



Rewarding Learning

General Certificate of Secondary Education
2021–2022

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3

Higher Tier



[GSA32]

GSA32

FRIDAY 25 FEBRUARY 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

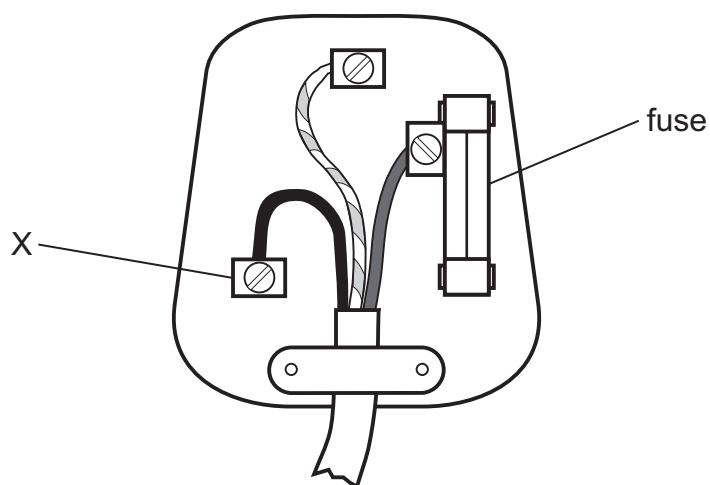
The total mark for this paper is 60.

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 **3(a)**.



- 1 The diagram below shows a 3-pin plug.



Source: Principal Examiner

- (a) Name the pin labelled **X** in the diagram.

_____ [1]

- (b) What **colour** of wire should be connected to the fuse?

_____ [1]

- (c) Describe fully how the fuse acts as a safety feature.

_____ [2]

- (d) Name **one** other safety feature of a 3-pin plug.

_____ [1]





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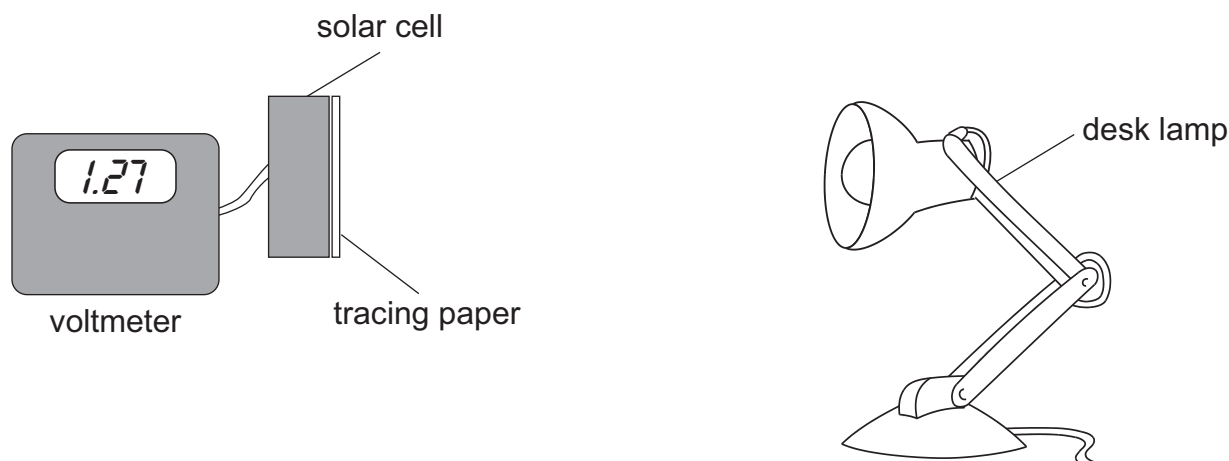
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(Questions continue overleaf)



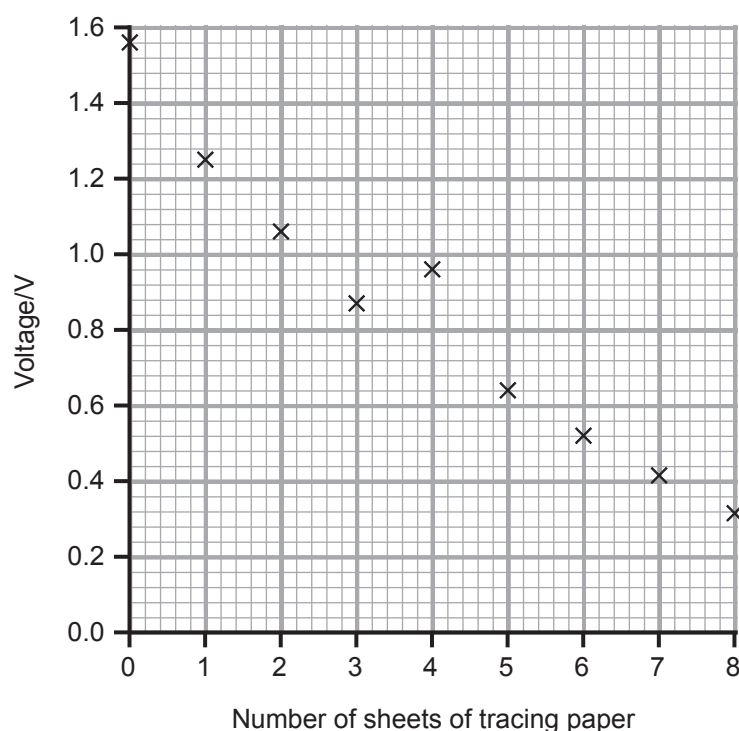
- 2 Some students used the equipment shown below to find out if dirt covering a solar cell affects its output voltage.

To represent the dirty surface the students used sheets of tracing paper.



Source: Principal Examiner

The results of the investigation are shown in the graph below.



(a) What conclusion can be made from these results?

[1]

(b) The result for four sheets of tracing paper does not follow the trend.

(i) What term is used to describe a result that does **not** follow the trend?

[1]

(ii) Suggest **one** way the students should deal with this result.

[1]

(c) Suggest **one** way the students ensured a fair test was carried out.

[1]

[Turn over



3 (a) Describe fully the structure of the Solar System.

Your answer should include:

- the names and positions of two planets;
- a description of how these planets move; and
- the names of other objects in the Solar System.

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

[6]

[6]



The table below gives the force of gravity on three planets.

Planet	Gravity/ N/kg
X	10
Y	16
Z	25

(b) An astronaut has a mass of 80 kg.

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravity}$$

to calculate the **maximum weight difference** of the astronaut moving between these planets.

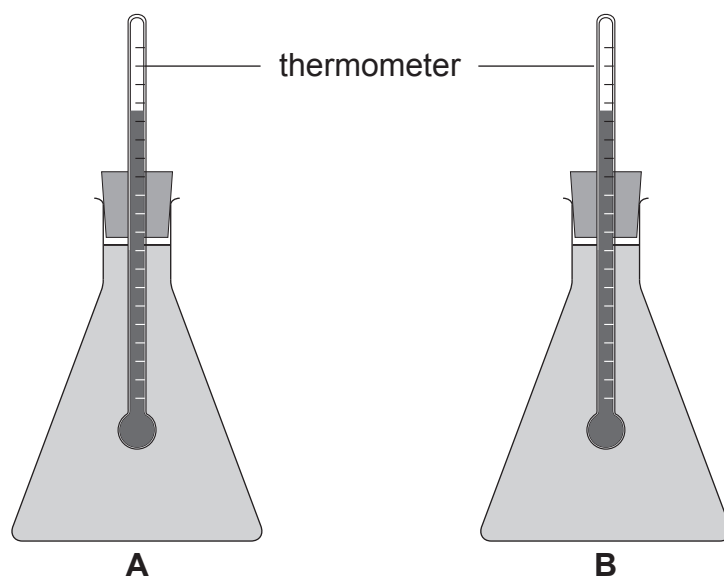
(Show your working out.)

_____ N [2]

[Turn over



- 4 (a) A student used two conical flasks, one with a dark matt cover and one with a light shiny cover, to investigate how an object's surface affects how quickly it cools down.



Source: Principal Examiner

The flasks were filled with boiling water and the temperature was measured every two minutes.

The results are shown below.

Time/mins	Temperature/°C	
	A	B
0	90	90
2	75	80
4	62	72
6	51	66
8	42	61
10	37	54



- (i) State the trend shown by the results for flask **A**.

_____ [1]

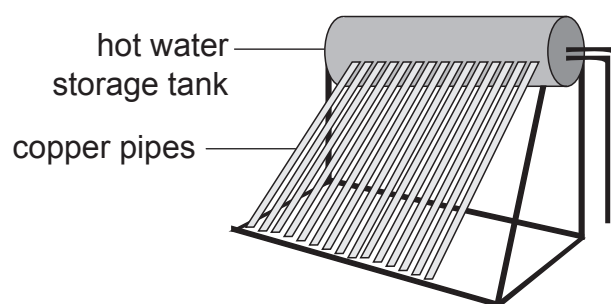
- (ii) Give **one** difference in the trend shown for flask **B** compared to flask **A**.

_____ [1]

- (iii) Which conical flask (**A** or **B**) has a dark matt covering?
Explain your answer.

_____ [1]

- (b) The diagram below shows a solar water heater, it uses energy from the Sun to heat water inside copper pipes. The hot water is then stored in a tank.



Source: Principal Examiner

- (i) Name the method of heat transfer that moves the heated water from the pipes up to the hot water storage tank.

_____ [1]

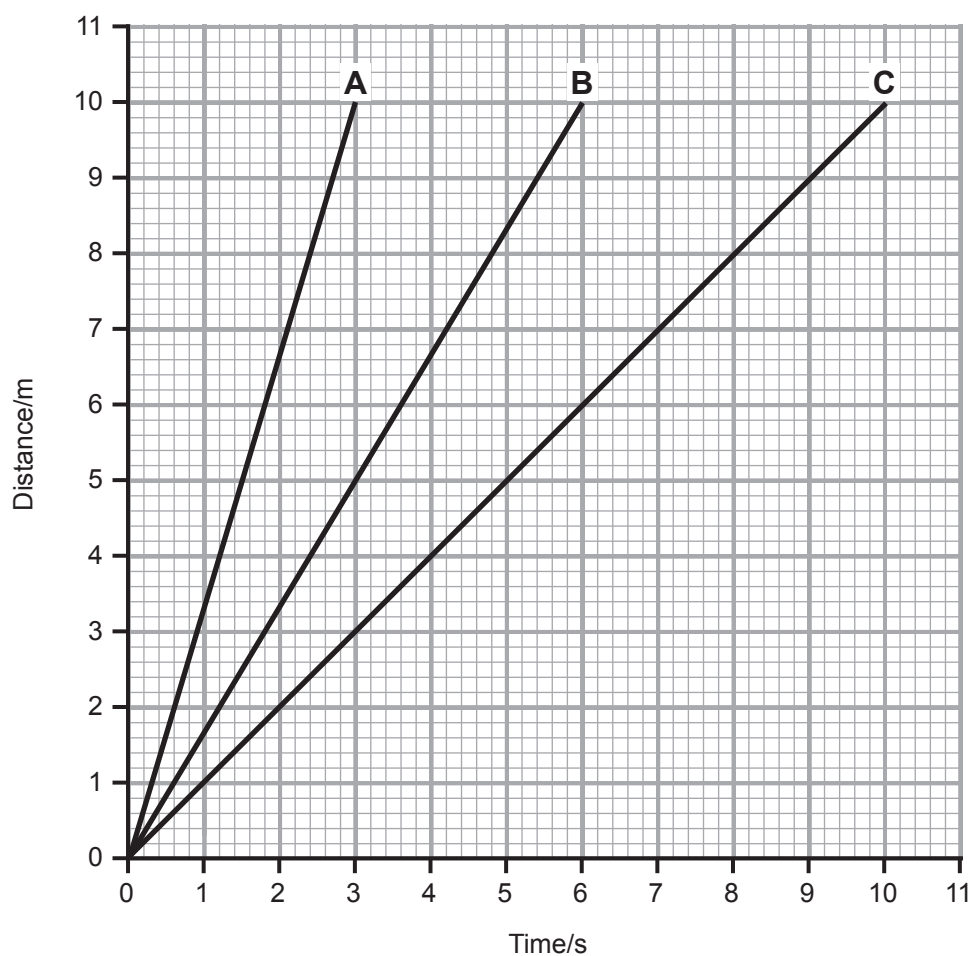
- (ii) Suggest **one** reason why the pipes are made from copper.

_____ [1]

[Turn over



- 5 (a) The distance–time graph below shows the movement of three toys (**A**, **B** and **C**).



- (i) How much further did toy **B** travel compared to toy **C** in the first 3 seconds?

_____ m [1]

- (ii) Toy **B** stopped after 6 seconds. On the grid above, complete the distance–time graph for toy **B**.

[1]



(iii) Use the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the speed of toy **A**.
Give your answer to one decimal place.

(Show your working out.)

_____ m/s [2]

(iv) How does the speed of toy **C** compare to the speed of toy **A**?

_____ [1]

[Turn over



- (b) The table below gives the number of drivers caught speeding in a part of England between 2015 and 2019.

Year	Number of drivers caught speeding
2015	29 564
2016	30 419
2017	36 532
2018	47 811
2019	55 461

- (i) State the trend shown by this information.

_____ [1]

- (ii) Apart from speed cameras, state **one** other way to restrict speed on the roads.

_____ [1]



- (c) The photograph below shows how the road surface changes on approach to traffic lights.

smooth surface

rough surface



Source: Principal Examiner

This change in surface has helped reduce the risk of accidents at these traffic lights.

- (i) Compared to the smooth surface, what effect, if any, will the rough surface have on braking distance? Explain your answer.

[2]

- (ii) What effect, if any, will this surface change have on thinking distance?

[1]

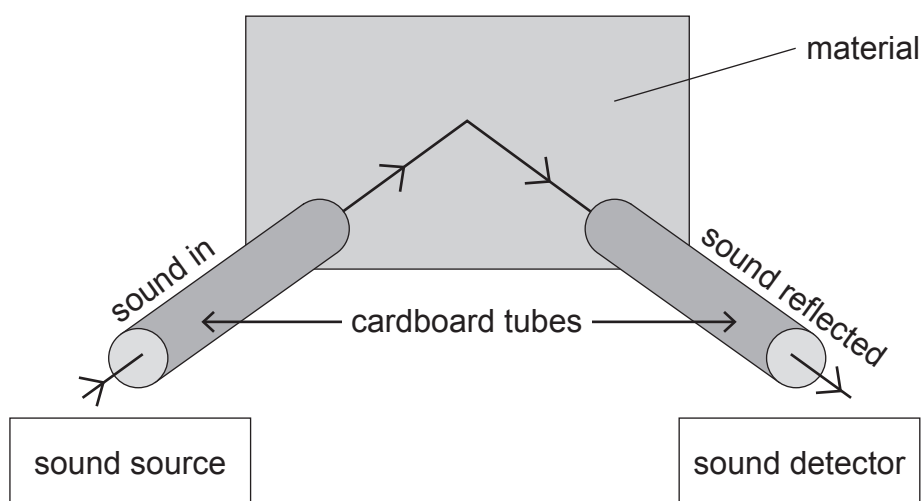
- (iii) Give **one** factor that will affect both thinking and braking distance.

[1]

[Turn over



- 6 (a) The diagram below shows how students investigated the reflection of sound by different materials.



Source: Principal Examiner

The students measured the level of the sound going into the tube and the level of the sound being reflected.

The results for six different materials are given below.

Material	Sound level in/ dB	Sound level reflected/ dB
glass	60	48
carpet	60	32
wood	60	52
paper	60	40
wool	60	24
plastic	60	44

- (i) Which material is the best absorber of sound?

_____ [1]

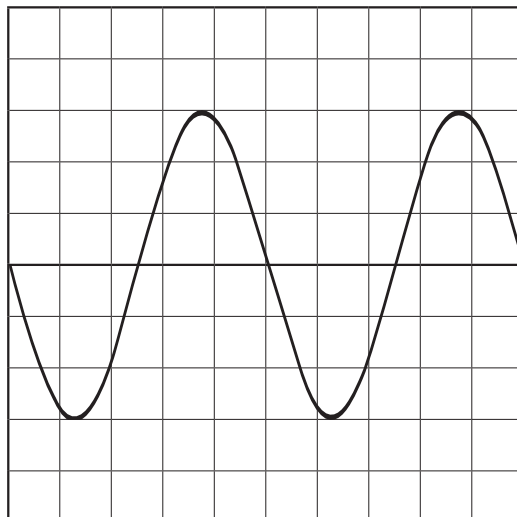


(ii) Calculate the percentage of sound reflected by **glass**.

(Show your working out.)

_____ % [2]

(b) A sound wave is represented in the diagram below.



Each square on the grid represents 1 cm.

(i) What is the wavelength of this wave?

_____ cm [1]

(ii) What is the amplitude of this wave?

_____ cm [1]

(c) Sound is a **longitudinal** wave. Describe the motion of the particles in a longitudinal wave.

_____ [2]

[Turn over]

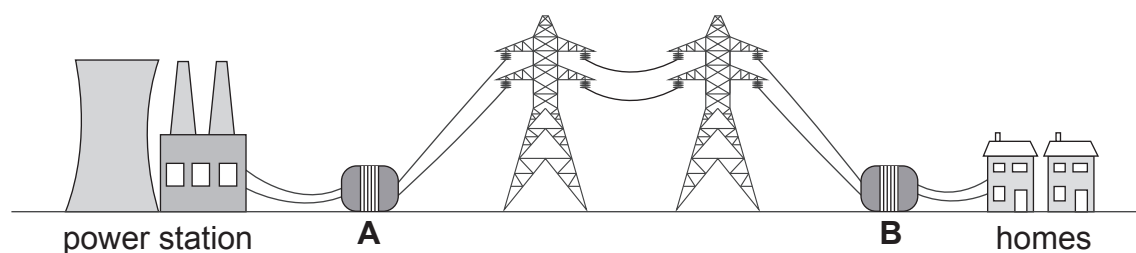


(d) Microwaves are transverse waves. Explain fully the heating effect of microwaves in terms of energy absorption and molecular behaviour.

[3]



- 7 The diagram below shows how electricity is transmitted from a power station to our homes.



Source: Principal Examiner

- (a) Name the type of transformers at **A** and **B**.

A _____

B _____ [1]

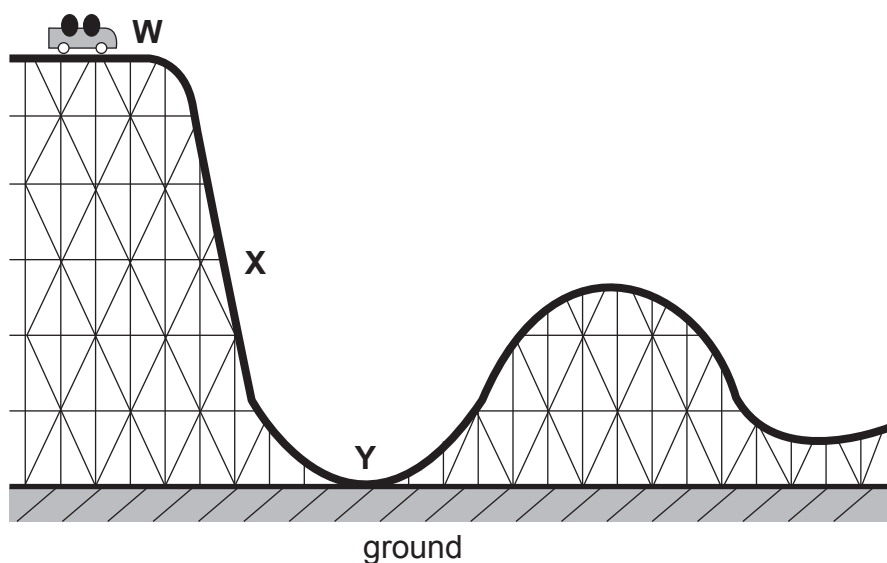
- (b) Describe fully the way in which transformer **A** changes the electricity coming from the power station and why this is important.

_____ [3]

[Turn over



- 8 The diagram below shows a 400 kg cart about to roll down a rollercoaster track.



Source: Principal Examiner

- (a) The gravitational potential energy of the cart at **W** is 60 000 J.

Use the equation:

$$\text{gravitational potential energy} = \text{mass} \times \text{gravity} \times \text{height}$$

to calculate the height of the cart at **W**.

Take gravity as 10 N/kg.

(Show your working out.)

_____ m [2]



(b) (i) Complete the table below using a tick (✓) to give the energy types the cart has at **X** and **Y**.

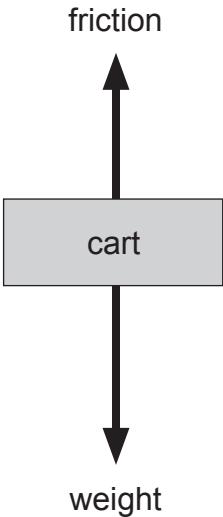
Position on track	Type of energy	
	Gravitational potential	Kinetic
W	✓	
X		
Y		

[1]

(ii) Name **one** type of energy that is wasted as the cart moves from **W** to **Y**.

[1]

The diagram below represents the forces acting on the cart at point **X**.



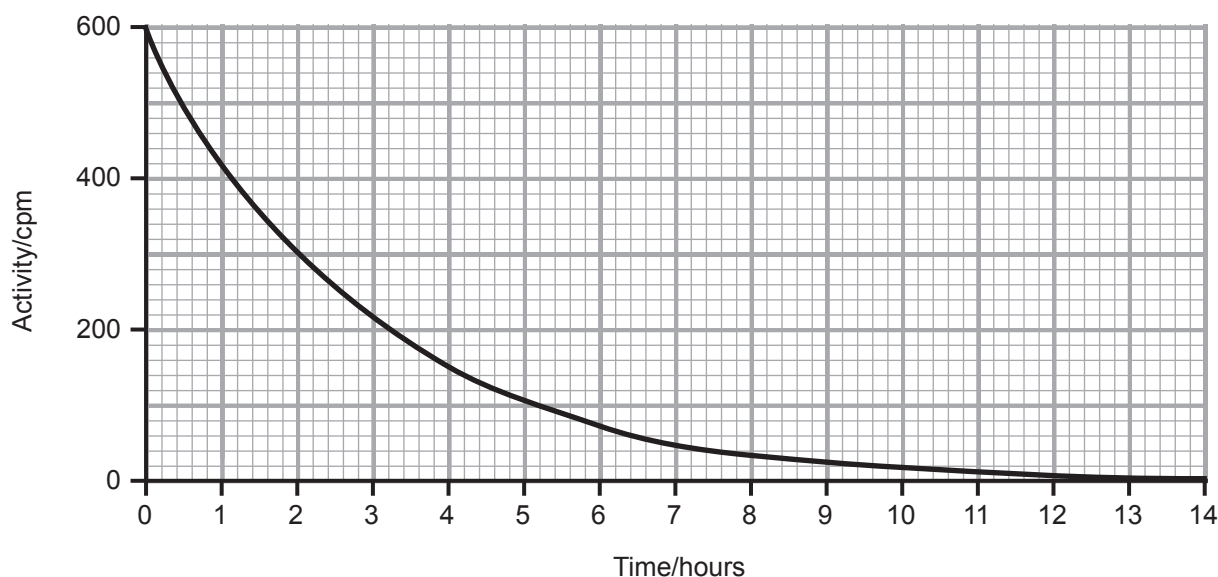
(c) Describe fully, in terms of forces, why the cart will be accelerating downwards at point **X**.

[2]

[Turn over



- 9 The graph below shows how the activity of a radioisotope changes with time and can be used to find its half-life.
Background radiation of 20 cpm has been taken into account.



- (a) What is meant by the term **half-life**?

[2]

- (b) How does the graph show that background radiation levels were taken into account?

[1]



The table below gives the half-life and type of radiation emitted by six radioisotopes.

Radioisotope	Half-life	Radiation emitted
A	10 seconds	Alpha
B	10 years	Beta
C	10 months	Alpha
D	5 seconds	Gamma
E	5 years	Beta
F	11 months	Gamma

In some cancer treatments a radioisotope is placed inside the tumour to destroy the cancerous cells but **not** destroy the surrounding healthy cells. The treatment takes almost a year to work.

- (c) Using information from the table and your knowledge, which radioisotope (A to F) should be chosen for cancer treatment? Explain your answer fully.

[3]

- (d) What is meant by the term **ionisation**?

[1]

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For Examiner's use only	
Question Number	Marks
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Examiner Number

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