OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE
COMBINED SCIENCE DOUBLE AWARD

9204/PC PHYSICS – PAPER 3 – CORE TIER

Specimen Material 1 hour 45 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a calculator
- the Physics Equation sheet.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname

Forename(s)

Candidate signature _____

Answer **all** questions in the spaces provided.

1 Adaptors can be used to connect up to four appliances in parallel to one 110 V mains socket.

Table 1 gives a list of appliances and the current in them when they are connected to the mains.

Table 1

Appliance	**Current in A**
computer	1
television	2
toaster	9
vacuum cleaner	8
washing machine	10

0 1 . 1 What is the current in the adaptor when the television, computer and vacuum cleaner are plugged into the adaptor?

Tick **one** box.

[1 mark]

- 11 A ☐
- 12 A ☐
- 20 A ☐
- 30 A ☐

0 1 . 2 Calculate the total power when the television, computer and vacuum cleaner are plugged into the adaptor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Power = _____ W

0 1 . 3 The adaptor is fitted with a 13 A fuse.

State and explain what would happen to the fuse if the washing machine and toaster are plugged into the adaptor and turned on.

[2 marks]

0 1 . 4 For safety reasons, it is important that the toaster has an earth wire connected to its outer metal case.

Explain why.

[2 marks]

0 1 . 5 The computer does not have an earth wire. It is safe to use because it is **double insulated**.

Explain what the term **double insulated** means.

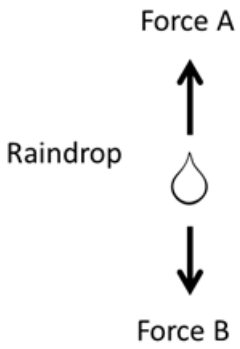
[2 marks]

2 **Figure 1** shows a rain drop falling.

After falling from a cloud, it accelerates to a constant velocity of 5 m/s.

It then falls for 500 seconds at 5 m/s before hitting the ground.

Figure 1



0 2 . 1 What is force **A**?

Tick **one** box.

[1 mark]

- air resistance ☐
- internal ☐
- tension ☐
- weight ☐

0 2 . 2 What is force **B**?

Tick **one** box.

[1 mark]

- air resistance ☐
- tension ☐
- upthrust ☐
- weight ☐

0 2 . 3 Explain why the raindrop falls at a constant velocity.

[2 marks]

0 2 . 4 The raindrop fell for 100 m before reaching a constant velocity.

Calculate the total distance the raindrop fell.

Use the correct equation from the Physics Equations Sheet.

[4 marks]

Distance = _____ m

0 2 . 5 When the raindrop started to fall from the cloud it had an acceleration of 9.8 m/s^2.

The raindrop had a mass of 0.1 g.

Calculate the size of the resultant force on the raindrop.

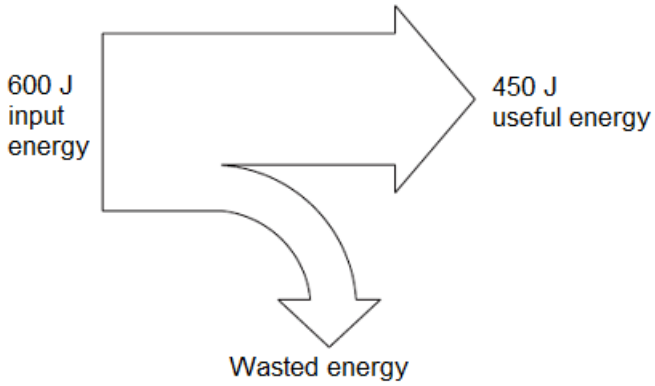
Use the correct equation from the Physics Equations Sheet.

[3 marks]

resultant force _____ N

3 The Sankey diagram in **Figure 2** is for an low energy lamp.

Figure 2



0 3 . 1 Calculate the energy wasted by the low energy lamp.

Tick **one** box.

[1 mark]

150 J ☐

180 J ☐

480 J ☐

570 J ☐

0 3 . 2 Describe what happens to the energy wasted by the low energy lamp.

[1 mark]

_____

_____

0 3 . 3 Calculate the efficiency of the low energy lamp

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Efficency = _____

0 3 . 4 It takes the low energy lamp 20 seconds to transfer 600 J of energy.

Calculate the power of the low energy lamp.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Power = _____ W

A company that makes filament lamps and LEDs provides information about some of their products.

Table 2 shows some of this information.

Table 2

	Power in watts	Lifetime in hours	Cost of bulb in £
Filament lamp	60	1 250	2.00
LED	12	50 000	16.00

0 3 . 5 Suggest why it is important to confirm this information independently.

[1 mark]

0 3 . 6 A homeowner is thinking about replacing his filament lamps with LEDs.

A 12 W LED provides the same amount of light as a 60 W filament lamp.

Suggest reasons why the homeowner is likely to choose LED.

Use the information given in **Table 2**.

[2 marks]

0 4 . 1 Draw one line from each circuit symbol to its correct name.

[3 marks]

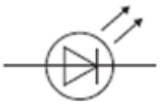
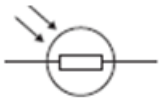
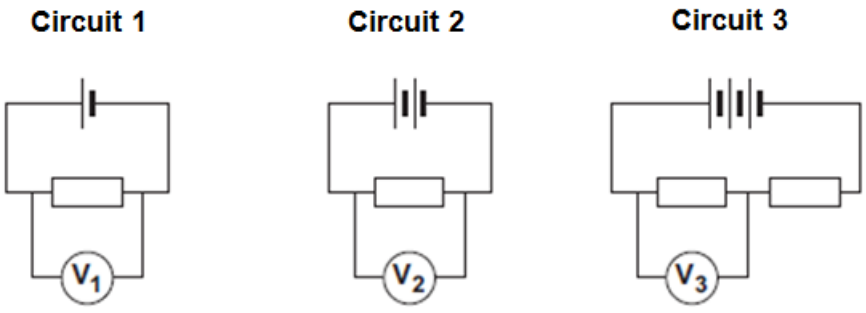
Circuit symbol	Name
	Diode
	Light-dependent resistor (LDR)
	Lamp
	Light-emitting diode (LED)

Figure 3 shows three circuits.

The resistors in the circuits are identical.

Each of the cells has a potential difference of 1.5 volts.

Figure 3



0 4 . 2 Use the correct answer from the box to complete the sentence.

[1 mark]

half	twice	the same as

The resistance of circuit **1** is _____ the resistance of circuit **3**.

0 4 . 3 Calculate the reading on voltmeter V_2.

[1 mark]

Voltmeter V_2 reading = _____ V

0 4 . 4 Which voltmeter, V_1, V_2 or V_3, will give the lowest reading?

Tick **one** box.

[1 mark]

V_1 ☐

V_2 ☐

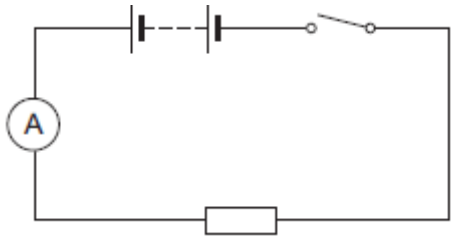
V_3 ☐

Question 4 continues on the next page

A student wanted to find out how the number of resistors affects the current in a series circuit.

Figure 4 shows the circuit used by the student.

Figure 4



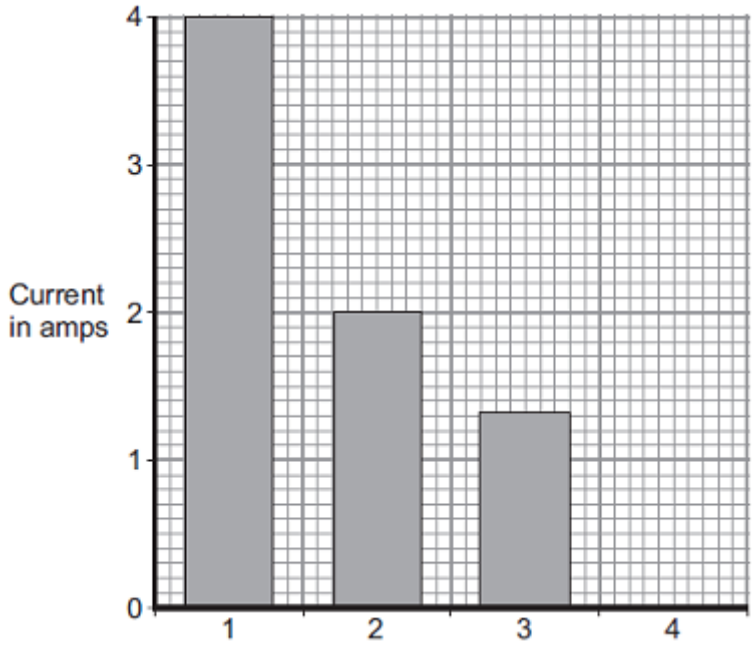
The student started with one resistor and then added more identical resistors to the circuit.

Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

Figure 5 shows three of the results obtained by the student.

Figure 5



0 4 . 5 To get valid results, the student kept one variable the same throughout the experiment.

[1 mark]

0 4 . 6 The bar chart in **Figure 5** is not complete.

The result using 4 resistors is not shown.

Complete the bar chart to show the current in the circuit when 4 resistors were used.

[2 marks]

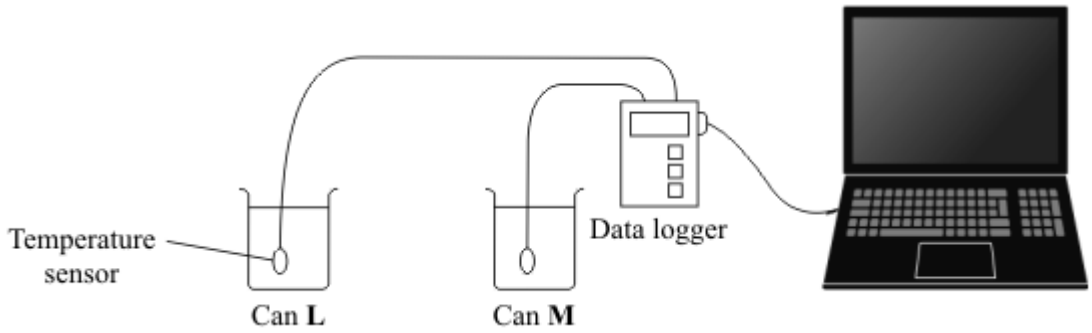
0 4 . 7 What conclusion should the student make from the bar chart?

[1 mark]

_____

_____

5 A student was asked to investigate the temperature change of two metal cans, **L** and **M**. The cans were identical except for the outside colour.

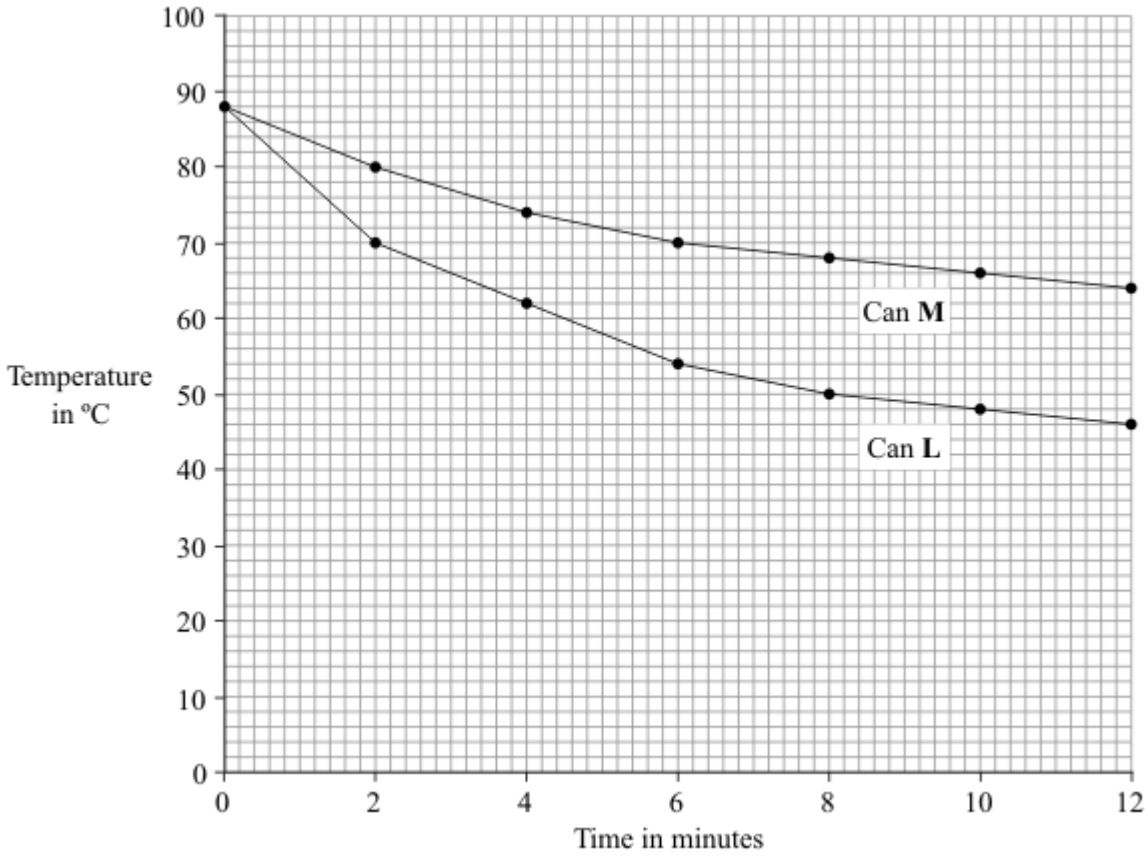


The student filled the two cans with equal volumes of hot water.

He then placed the temperature sensors in the water and started the data logger.

The computer used the data to draw the graph in **Figure 6**.

Figure 6



0 5 . 1 What is the initial temperature of both cans?

Tick **one** box.

[1 mark]

- 20 °C ☐
- 25 °C ☐
- 45 °C ☐
- 88 °C ☐

0 5 . 2 For can **L**, state the temperature drop of the water:

[2 marks]

in the **first** two-minute interval

in the **second** two-minute interval.

0 5 . 3 In both cans the water cooled faster at the start of the investigation than at the end of the investigation. Why?

[1 mark]

0 5 . 4 One can was black on the outside and the other can was white on the outside.

[3 marks]

What colour was can **L**?

Explain the reason for your answer.

0 5 . 5 The two cans were left for an hour and the temperature was recorded again. What temperatue are the cans at?

Tick **one** box.

[1 mark]

- Can **L** will be the same temperature as Can **M** ☐
- Can **L** will be at a higher temperature than Can **M** ☐
- Can **L** will be at a lower temperature than Can **M** ☐
- Can **L** and Can **M** will still be decreasing in temperature ☐

0 5 . 6 The student records the rate of temperature drop of a third can that was wrapped in cloth.

Draw a third line on the graph in **Figure 6** to show what you would predict the rate of temperature drop to be.

[2 marks]

0 6 . 1 Starting with the smallest, list the following in order of increasing size.

[1 mark]

Universe **Earth** **Milky Way** **Sun**

Smallest _____ Largest

0 6 . 2 Which one of the following describes the process by which energy is given out in stars?

Tick **one** box.

[1 mark]

Atomic nuclei inside the star join together. ☐

Atomic nuclei inside the star split apart. ☐

Combustion of the gases in the star ☐

Gases inside the star burn. ☐

0 6 . 3 Draw a ring around a phrase from each pair to complete the sentence.

[1 mark]

Stars are **stable / unstable** during the 'main sequence' period of their life cycle because the gravitational forces acting **inwards to / outwards from** the centre of the star **just balance / are greater than** the total pressure pushing out.

0 6 . 4 **Table 3** gives an estimated time for the number of years that three stars, **X**, **Y** and **Z**, will be in the 'main sequence' period of their life cycle.

Table 3

Star	Relative mass of the star compared to the Sun	Estimated 'main sequence' period in millions of years
X	0.1	4 000 000
Y	1.0	9 000
Z	40.0	200

This data suggests that there is a pattern linking the mass of a star and the number of years the star is in the 'main sequence' period of its life cycle.

Describe the pattern suggested by the table.

[1 mark]

0 6 . 5 Suggest why scientists cannot give the exact number of years a star will be in the 'main sequence' period.

[1 mark]

0 6 . 6 Nuclear fusion is the process by which energy is released in stars.

Use the data in the table to describe how the rate at which energy is released by a star is related to the mass of the star.

[2 marks]

0 6 . 7 Describe the life cycle of a **large star** after its main sequence

[3 marks]

7 Atoms contain three types of particle.

0 7 . 1 Which particles are found in the nucleus of an atom?

Tick **one** box.

[1 mark]

electrons and neutrons ☐

electrons and protons ☐

neutrons and protons ☐

protons, electrons and neutrons ☐

Table 4 gives information about four radioactive isotopes.

Table 4

Isotope	Type of radiation emitted	Half-life
iridium-192	gamma ray	74 days
polonium-210	alpha particle	138 days
polonium-213	alpha particle	less than 1 second
technetium-99	gamma ray	6 hours

0 7 . 2 Two isotopes of polonium are given in **Table 4**.

Compare the two isotopes of polonium in terms of the particles in their nuclei.

[1 mark]

_____

_____

0 7 . 3 A doctor injects a patient with a very small dose of technetium-99 to monitor the blood flow through the patient's heart.

The radiation detected outside of the patient's body can be used to see if the heart is working correctly.

Explain why technetium-99 is the most suitable for this use.

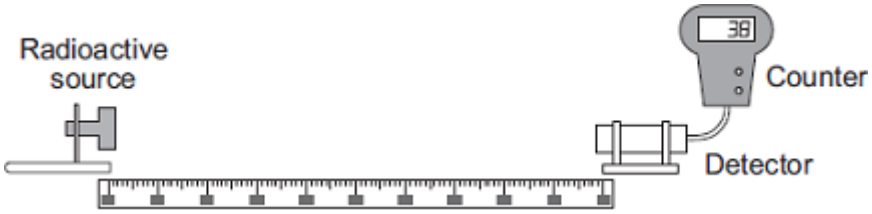
[2 marks]

Question 7 continues on the next page

A teacher used the equipment shown in the diagram to measure the count rate at different distances from a radioactive source.

The detector detected radiation. The number detected per minute is called the count rate.

Figure 7



Her results are shown in **Table 5**.

Table 5

Distance in metres	Count rate in counts per minute	Corrected count rate in counts per minute
0.4	143	125
0.6	74	56
0.8	49	31
1.0	38	20
1.2	32	14
1.4	28	10
1.6	18	0
1.8	18	0
2.0	18	0

0 7 . 4 Calculate, using data from **Table 5**, the value of the background count rate.

[1 mark]

Background count rate = _____counts per minute

0 7 . 5 Name the type of error caused by the background count in this experiment.

[1 mark]

_____

0 7 . 6 The radioactive source used in the demonstration emits only one type of radiation.

How can you tell from the data in the table that the radioactive source is **not** an alpha emitter?

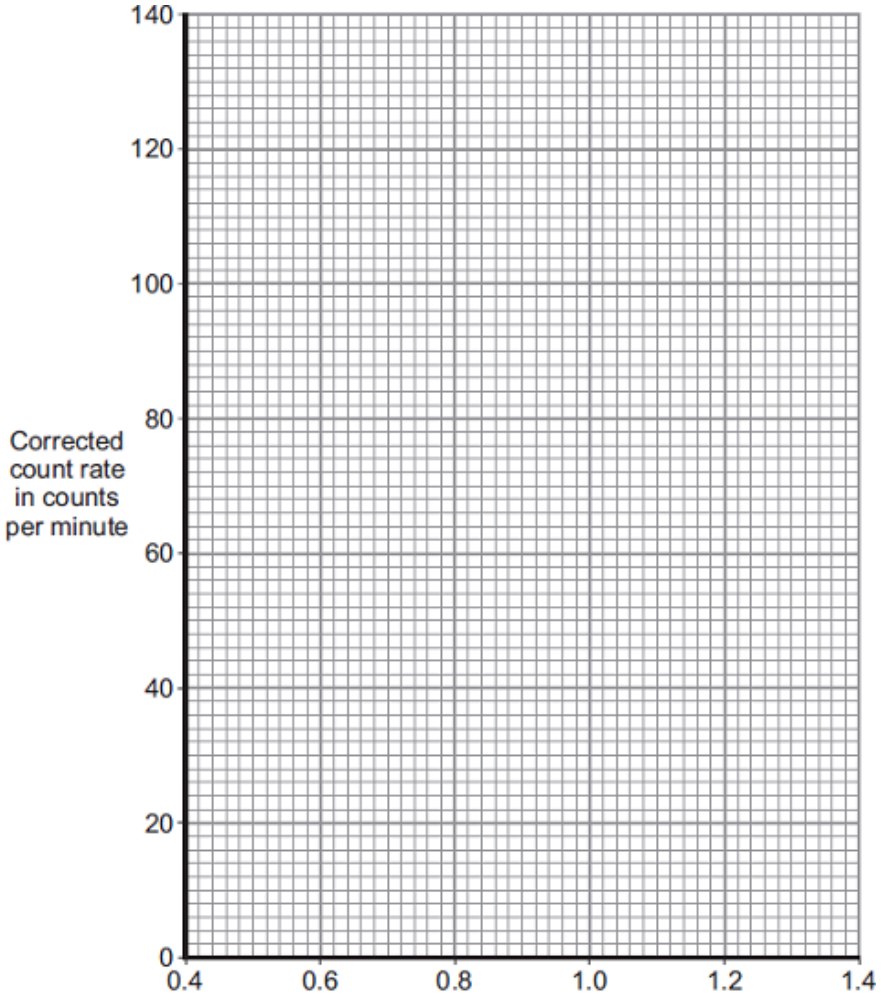
[1 mark]

0 7 . 7 Plot a graph of corrected count rate against distance for distances between 0.4 m and 1.4 m.

Draw a line of best fit to complete the graph in **Figure 8**.

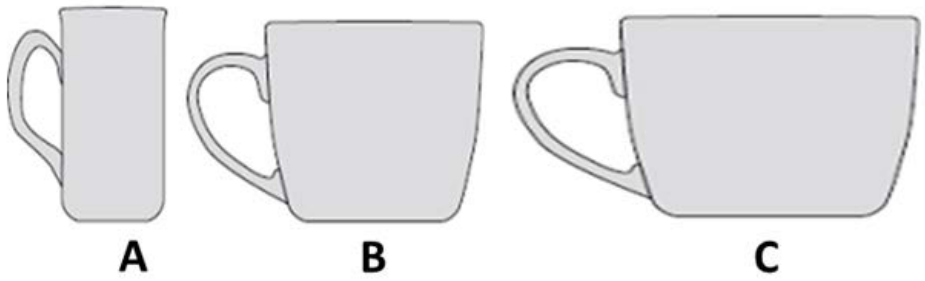
[3 marks]

Figure 8



8 The diagram shows three cups.

A student would like to investigate the rate of cooling when each cup is filled with hot water.



0 8 . 1 Write a method to perform this investigation.

Include:

- an equipment list
- the independent variable
- the dependent variable
- the variables you need to control
- what you will need to measure
- safety issues.

[6 marks]

0 8 . 2 Complete the **headings** in the table of results to collect this data.

[2 marks]

0 8 . 3 The table of results above does not allow any room to take repeat readings.

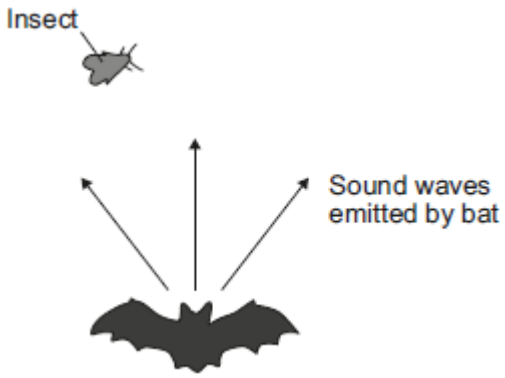
Suggest **two** reasons why it is always a good idea to repeat your experiment.

[2 marks]

9 Bats use the reflection of high pitched sound waves to determine the position of objects.

Figure 9 shows a bat and an insect flying in front of the bat.

Figure 9



0 9 . 1 What determines the pitch of a sound wave?

Tick **one** box.

[1 mark]

amplitude ☐

frequency ☐

velocity ☐

0 9 . 2 State the name given to reflected sound waves.

[1 mark]

_____

0 9 . 3 The bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

[2 marks]

_____

_____

Speed = _____ m/s

0 9 . 4 Sound waves are longitudinal.

Describe a longitudinal sound wave.

[2 marks]

Infrared and microwaves are two types of electromagnetic radiation.

0 9 . 5 State **one** example of the use of each type of radiation for communication.

[2 marks]

Infrared

Microwaves

0 9 . 6 Some of the properties of infrared and microwaves are the same.

State **two** of these properties.

[2 marks]

10 Sweating helps to prevent people from getting too hot.

1 0 . 1 When sweat evaporates, it cools the skin.

Explain why.

[4 marks]

1 0 . 2 Higher temperature increases the rate at which sweat will evaporate from a person's skin.

State **two** other factors that will increase the rate of evaporation.

[2 marks]

Air conditioning units are used to cool a room.

Warm air enters the air conditioning unit and the air is cooled.

1 0 . 3 Air conditioning units are usually positioned near the ceiling.

Explain why.

[2 marks]

1 0 . 4 The air in the room has a specific heat capacity of 1250 J/kg °C.

The air is cooled from 33 °C to 18 °C by an air conditioning unit.

The air conditioning unit removes 6000 J of energy per second.

Calculate the mass of air per second passing through the air conditioning unit.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

END OF QUESTIONS

There are no questions printed on this page