Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2021–2022

Single Award Science: Physics

Unit 3

Foundation Tier

[GSA31] *GSA31*

WEDNESDAY 24 NOVEMBER, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

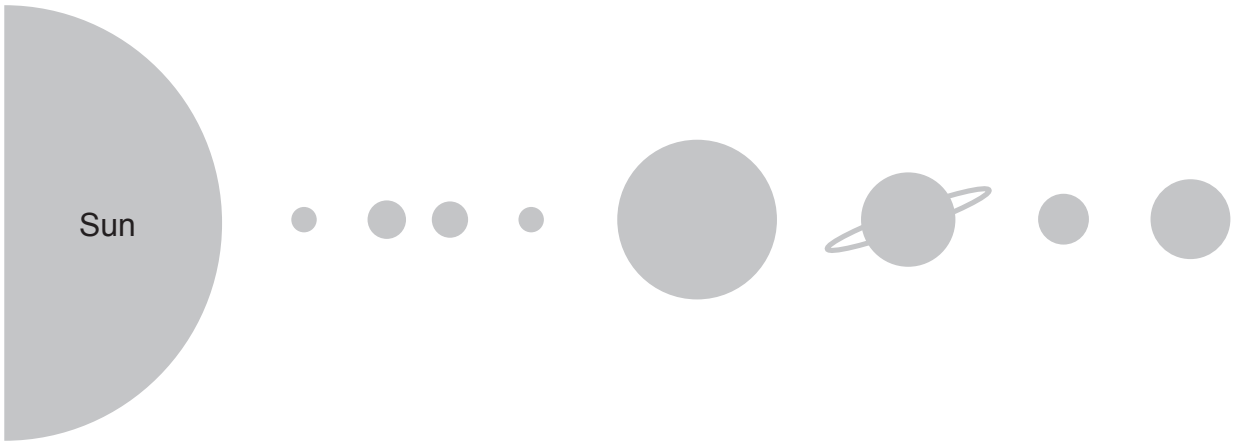
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **11**.

13201

1 The diagram below shows the Sun and its eight planets.



Source: Principal Examiner

(a) Complete the following sentence.

The Sun and its eight planets are known as the _____

_____ . [1]

(b) On the diagram above label the planet Mars with the letter **M**. [1]

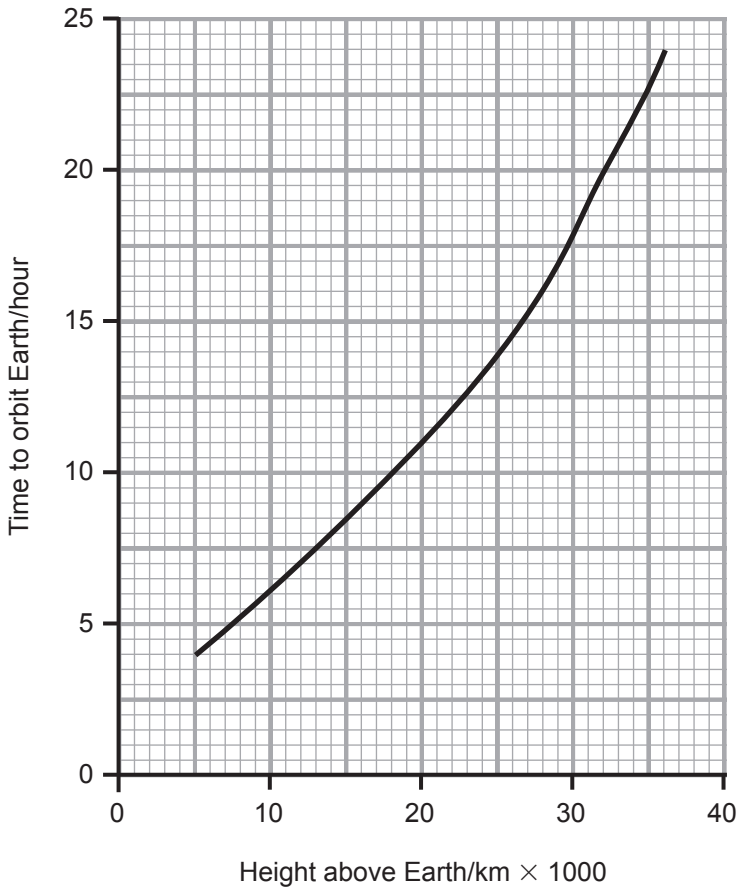
The table below shows the strength of gravity on five planets.

Planet	Strength of gravity/ N/kg
A	4
B	9
C	10
D	4
E	26

(c) On which planet (**A**, **B**, **C**, **D** or **E**) would your weight be greatest?

_____ [1]

(d) The graph below shows how the height of an artificial satellite above the Earth affects the time it takes to orbit the Earth.



(i) Complete the following sentence to give a trend shown in this graph.

As the height of the artificial satellite above Earth _____

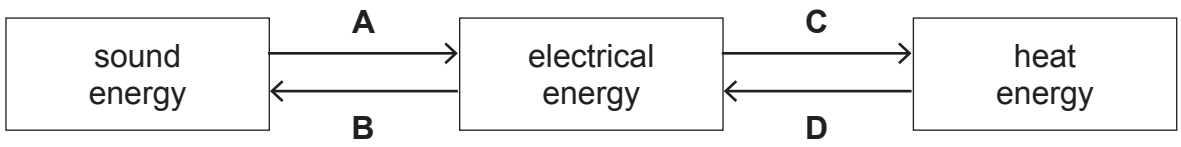
_____ . [1]

(ii) Give **one** use for an artificial satellite.

_____ [1]

[Turn over

2 The diagram below shows four energy changes (**A**, **B**, **C** and **D**).



(a) Which letter (**A**, **B**, **C** or **D**) shows the main energy change:

in a loudspeaker? _____

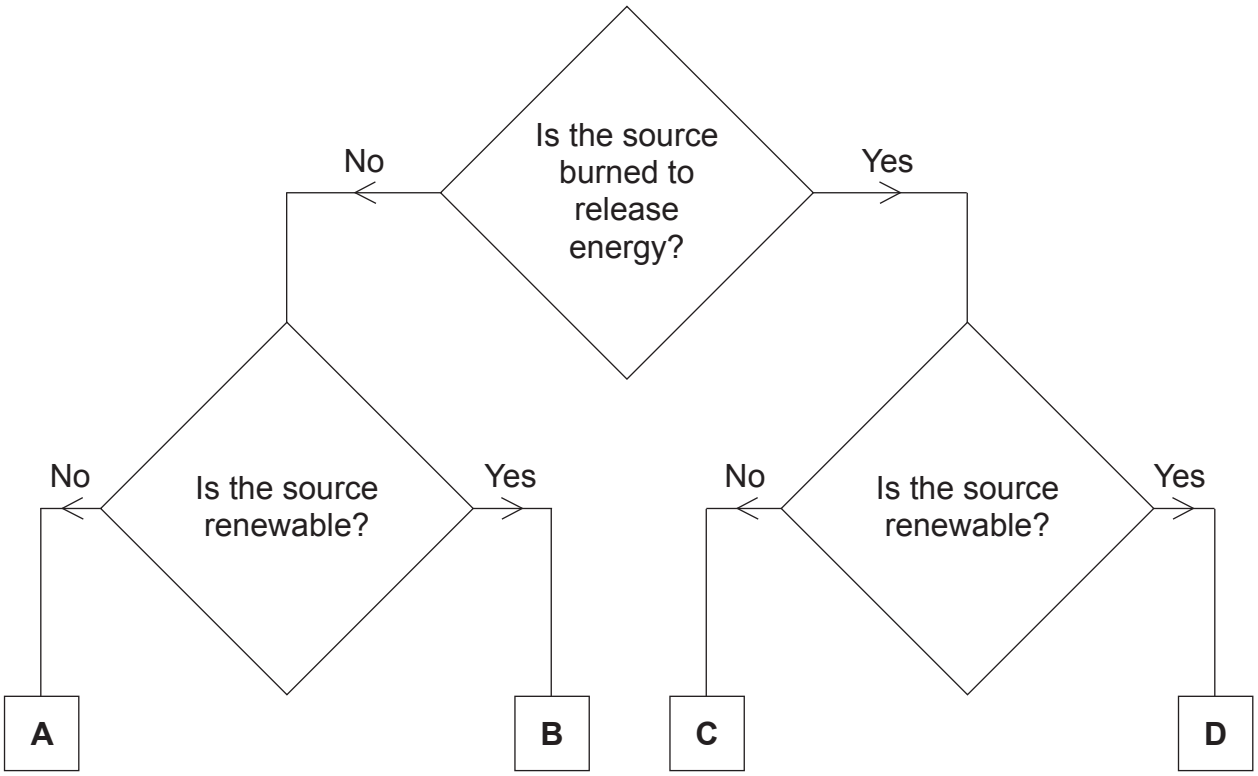
in an electric kettle? _____ [2]

(b) Below are descriptions and examples of some renewable sources of energy.
Using lines, match each description to one renewable source.
One has been done for you.

Description	Renewable source
energy from sunlight	biomass
energy from burning dead plants	solar
energy from moving water on the surface of the sea	wave
	hydroelectric

[2]

The diagram below shows information about four different energy sources (**A**, **B**, **C** and **D**).

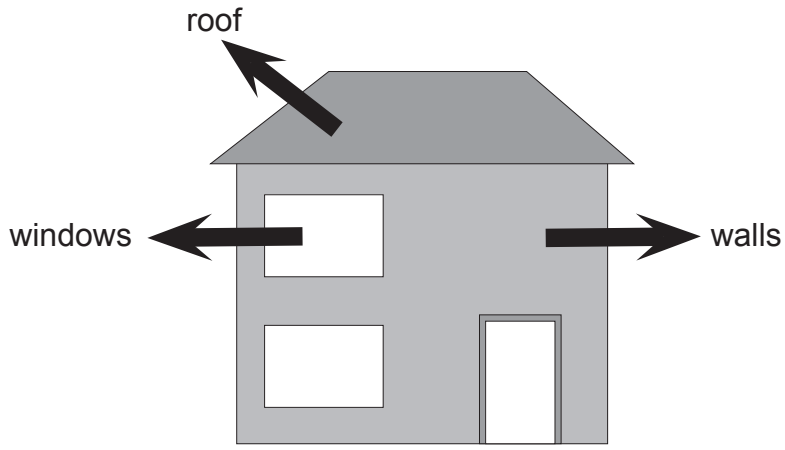


(c) Use the diagram and your knowledge to identify which letter (**A**, **B**, **C** or **D**) is describing oil.

_____ [1]

[Turn over

3 The diagram below shows some ways that heat can be lost from a house on a winter's day.



Source: Principal Examiner

(a) Name **one** other part of this house through which heat can be lost.

_____ [1]

The table below shows how different thicknesses of roof insulation affects the heat lost from a house at two different temperatures.

	Heat energy lost per hour/MJ	
Thickness of roof insulation/mm \ **House temperature**	**20 °C**	**22 °C**
100	9.4	10.8
200	8.8	10.1
300	8.6	9.9

(b) Give **two** conclusions that can be made from this data.

1. _____

_____

2. _____

_____ [2]

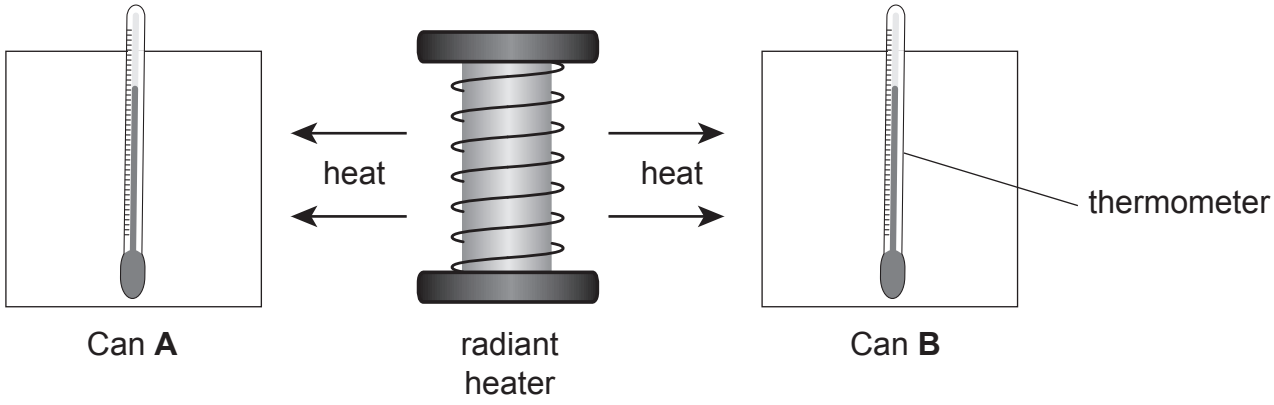
BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

[Turn over

4 Adam investigated the absorption of radiated heat using the apparatus shown below.



Source: Principal Examiner

The cans he used were identical but had a different colour on the outside surface. Adam measured the temperature in each can at the start and then 10 minutes later. His results are shown below.

	Can A	**Can B**
starting temperature/°C	22	22
temperature after 10 minutes/°C	44	50
change in temperature/°C	22	

(a) Calculate the change in temperature for can **B**.

_____ °C [1]

(b) Why should both cans be the same distance from the radiant heater?

_____ [1]

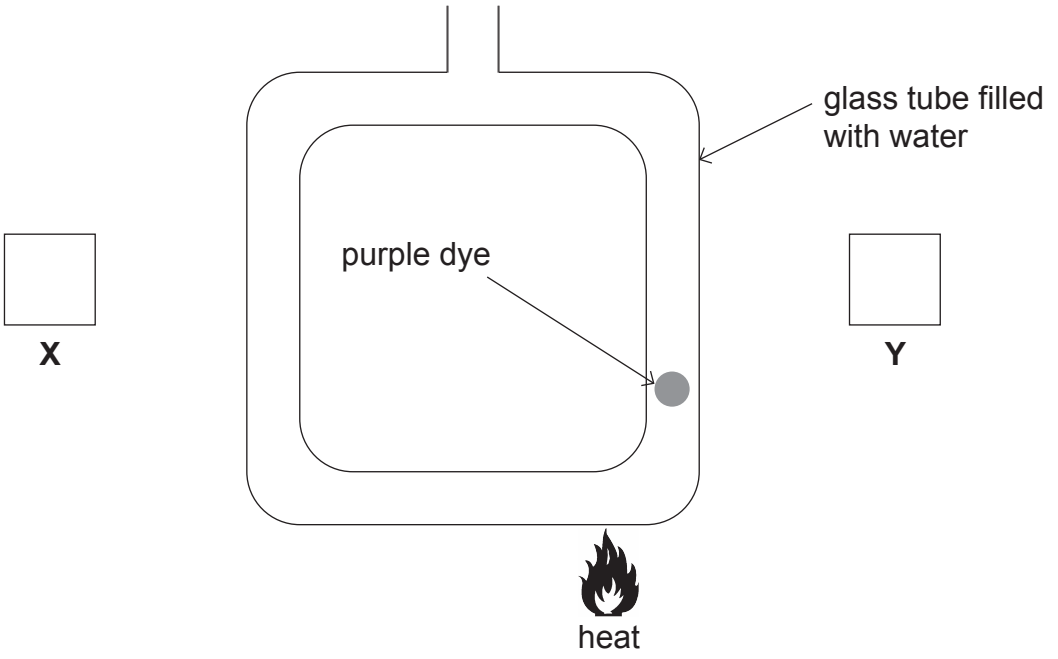
(c) From the results, what can be concluded about the surface colour of can **A** compared to can **B**?

Circle your answer.

better absorber of heat : **better radiator of heat** : **poorer absorber of heat**

[1]

(d) Anna investigated heat transfer in water using the apparatus shown below.



Source: Principal Examiner

(i) Put an arrow in each box (**X** and **Y**) to show the direction the dye will move when the water is heated. [1]

(ii) Name the main process by which heat is transferred in water.

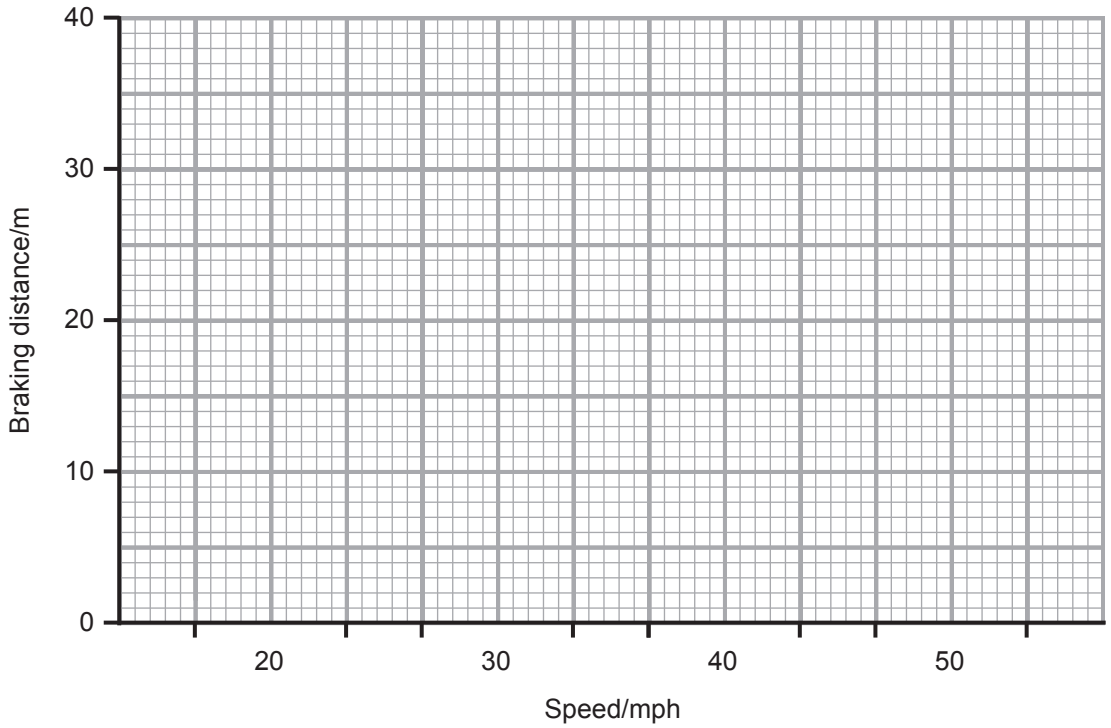
_____ [1]

[Turn over

5 **(a)** The table below shows the braking distance of a car at different speeds in wet and dry conditions.

Speed/mph	Braking distance/m	
	dry	wet
20	6	12
30	14	27
40	24	49
50	38	74

(i) On the grid below, draw a **bar** graph to show braking distance in **dry** conditions.



[2]

(ii) What effect, if any, do **wet** conditions have on the braking distance?

_____ [1]

13201

(b) Complete the following sentence.

The total stopping distance of a car is the _____

distance added to the braking distance. [1]

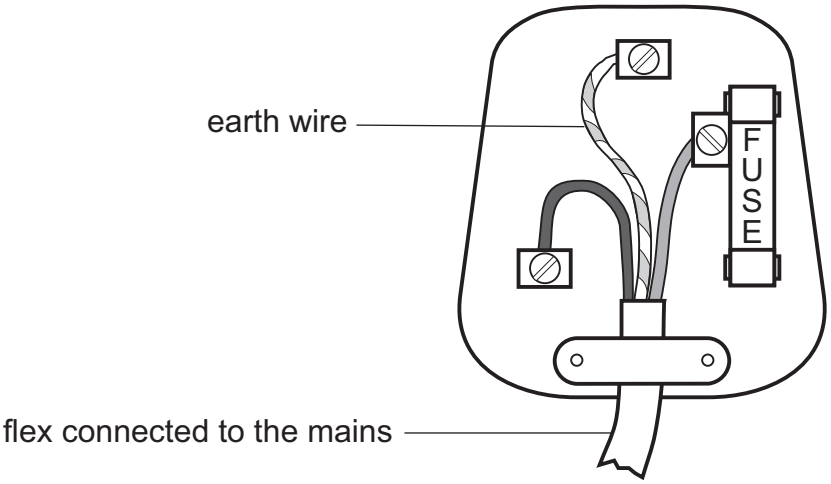
(c) During a car crash a driver's head can hit the steering wheel, causing serious injury. Give **two** safety features in a car which prevent the driver's head from hitting the steering wheel.

1. _____

2. _____ [2]

[Turn over

6 **(a)** The diagram below shows a three-pin plug used for a microwave oven.



Source: Principal Examiner

(i) The microwave oven uses 1000 W of power and is connected to the 250 V mains.

Use the equation:

$$\textbf{current} = \frac{\textbf{power}}{\textbf{voltage}}$$

to calculate the current flowing through the plug.

(Show your working out.)

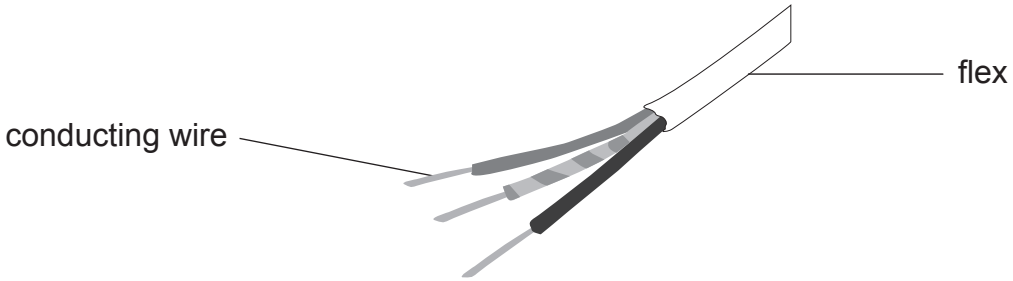
_____ A [2]

(ii) What size of fuse should be used in this plug?
Circle your answer.

1A **3A** **5A** **13A**

[1]

The flex that connects the microwave oven to the mains must have the correct diameter of conducting wires.



Source: Principal Examiner

The table below gives the maximum current that different diameters of conducting wire can safely carry.

Diameter/ mm²	**Maximum current/A**
0.50	3
0.75	6
1.00	10
1.25	13
1.50	15

(iii) Use this information and your answer from part (i) to give the smallest diameter of conducting wire that should be used for this microwave oven.

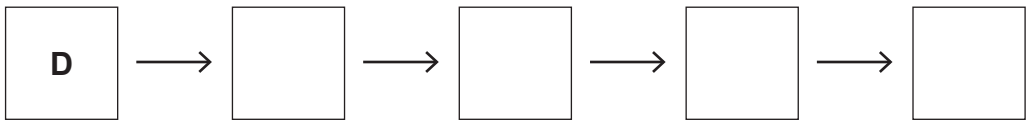
_____ mm² [1]

[Turn over

The earth wire in a plug is a safety feature that protects a person from an electric shock. Given below are the steps describing how it works but they are **not** in the correct order.

A circuit is broken
B large current flows through earth wire and the fuse
C fuse wire melts
D metal case becomes live
E user protected from electric shock

(b) Put the letters **A** to **E** in the correct order.
The first one has been done for you.



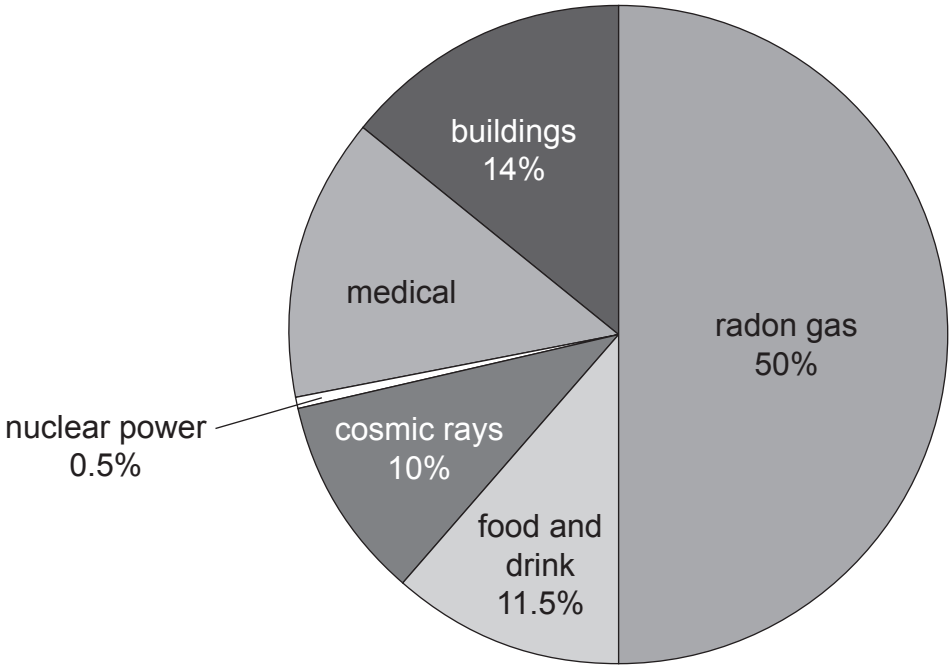
[2]

BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

7 The pie chart below shows the sources of the small amount of radiation that is always around us.



(a) Calculate the percentage of this radiation that comes from medical sources.

(Show your working out.)

_____ % [2]

(b) Complete the following sentence.

Choose from:

underground **foreground** **surround** **background**

The small amount of radiation that is always around us is called

_____ radiation. [1]

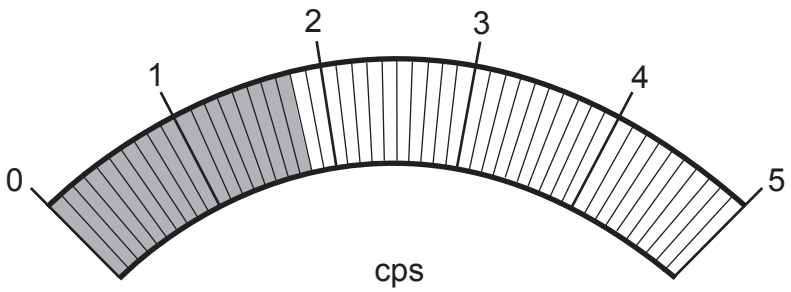
13201

(c) Some of this radiation that is always around us is caused by humans. Place a tick (✓) beside each source in the table caused by humans.

Source	Caused by humans
nuclear weapons	
radon gas	
x-rays from hospitals	
cosmic rays	
granite rock	

[2]

The meter below shows a reading of the radiation level in a house.



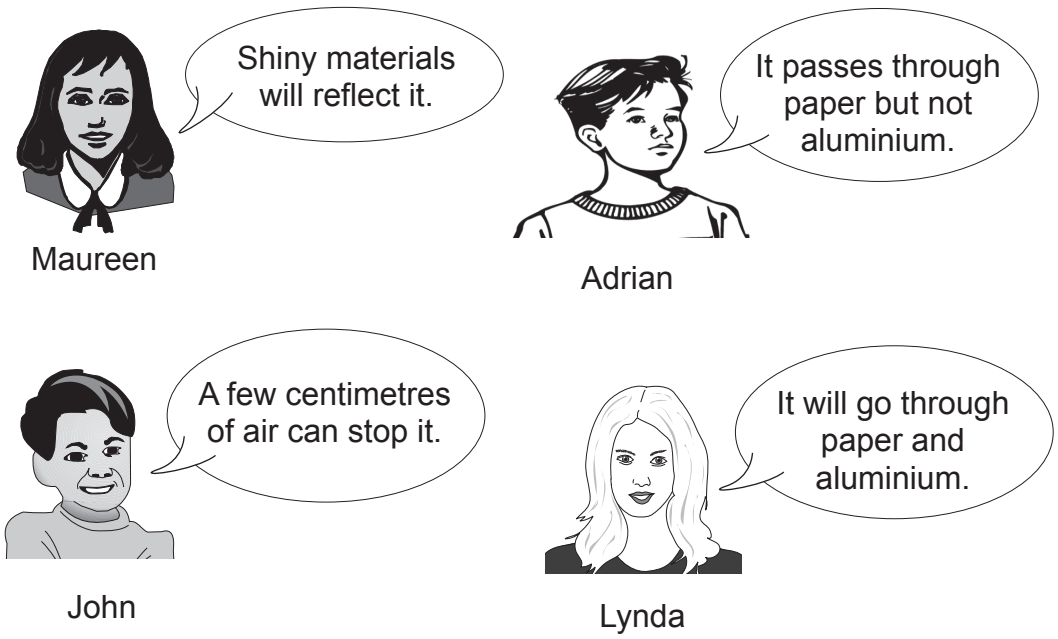
Source: Principal Examiner

(d) What is the reading on this meter?

_____ cps [1]

[Turn over

The diagram below shows four answers given by students when asked to describe the three types of radiation (alpha, beta and gamma).



(e) Name the student who gave the correct description for:

alpha radiation. _____

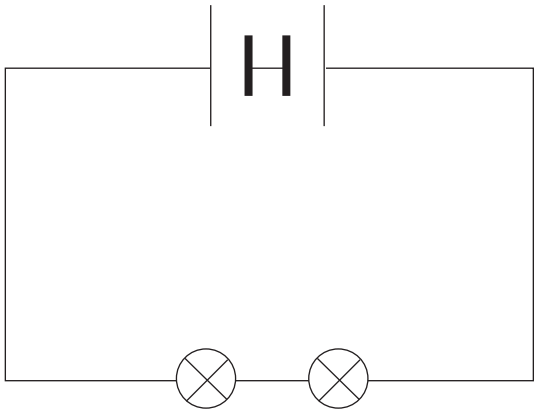
beta radiation. _____ [2]

BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

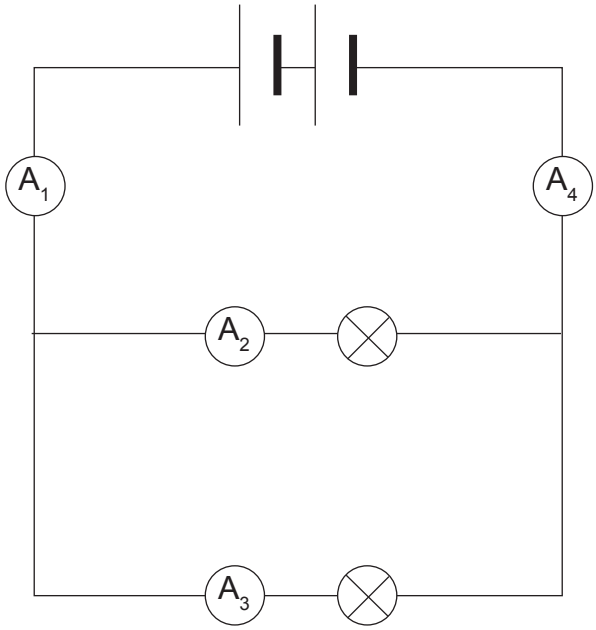
8 The diagram below shows a circuit which has been incorrectly set up.



(a) Each cell has a voltage of 1.5 V. What is the total voltage in this circuit?

_____ V [1]

(b) A student set up the circuit shown below containing two identical bulbs and four ammeters.



(i) What term is used to describe how the bulbs are connected in this circuit?

_____ [1]

The ammeter A_1 has a reading of 0.4 A.

(ii) What is the reading on:

ammeter A_3? _____ A

ammeter A_4? _____ A [2]

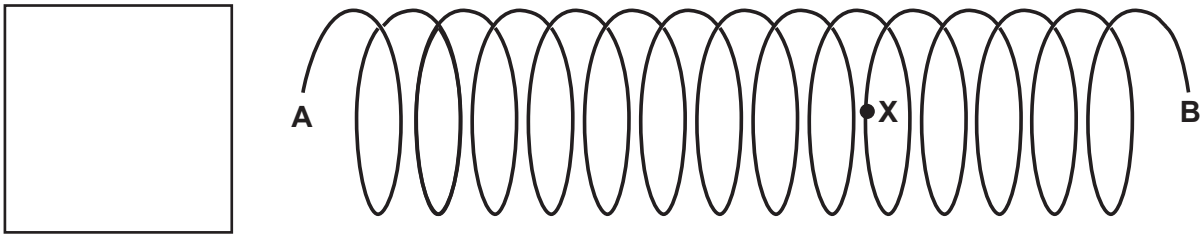
(iii) Give **two** advantages of connecting bulbs as shown in this circuit.

1. _____

2. _____ [2]

[Turn over

9 **(a)** A student uses a slinky spring to show a longitudinal wave.



Source: Principal Examiner

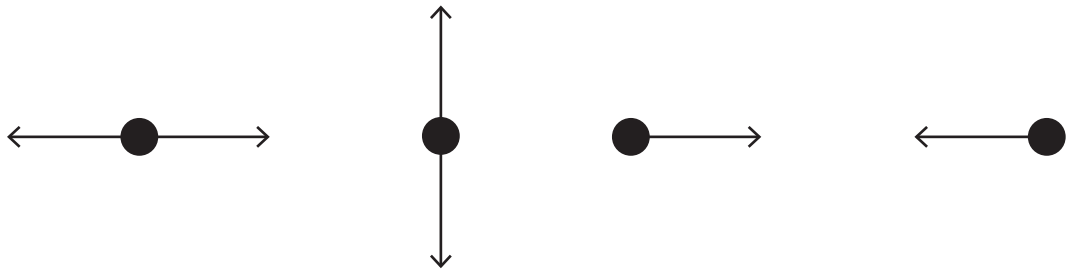
(i) In the box above, draw an arrow to show the direction the student would move the slinky spring to produce a longitudinal wave. [1]

(ii) What do longitudinal waves carry from one place to another?

_____ [1]

(iii) How will the particle, labelled **X** on the diagram above, move when the longitudinal wave travels along the slinky spring from **A** to **B**?

Circle your answer.



[1]

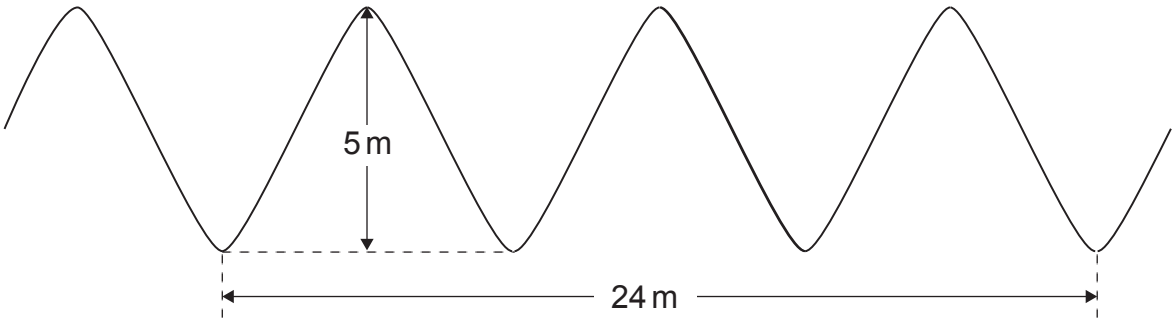
The table below shows the range of frequencies some animals can hear.

Animal	Lowest frequency/Hz	Highest frequency/Hz
dog	67	45 000
cow	23	35 000
ferret	16	44 000
rat	200	76 000

(b) How many animals, named in the table, can hear frequencies lower than a human?

_____ [1]

(c) The diagram below shows a transverse wave.



Source: Principal Examiner

(i) What is the amplitude of this wave?

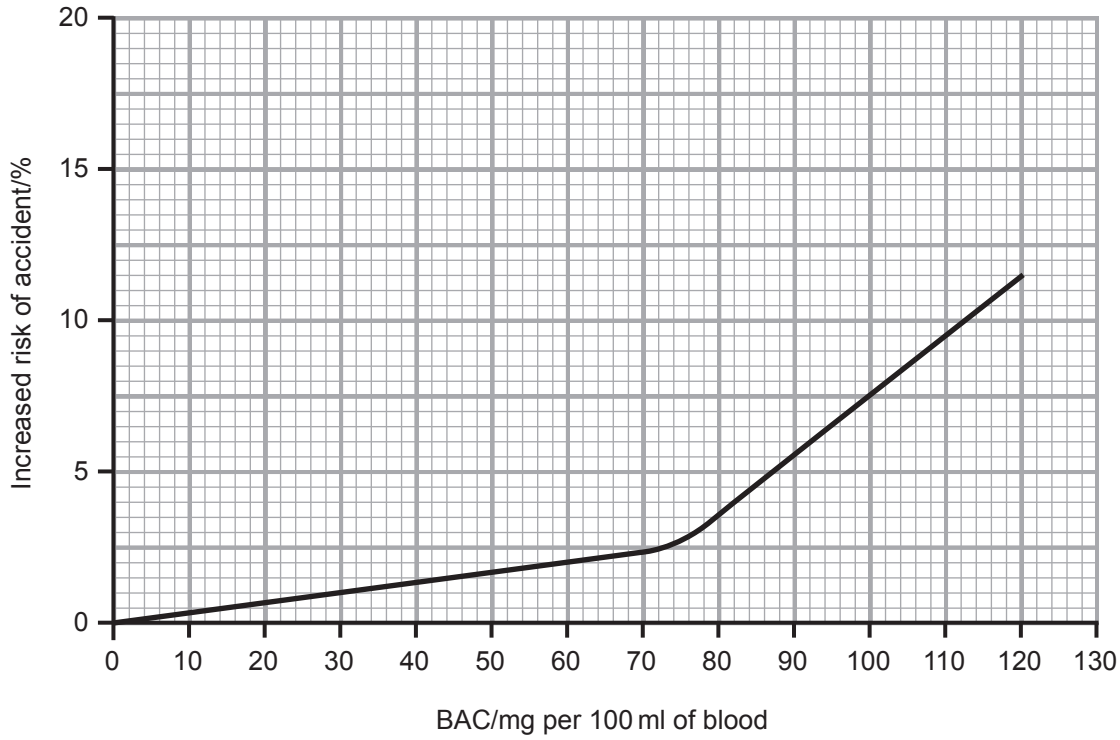
_____ m [1]

(ii) What is the wavelength of this wave?

_____ m [1]

[Turn over

10 The graph below shows how blood alcohol concentration (**BAC**) affects the risk of a driver causing an accident.



(a) Use the graph to estimate the percentage increased risk of causing an accident with a **BAC** of 130 mg per 100 ml of blood.

_____ [1]

(b) The legal limit for driving in Northern Ireland is 80 mg of alcohol in 100 ml of blood.
Using information from the graph explain why some people think this limit is too high.

_____

_____ [1]

The table below shows how the percentage blood alcohol content in males and females is affected by the number of units of alcohol consumed and body mass.

	Blood alcohol content/%					
	Male body mass			Female body mass		
Units of alcohol	**60 kg**	**80 kg**	**100 kg**	**60 kg**	**80 kg**	**100 kg**
1	0.03	0.02	0.01	0.04	0.03	0.02
2	0.06	0.05	0.04	0.08	0.06	0.05
3	0.09	0.07	0.06	0.11	0.09	0.07
4	0.12	0.09	0.08	0.15	0.11	0.09
5	0.16	0.12	0.09	0.19	0.14	0.10

(c) Give **two** conclusions that can be made from this data.

1. _____

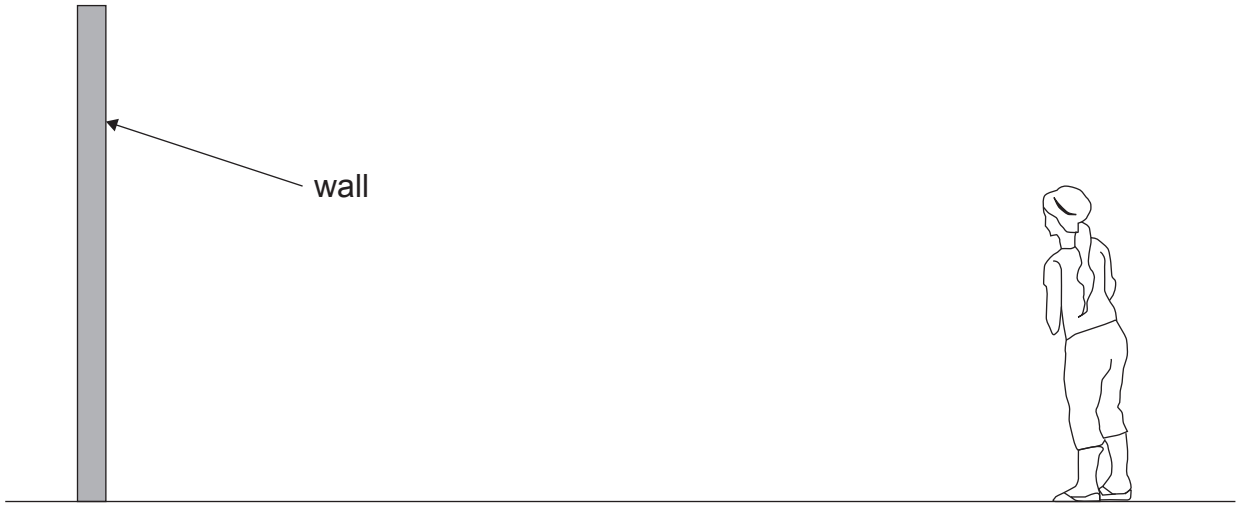
_____

2. _____

_____ [2]

[Turn over

11 The speed of sound can be found by making careful measurements and using a formula to calculate the answer.



Source: © Getty Images

Describe how a student could use a wall to find an accurate and reliable value for the speed of sound using the **echo method**.

Your answer should include:
- the measurements needed;
- the equipment used and
- how the speed of sound is calculated from the measurements.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

Examiner Number