies and radiation

5D As an object gets hotter, its main infra red emission wavelength gets shorter.

If human activity continues to increase the amount of carbon dioxide gas in the atmosphere, then the Earth will emit . . .

1 more energy, with a shorter main emission wavelength.

2 more energy, with the same main emission wavelength.

3 the same energy, with a shorter main emission wavelength.

4 the same energy, with the same main emission wavelength.

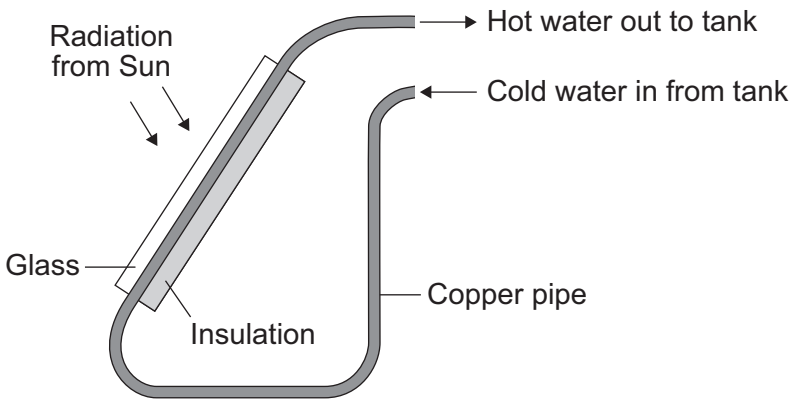
Turn over for the next question

4.6.3.2 Perfect black bodies and radiation

Question 07

QUESTION EIGHT

The diagram shows a solar panel fitted to the roof of a house.
The solar panel is used for heating water.



- The panel is 5 m long and 2 m wide.
- Each square metre of panel receives 0.6 kJ of solar energy each second when the Sun is shining.

8A The solar panel collects . . .

1 infra red radiation from the Sun and transforms it into electricity.

2 infra red radiation from the Sun and uses it to heat water.

3 light energy from the Sun and transforms it into electricity.

4 ultraviolet radiation from the Sun and uses it to heat water.

8B The total amount of solar energy, in kJ, collected by the panel in 5 hours when the Sun is shining is . . .

1 1 800

2 10 800

3 21 600

4 108 000

4.6.3.2 Perfect black bodies and radiation

8C The pipe inside the solar panel has a black surface because . . .

1 black surfaces are good reflectors of radiation.

2 black surfaces are good absorbers of radiation.

3 black surfaces are good emitters of radiation.

4 black surfaces stay hot for longer.

8D The hot water tank is placed higher than the solar panel.

This is because . . .

1 heated water contracts, and sinks.

2 heated water contracts, and rises.

3 heated water expands, and rises.

4 heated water expands, and sinks.

Turn over for the next question

4.6.3.2 Perfect black bodies and radiation

Question 08

November 2010 | PHY1BP | Original Q9 | Legacy

QUESTION NINE

Four hundred years ago, Galileo pointed his small, primitive telescope at the night sky.

His telescope had lenses to focus light from the stars.

Today, much larger optical telescopes use large curved mirrors to focus light. The largest single-piece mirror has a diameter of 8.4 m. If the diameter was made any larger, the mirror would deform under its own weight. Very large telescopes use smaller mirrors linked together.

The table gives the effective diameters of the mirrors in several large optical telescopes.

Telescope	Keck	Giant Magellan Telescope (GMT)	Thirty Metre Telescope(TMT)	Very Large Telescope (VLT)
Effective diameter of mirror in metres	10.0	27.0	30.0	32.8

9A The TMT has nine times the light-collecting power of the Keck telescope mirror.

This is because the light-collecting power of a telescope is . . .

1 directly proportional to the diameter of the mirror.

2 inversely proportional to the diameter of the mirror.

3 directly proportional to the square of the diameter of the mirror.

4 inversely proportional to the square of the diameter of the mirror.

9B The VLT is located in a desert high in the mountains of South America.

The VLT produces sharp images because . . .

1 the VLT is nearer to the stars than optical telescopes at sea level.

2 light rays are more easily reflected higher in the atmosphere.

3 the night sky in the desert is clear and dark.

4 at the top of a mountain the telescope weighs less.

4.6.3.2 Perfect black bodies and radiation

9C Some telescopes are put into orbit round the Earth.

This is so that the telescopes . . .

1 can detect only visible light.

2 can detect only the electromagnetic waves that the Earth's atmosphere absorbs.

3 can detect visible light and sound waves.

4 can detect electromagnetic waves that do not reach the Earth's surface.

9D The smaller the diameter of a telescope, the higher the frequency of the waves that it can detect.

Pulsars are objects in space that emit radio waves. Pulsars were discovered using radio telescopes based on Earth.

The telescope that first detected the radiation from a pulsar had a diameter . . .

1 about the same size as the diameter of an optical telescope because the frequencies it detects are about the same.

2 smaller than the diameter of an optical telescope because the frequencies it detects are lower.

3 larger than the diameter of an optical telescope because the frequencies it detects are higher.

4 larger than the diameter of an optical telescope because the frequencies it detects are lower.

END OF TEST

4.6.3.2 Perfect black bodies and radiation

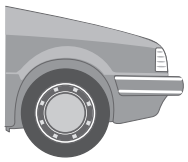
Question 09

March 2011 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about controlling some forms of radiation.

1



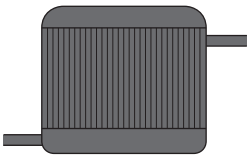
Car headlight has a shiny coating inside

2



Camera is matt black inside

3



Car radiator is painted matt black

4



Soil is covered with black plastic

Match statements, **A**, **B**, **C** and **D**, with diagrams **1**–**4**.

A is designed to increase the rate at which infra red radiation is absorbed

B is designed to increase the rate at which infra red radiation is emitted

C is designed to improve the ability to reflect visible light

D is designed to prevent the reflection of visible light

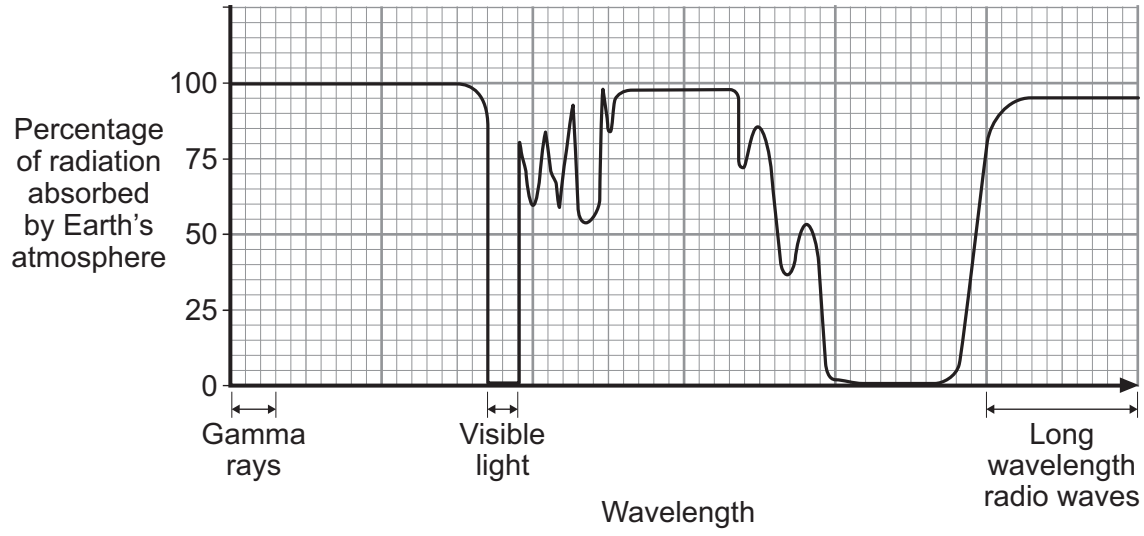
4.6.3.2 Perfect black bodies and radiation

Question 10

March 2011 | PHY1BP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows the absorption of electromagnetic radiation by the Earth's atmosphere.



4A The diagram shows that . . .

1 all wavelengths of gamma radiation reach the Earth's surface.

2 all wavelengths of radio waves reach the Earth's surface.

3 all wavelengths of ultraviolet radiation reach the Earth's surface.

4 all wavelengths of visible light reach the Earth's surface.

4B Some objects in space emit X-rays.

Where would you put a telescope to detect these X-rays?

1 above the Earth's atmosphere

2 at the top of a hill

3 at ground level in a hot desert

4 at ground level in the Antarctic

4.6.3.2 Perfect black bodies and radiation

Question 10 · continued

The table gives information about some space telescopes.

Name	Hubble	Compton	Chandra	Spitzer
Launched in	1990	1991	1999	2003
Detects	infra red rays ultraviolet rays visible light	gamma rays	X-rays	infra red rays

4C Which statement about these space telescopes can be deduced from the information in the table?

1 They all collect data using mirrors.

2 They all detect electromagnetic radiation.

3 They are all in space at present.

4 They were all used to study the Earth.

4D From the information in the table, which one of the following emissions could be detected by one of these space telescopes?

1 alpha particles

2 nuclear radiation

3 radio waves

4 sound waves

4.6.3.2 Perfect black bodies and radiation

Question 11

March 2011 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

In 2009, the European Space Agency launched two space telescopes: the Herschel and the Planck.

Also in 2009, the US space shuttle Atlantis was launched. Atlantis carried seven astronauts to service the Hubble space telescope.

The table gives information about the three space telescopes.

	Hubble	Herschel	Planck
Distance from Earth	560 km	1.5 million km	1.5 million km
Radiation detected	Visible light, ultraviolet	Infra red	Microwaves
Cost of 2009 launch	£1 billion (for servicing)	Total for the 2 telescopes - £1.7 billion	
Objects observed	Distant stars and galaxies	Early development of galaxies	Radiation left over from the 'Big Bang'

7A The Hubble and Herschel telescopes both contain mirrors. The diameter of the mirror in the Herschel telescope is 50 % larger than the diameter of the main mirror in the Hubble telescope.

This means that the . . .

1 Herschel mirror is capable of collecting more energy each second than the Hubble mirror.

2 cost of the Herschel telescope is higher than the cost of the Hubble servicing mission.

3 Herschel telescope is much lighter than the Hubble telescope.

4 orbit of the Herschel telescope is much larger than the orbit of the Hubble telescope.

7B The larger the diameter of a telescope mirror, the longer the wavelength of radiation it can detect.

The order of increasing diameters for the space telescopes in the table is . . .

1 Herschel; Hubble; Planck.

2 Hubble; Herschel; Planck.

3 Planck; Herschel; Hubble.

4 Planck; Hubble; Herschel.

4.6.3.2 Perfect black bodies and radiation

Question 11 · continued

7C The table refers to radiation left over from the ‘Big Bang’.

What is the ‘Big Bang’?

1 a theory that the light from distant galaxies shows a red-shift

2 an observation that the universe is expanding

3 a theory that the universe began from a very small initial point

4 evidence that distant galaxies are moving away from the Earth

7D A survey showed that a lot of people living in the UK think that the money spent on the launches in 2009 would have been better spent on feeding starving people in the developing world.

The people in the survey are concerned about . . .

1 political and scientific issues.

2 political and environmental issues.

3 economic and environmental issues.

4 economic and ethical issues.

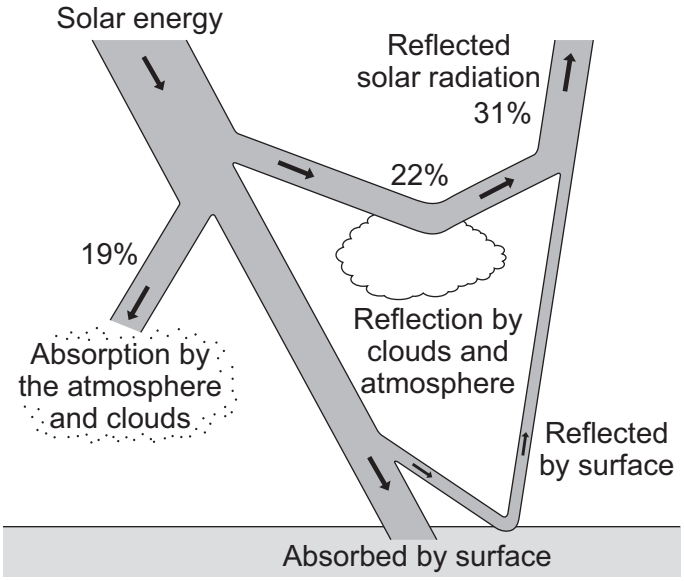
4.6.3.2 Perfect black bodies and radiation

Question 12

March 2011 | PHY1BP | Original Q9 | Legacy

QUESTION NINE

The diagram shows what happens to solar energy as it enters the Earth's atmosphere on one day.



9A What percentage of the energy is absorbed by the Earth's surface?

1 28 %

2 50%

3 72 %

4 78 %

9B Solar radiation consists of different groups from the electromagnetic spectrum. In the ultraviolet region there are three main types, as shown in the diagram below.

Gamma	X-ray	Ultraviolet **UVC UVB UVA**	Visible	Infra red	Microwave	Radio

Which of the following statements is correct?

1 UVA rays have the same frequency, longer wavelength and travel at a faster speed than UVB rays.

2 UVB rays have a lower frequency, the same wavelength and travel at the same speed as UVC rays.

3 UVB rays have a lower frequency, a longer wavelength and travel at the same speed as UVC rays.

4 UVB rays have a higher frequency, a shorter wavelength and travel at a slower speed than UVC rays.

4.6.3.2 Perfect black bodies and radiation

Question 12 · continued

A measure of the ability of a surface to reflect sunlight is called the 'albedo' of the surface.

The *albedo* has a range of values from 0 (no reflection) to 1 (total reflection).

The table below gives the *albedo* values for some surfaces on the Earth.

Surface	Albedo
forest	0.06 – 0.14
crops	0.15 – 0.25
dry soil	0.24 – 0.35
ice	0.33 – 0.38
dry sand	0.36 – 0.44
old snow	0.42 – 0.60
new concrete	0.50 – 0.60
fresh snow	0.80 – 0.90

9C From the table, which of the following surfaces has the biggest range of *albedo* values?

1 crops

2 dry sand

3 dry soil

4 old snow

9D The average *albedo* of the Earth – atmosphere system is currently about 0.30. Scientists think that this value may rise over the next 50 years.

Which one of the following statements supports their idea?

1 More crops are being produced.

2 The Earth is getting further away from the Sun.

3 There is a decrease in forest area and an increase in urban areas.

4 Less fresh snow is being deposited because of climate change.

END OF TEST

4.6.3.2 Perfect black bodies and radiation

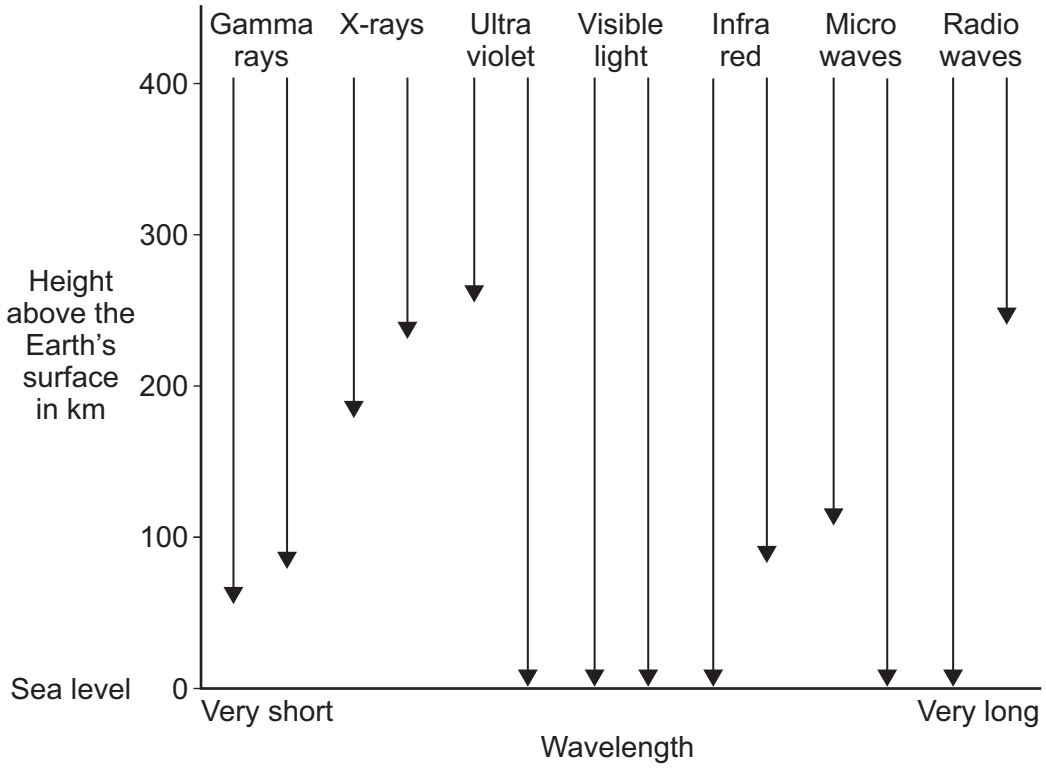
Question 13

June 2011 | PHY1BP | Original Q4 | Legacy

QUESTION FOUR

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.



4A 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.

4B 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.

4.6.3.2 Perfect black bodies and radiation

Question 13 · continued June 2011 | PHY1BP | Original Q4 | Legacy

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

4C The Hubble telescope detects visible light.

Which telescope detects infra red radiation?

1 Chandra

2 FUSE

3 INTEGRAL

4 Spitzer

4D Which telescope detects X-rays?

1 Chandra

2 FUSE

3 INTEGRAL

4 Spitzer

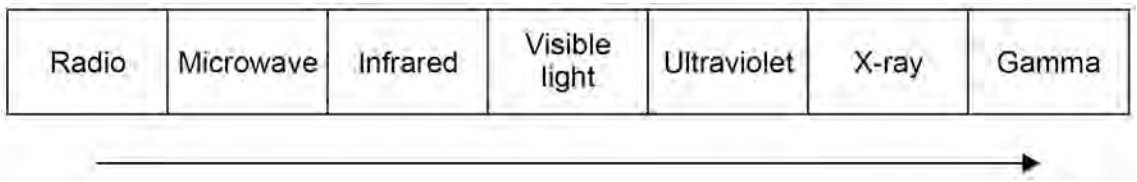
4.6.3.2 Perfect black bodies and radiation

Question 14

June 2019 | 8463/2H | Original Q7

0 7 . 1 **Figure 12** shows the electromagnetic spectrum.

Figure 12



Which statement is correct for the direction of the arrow in **Figure 12**?

[1 mark]

Tick (✓) **one** box.

The wavelength decreases and the wave speed in air increases. ☐

The frequency increases and the wavelength increases. ☐

The frequency increases and the wave speed in air stays the same. ☐

The wavelength increases and the wave speed in air increases. ☐

0 7 . 2 Explain how the properties of X-rays make them suitable for the medical imaging of bones.

[2 marks]

Question 7 continues on the next page

4.6.3.2 Perfect black bodies and radiation

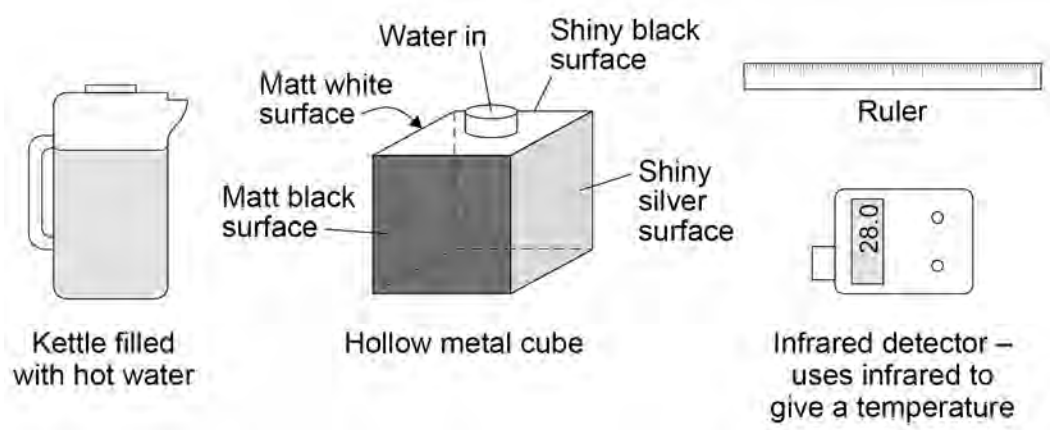
Question 14 · continued

A student investigated the infrared radiation emitted from the sides of a hollow metal cube.

The sides of the cube are different colours or textures.

Figure 13 shows the equipment used.

Figure 13



Boiling water was poured into the cube. The amount of infrared radiation emitted from each vertical surface was then measured.

0 7 . 3 Boiling water is a hazard in this investigation.

Suggest how the risk of harm could be reduced in this investigation.

[1 mark]

0 7 . 4 What is the control variable in this investigation?

[1 mark]

4.6.3.2 Perfect black bodies and radiation

Question 14 · continued

Table 2 shows the results.

Table 2

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

0 7 . 5 The four temperature values in **Table 2** cannot be used to show that the infrared detector gives precise readings.

Give the reason why.

[1 mark]

0 7 . 6 The student looked at the data in **Table 2** and concluded:

'A black surface always emits more infrared radiation than a white surface.'

Explain how using an infrared detector with a resolution of 1 °C would have affected the student's conclusion.

[2 marks]

4.6.3.2 Perfect black bodies and radiation

Question 14 · continued

Albedo is a measure of the amount of solar radiation reflected by an object compared to the total solar radiation incident on the object.

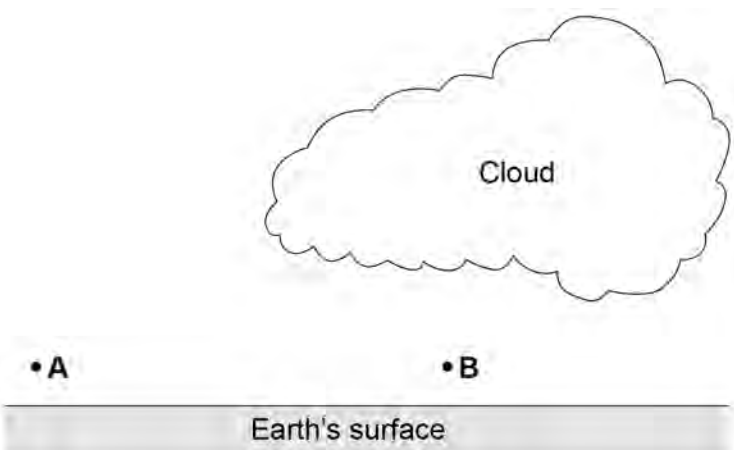
A perfect reflector has an Albedo value of 1.0
A perfect absorber has an Albedo value of 0.0

0 7 . 7 What is the Albedo value of a perfect black body?

[1 mark]

0 7 . 8 **Figure 14** shows two points, **A** and **B**, just above the Earth's surface.

Figure 14



The average Albedo value of the Earth's surface is 0.3
The Albedo value of thick cloud varies between 0.6 and 0.9

At night the air at point **A** cools faster than the air at point **B**.

Explain why.

[3 marks]

12

4.6.3.2 Perfect black bodies and radiation

Question 15

June 2023 | 8463/2H | Original Q1

0 1 Infrared waves are transverse waves.

0 1 . 1 Complete the sentence.

[1 mark]

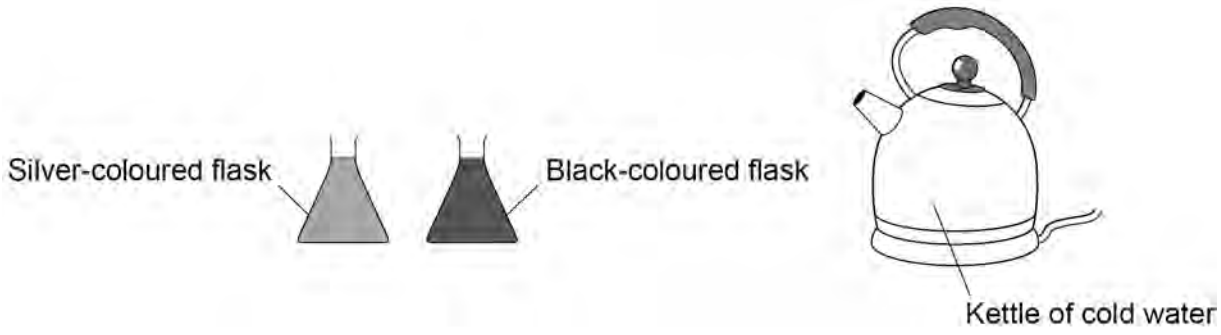
In a transverse wave, the direction of oscillation is _____

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 1 shows some of the equipment used.

Figure 1



4.6.3.2 Perfect black bodies and radiation

Question 15 · continued

0 1 . 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 1 continues on the next page

4.6.3.2 Perfect black bodies and radiation

Question 15 · continued

0 1 . 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 _____

_____

Question 15 · 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 1 . 4 What was the dependent variable in this investigation?

[1 mark]

0 1 . 5 **Table 1** shows the results.

Table 1

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 1**.

[2 marks]

1

2

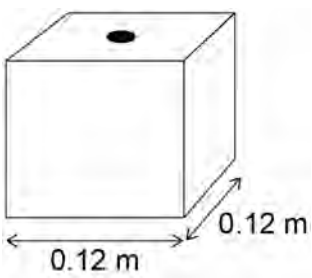
4.6.3.2 Perfect black bodies and radiation

Question 15 · continued

Figure 2 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 2



Use the Physics Equations Sheet to answer questions **01.6** and **01.7**.

0 1 . 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 = $\frac{\text{area}}{\text{force}}$ ☐

4.6.3.2 Perfect black bodies and radiation

Question 15 · continued

0 1 . 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