Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2022–2023

Single Award Science: Physics

Unit 3

Foundation Tier

[GSA31]

GSA31

WEDNESDAY 23 NOVEMBER 2022, 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 nine** 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 **9**.

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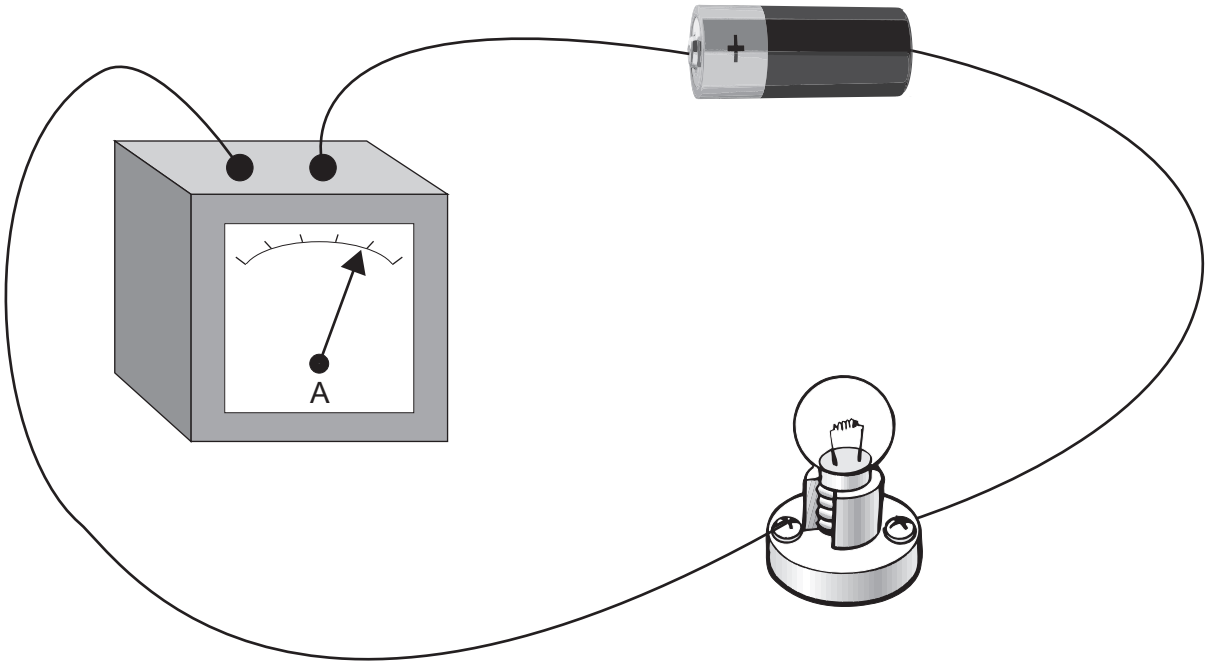
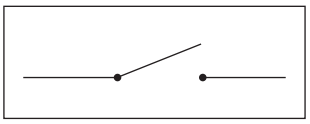
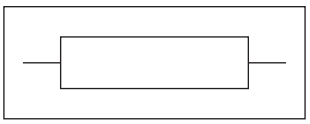
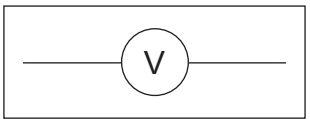
1 The diagram below shows a simple electrical circuit.



(a) In the space below, use electrical symbols to draw this circuit.

[2]

(b) Using lines, match the following components with the correct symbol.

Component	**Symbol**
resistor	
switch	
voltmeter	

[2]

(c) A switch can be used to turn off a light.
Describe what happens in the circuit when a light is switched off.

_____

_____ [1]

[Turn over

(d) The table below gives the voltage and current as more bulbs are added to a **series** circuit.

Number of bulbs	Voltage across each bulb/V	Current flowing through each bulb/A
1	6	0.40
2	3	0.20
3	2	0.13

Use this information to answer the following questions.

(i) Describe the effect that changing the number of bulbs has on the voltage across each bulb.

_____

_____ [1]

(ii) Suggest what effect, if any, increasing the number of bulbs will have on the brightness of each bulb. Explain your answer.

_____

_____ [2]

(e) Complete the sentence below to describe the effect of adding more bulbs to a **parallel** circuit.

Choose from:

increase : **stay the same** : **decrease**

If more bulbs are added in parallel with the first bulb, the voltage

across each bulb will _____. [1]

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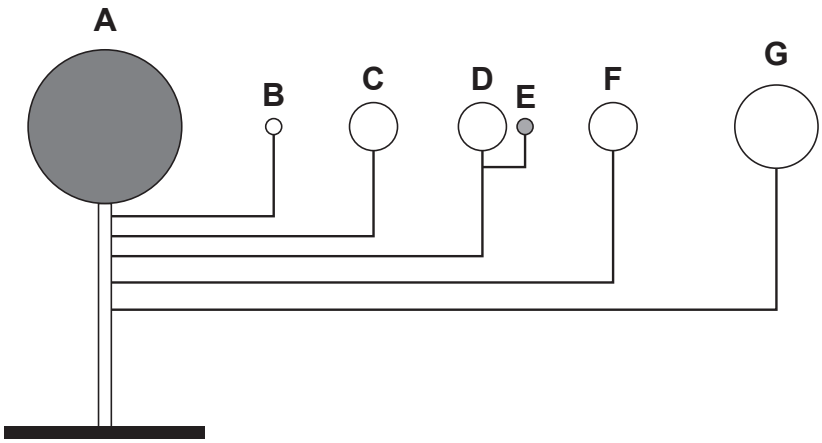
(Questions continue overleaf)

2 The diagram below shows a model of part of the Solar System.



B, **C**, **D**, **F** and **G** orbit object **A**, and object **E** orbits **D**.

(a) Use this information and your knowledge to name the objects labelled **A** and **E**.

A _____

E _____ [2]

(b) **(i)** Name **one** rocky planet in the Solar System.

_____ [1]

(ii) Name **one** gas planet in the Solar System.

_____ [1]

The Solar System also contains asteroids which sometimes crash into planets.

(c) What evidence exists that asteroids have struck planets in the past?

_____ [1]

(d) The table below gives the mass, density and gravity of four planets in the Solar System.

Planet	Mass/kg $\times 10^{23}$	Density/ g/cm^3	Gravity/ N/kg
W	3.2	5.4	3.6
X	6.4	3.9	4.0
Y	48.8	5.2	9.0
Z	59.8	5.5	9.8

(i) What conclusion can be made from this information?

Circle your answer.

As mass increases, gravity decreases.

As mass increases, gravity increases.

As density increases, gravity increases.

[1]

(ii) Use the equation:

weight = mass × gravity

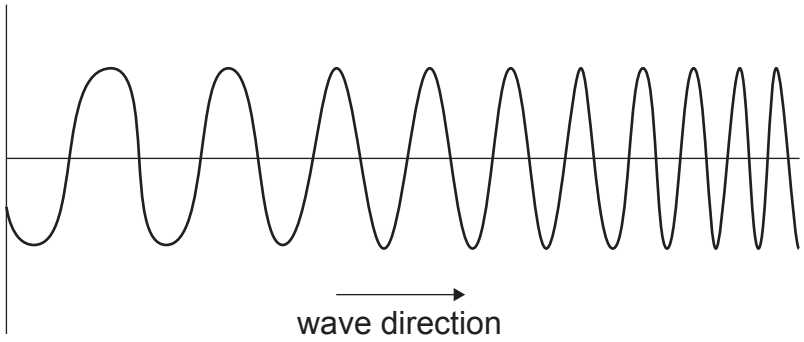
to calculate the weight of an 80 kg astronaut landing on planet **X**.

(Show your working out.)

_____ N [2]

[Turn over

3 The diagram below represents a sound wave.



(a) Complete the following sentence about this wave.

Choose from:

decreases : **stays the same** : **increases**

The amplitude of this wave _____ and

the wavelength _____. [2]

(b) The table below shows the maximum time a person can listen to music, at different sound levels, without damaging their hearing.

Sound level/dB	Maximum time/h
86	8.0
88	4.0
90	2.0
92	1.0
94	0.5

(i) State the trend shown by this information.

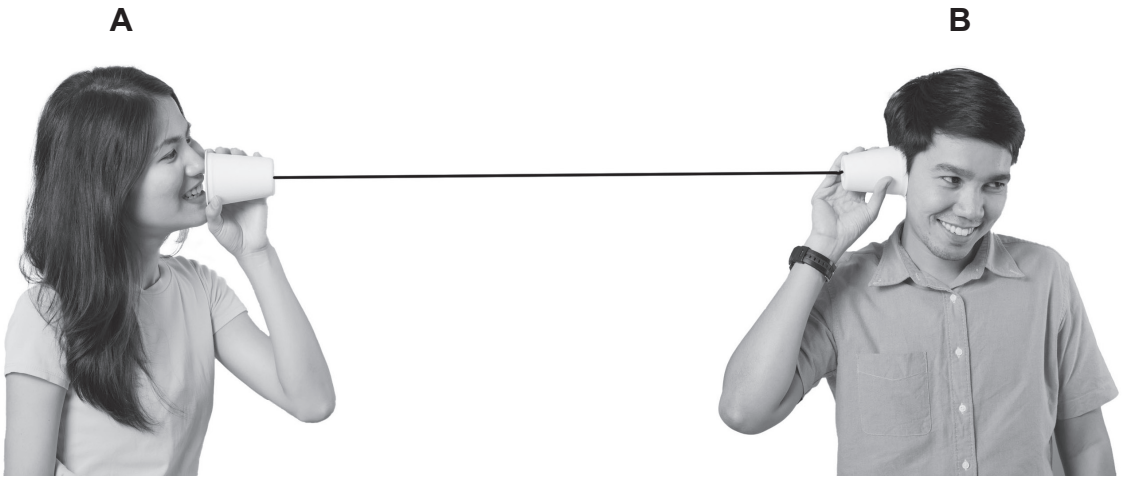
_____

_____ [1]

(ii) Suggest the maximum time a person could listen to a sound level of 87 dB without damaging their hearing.

_____ h [1]

(c) The diagram below shows two people using a string telephone to communicate.



(i) What is transferred when the sound wave travels from **A** to **B**?

_____ [1]

(ii) What type of wave is sound?

Choose from:

transverse **longitudinal** **electromagnetic**

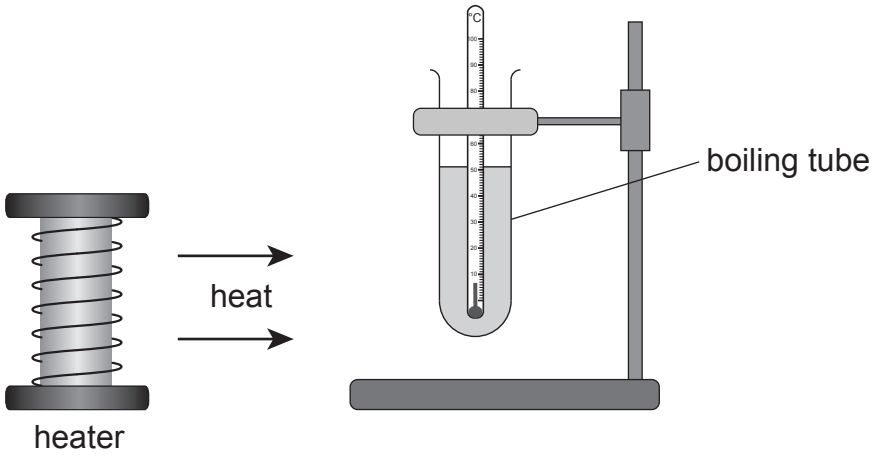
_____ [1]

(d) What name is given to sounds with a frequency greater than 20 000 Hz?

_____ [1]

[Turn over

4 **(a)** The diagram below shows a heater being used to heat water in a boiling tube.



(i) Name the heat transfer method that carries heat from the heater to the boiling tube as shown in the diagram.

Choose from:

conduction **convection** **radiation**

_____ [1]

(ii) Name the heat transfer method that carries heat around the water.

Choose from:

conduction **convection** **radiation**

_____ [1]

(b) A student used this apparatus to investigate the effect different coloured surfaces have on the temperature rise of the water.
He first tested a clear glass boiling tube. He then tested one covered in dark matt paint and another covered in light shiny paint.

The results are shown below.

Surface colour of boiling tube	Starting temperature/°C	Temperature after 3 minutes/°C	Temperature rise/°C
clear	21	36	15
dark matt	19	48	29
light shiny	20	30	10

(i) Suggest **two** things that the student needed to do to make this a fair test.

1. _____

_____

2. _____

_____ [2]

(ii) Why did the dark matt surface colour give the largest temperature rise?

_____

_____ [1]

(iii) Why did the student calculate the temperature rise, rather than use the temperature recorded after 3 minutes?

_____

_____ [1]

(iv) Give **one** way the student could make this investigation more reliable.

_____

_____ [1]

[Turn over

5 Given below are the names of the parts in a fossil fuelled power station.

burner	**boiler**	**turbine**	**generator**

(a) Name the part in which each of the following energy changes occur.

(i) chemical ⟶ heat _____

(ii) kinetic ⟶ electrical _____ [2]

(b) The fossil fuels used in the power station are described as non-renewable.

(i) What is meant by the term **non-renewable**?

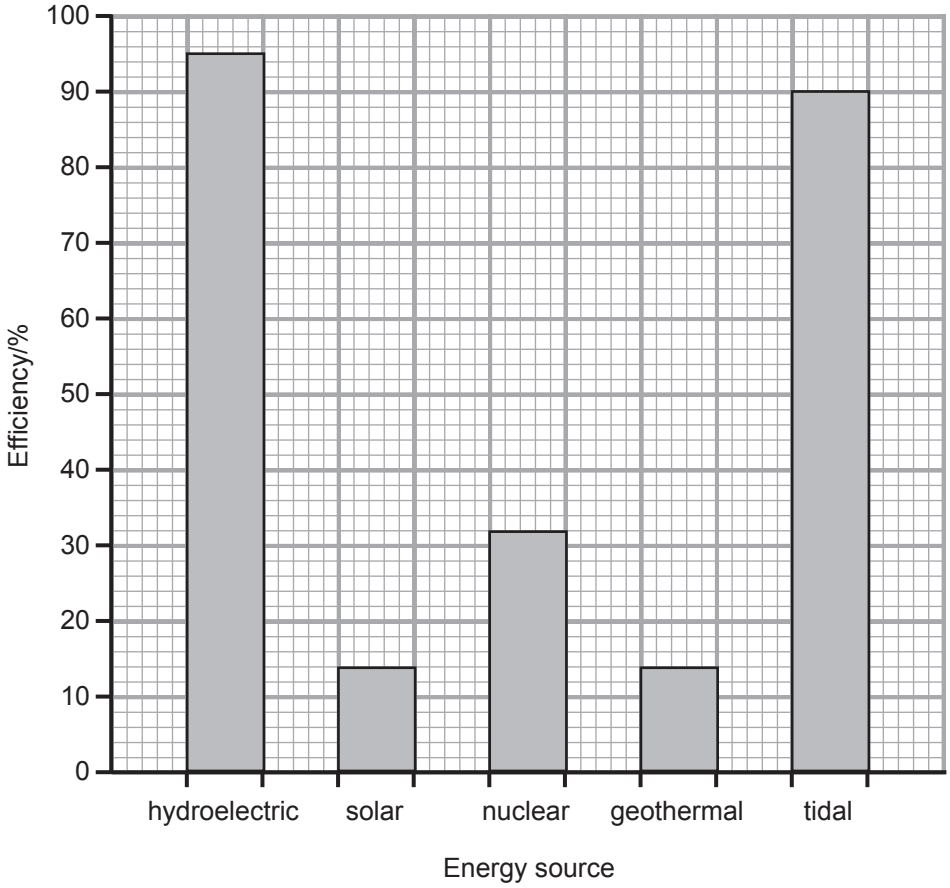
_____

_____ [1]

(ii) Name **one** fossil fuel.

_____ [1]

(c) The bar chart below shows the efficiency of five energy sources when they are used to make electricity.



(i) Calculate the difference in efficiency between tidal energy and nuclear energy when used to make electricity.

(Show your working out.)

_____ % [2]

(ii) Name the source, shown in the bar chart, that would need the least input energy to produce 1000 units of electricity.

_____ [1]

[Turn over

6 **(a)** The table below gives the results of an investigation to find the stopping distance of three different vehicles (**A**, **B** and **C**).

	A	**B**	**C**
Thinking distance/m	9	9	9
Braking distance/m	12		15
Stopping distance/m	21	23	24

(i) Calculate the braking distance for vehicle **B**.

_____ m [1]

(ii) In the event of having to avoid an accident, which vehicle (**A**, **B** or **C**) would stop in the least amount of **time**?

_____ [1]

(b) **(i)** What is meant by the term **thinking distance**?

_____

_____

_____ [2]

(ii) What effect, if any, would a shorter reaction time have on the thinking distance?

Circle your answer.

increased : **no effect** : **decreased**

[1]

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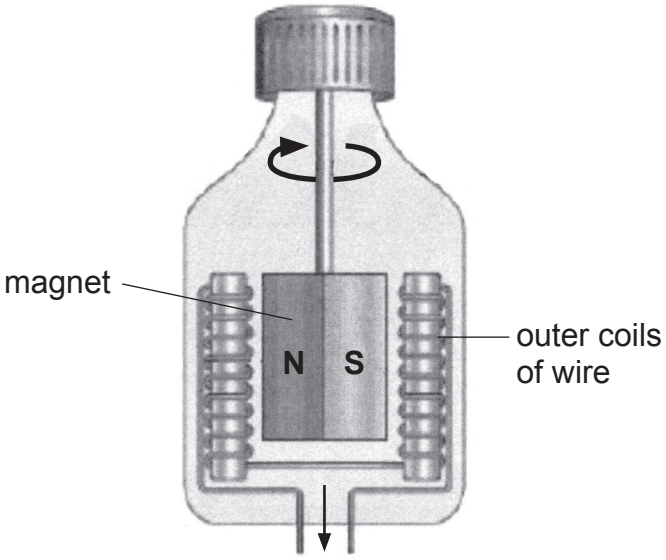
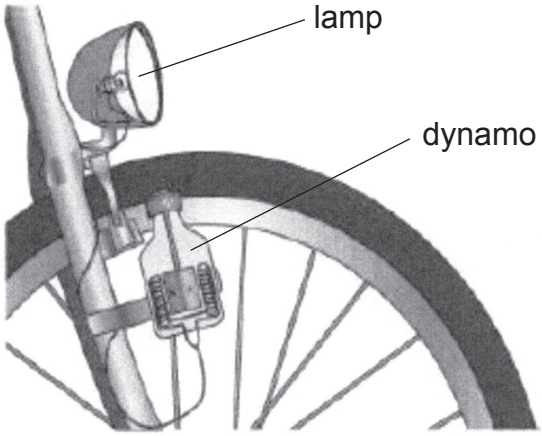
7 The diagram below shows a dynamo and how it can be used to light a lamp on a bicycle. A dynamo is a small generator.





(a) Describe fully how the dynamo works to light the lamp on the bicycle.

_____

_____

_____ [3]

The table below gives the current output of the dynamo at different speeds.

Speed/ km/h	Current/ mA
0	0
5	200
10	300
15	400
20	500
25	510
30	520
35	520
40	520

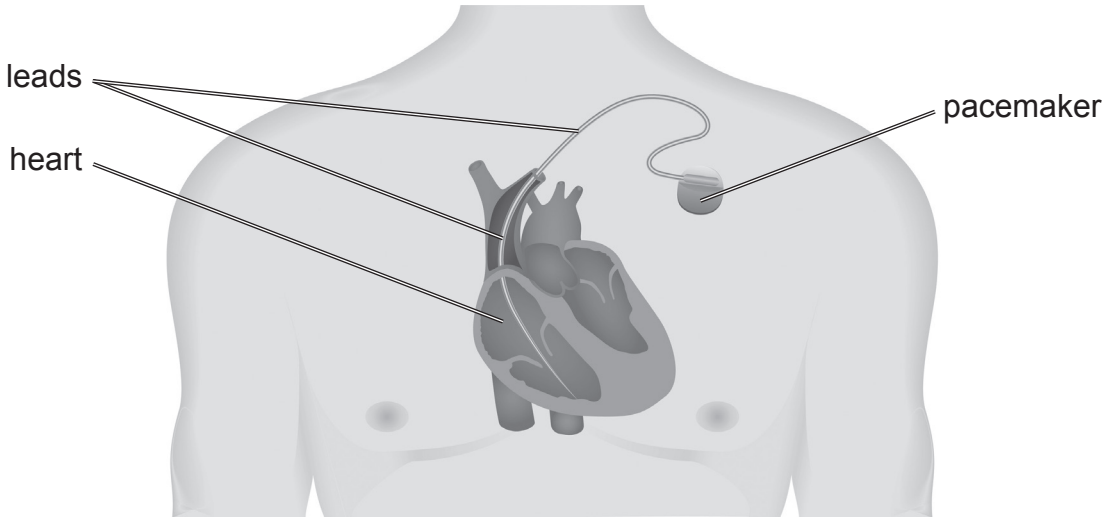
(b) Describe fully the trend shown by this information.

_____

_____

_____ [2]

8 **(a)** The diagram below shows a pacemaker attached to a person's heart to regulate their heart rate. To fit the pacemaker, an operation is needed.



This pacemaker is powered by a radioactive source and has a metal and plastic casing. The radioactive source must be long-lasting and emit alpha radiation.

(i) Explain fully why an alpha source is used in this pacemaker rather than a beta or gamma source.

_____

_____

_____ [2]

(ii) Suggest **one** reason why it is important, to the person, that the radioactive source is long-lasting.

_____

_____ [1]

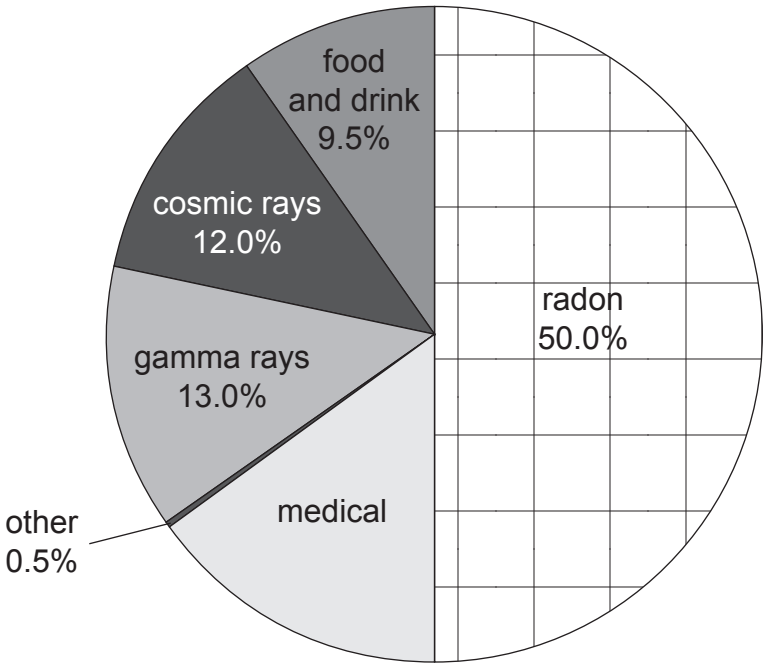
(b) Many different radioactive sources contribute to background radiation.

(i) What is meant by the term **background radiation**?

_____

_____ [1]

The pie chart below shows the percentage that different sources contribute to background radiation.



(ii) Calculate the percentage that medical sources contribute to background radiation.

(Show your working out.)

_____ % [2]

[Turn over

9 Given below are the names of five waves that are in the electromagnetic spectrum. The letters **A** and **B** show the positions of two other waves.

gamma rays	**X-rays**	**A**	**visible light**	**B**	**micro waves**	**radio waves**

Compare the different waves that make up the electromagnetic spectrum.

Your answer should include:

- the names of the **two** waves (**A** and **B**);
- **two** features all these waves have in common;
- **two** differences between these waves; and
- **one** use and **one** danger of gamma rays.

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

[6]

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Examiner Number

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