



General Certificate of Secondary Education
2023–2024

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3
Foundation Tier



[GSA31]

GSA31

FRIDAY 7 JUNE 2024, AFTERNOON

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 eight** 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.

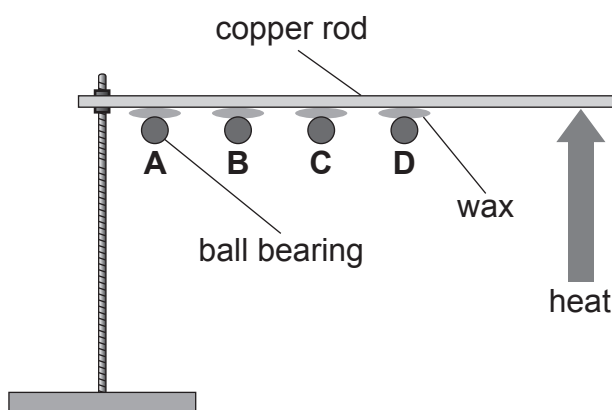
Quality of written communication will be assessed in Question **7(c)**.

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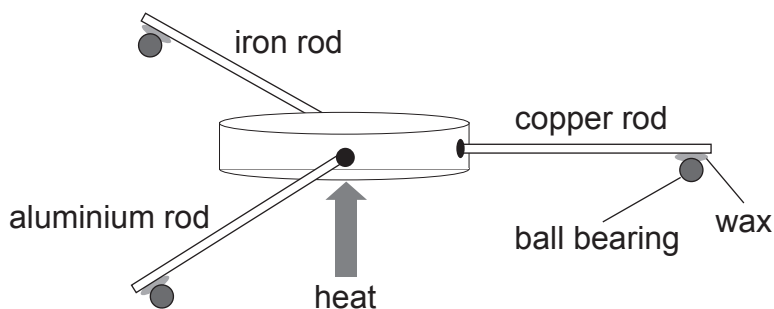
1 The apparatus below was used to investigate how heat travels through a copper rod.



(a) Which ball bearing **A**, **B**, **C** or **D** would fall off **last**?

_____ [1]

The apparatus below was used to compare the conduction of three metal rods of equal length and thickness.



The time for each ball bearing to fall off was measured.

The results are shown below.

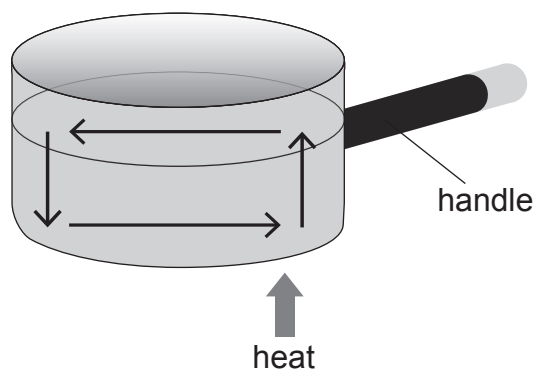
Metal rod	Time taken/s
copper	127
iron	283
aluminium	161

(b) Which metal is the **best** conductor of heat?

_____ [1]



(c) The diagram below shows water being heated in a saucepan.



(i) Name the method of heat transfer shown by the arrows in the water.

Circle your answer.

radiation

conduction

convection

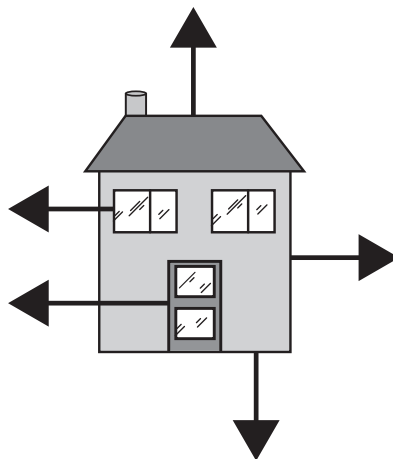
[1]

The handles of saucepans are often made of an insulating material.

(ii) Suggest **one** material that would be suitable to use for the handle.

_____ [1]

The arrows in the diagram below show heat being lost from a house.



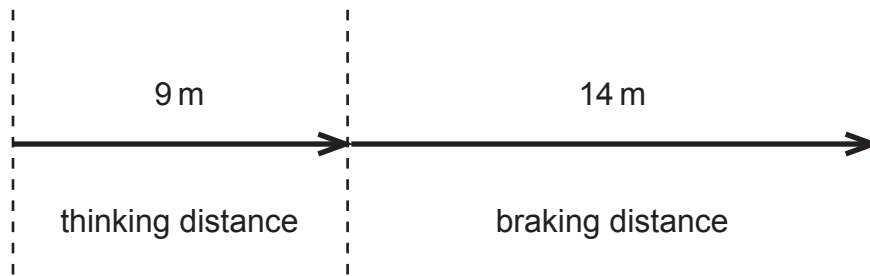
(d) Name **one** method of insulating a house to reduce heat loss.

_____ [1]

[Turn over



- 2 (a) A driver sees a traffic light turn red and needs to stop. The distances travelled by the car are shown below.



- (i) Calculate the stopping distance of the car.

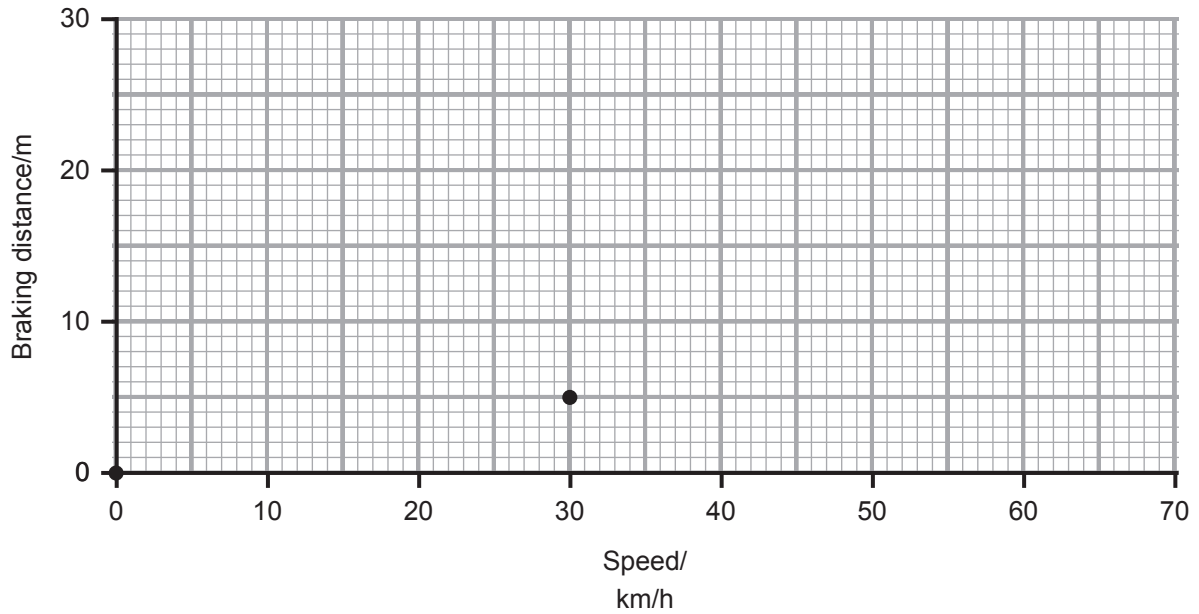
_____ m [1]

The table below gives the braking distance of a car at different speeds.

Speed/ km/h	Braking distance/ m
0	0
30	5
40	10
50	15
60	22
70	30



(ii) On the grid below plot and draw a line graph for this information.
The first two points have been plotted for you.



[3]

(iii) Complete the following sentence to give the trend shown by this information.

As the speed increases _____

_____ [1]

(iv) Use the graph to find the braking distance for a car travelling at **20 km/h**.

_____ m [1]

[Turn over



(b) Stopping, braking and thinking distances may be affected by the condition of the car, the road or the driver.

(i) Complete the table below, using ticks (✓), to show which of the distances are affected by each condition.

The first row has been completed for you.

Condition	Thinking distance	Braking distance	Stopping distance
wet road		✓	✓
driver has consumed alcohol			
worn tyres			

[2]

(ii) Complete the following sentence.

Braking distance is increased on a wet road because the force of

_____ is reduced.

[1]



3 (a) Given below are three features of waves and their descriptions.

(i) Use lines to match each feature with the correct description.

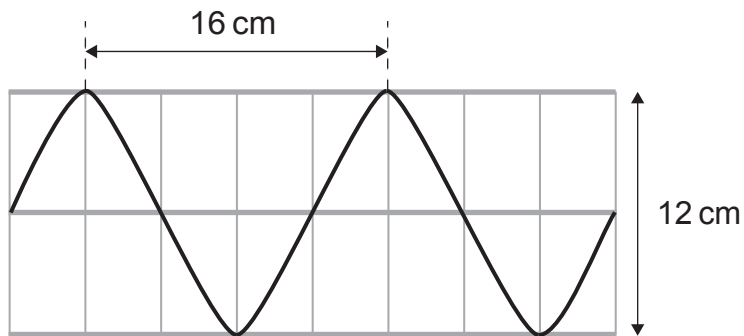
Feature	Description
frequency	particles vibrate at right angles to the direction of the wave
energy	carried by the wave
transverse wave	the number of vibrations per second

[2]

(ii) Give **one** example of a transverse wave.

[1]

(b) A wave is represented by the diagram below.



(i) What is the wavelength of this wave?

_____ cm [1]

(ii) What is the amplitude of this wave?

_____ cm [1]

[Turn over



(c) A wave has a wavelength of 0.5 m and a frequency of 6 Hz.

(i) Use the equation:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

to calculate the wave speed.

Show your working out.

_____ [2]

(ii) What is the unit of wave speed?

Circle your answer.

s/m

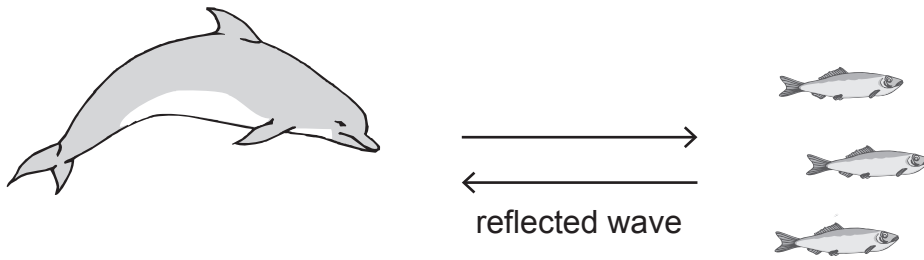
ms

m/s

[1]



(d) Dolphins use ultrasound to find fish.



(i) Complete the following sentence.

Ultrasound is a sound wave with a _____

over _____ hertz. [2]

(ii) What name is given to a reflected sound wave?

_____ [1]

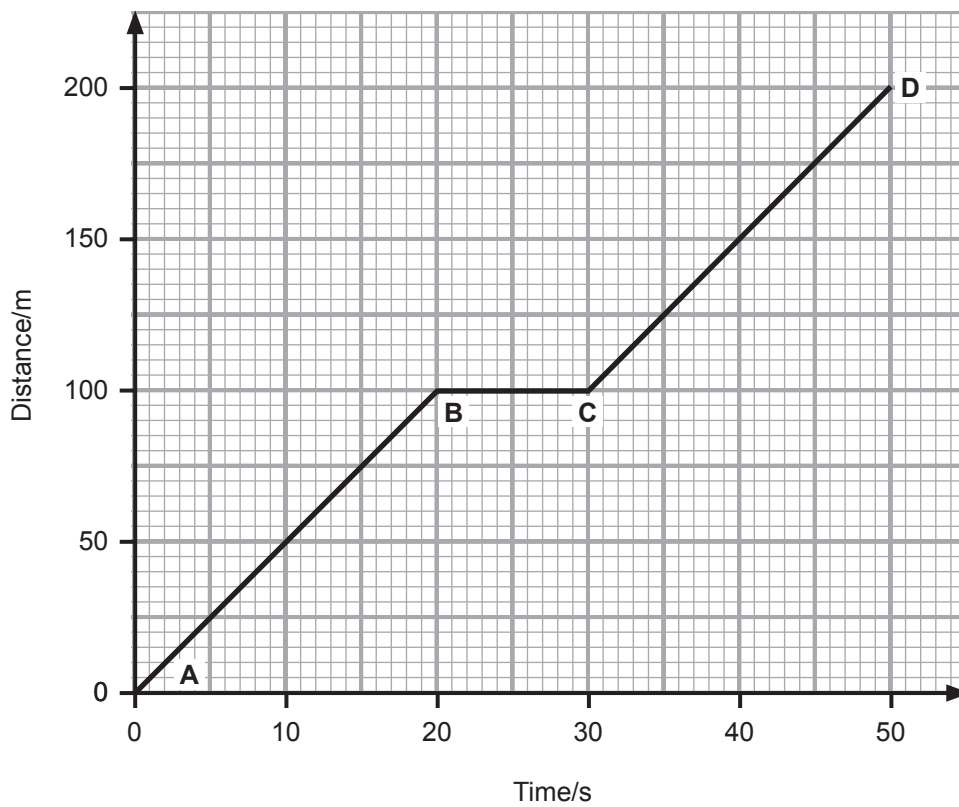
(iii) The ultrasound signal travels a total distance of 800 m. How far are the fish from the dolphin?

_____ m [1]

[Turn over



4 The distance-time graph for a boy's journey is shown below.



(a) (i) Describe the motion, if any, of the boy:

from **A** to **B**.

from **B** to **C**.

[2]

(ii) Compare the boy's speed between **A** and **B** to his speed between **C** and **D**.

Circle the correct answer.

slower : **faster** : **the same**

[1]



(b) Use the equation:

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

to calculate the average speed of the boy between **A** and **D**.

Show your working out.

_____ m/s [2]

(c) Speed limits for vehicles make our roads safer.

In a town, the speed limit is 30 mph and this is reduced to 20 mph near a school.

(i) State **one** method used to keep vehicles within the speed limit.

_____ [1]

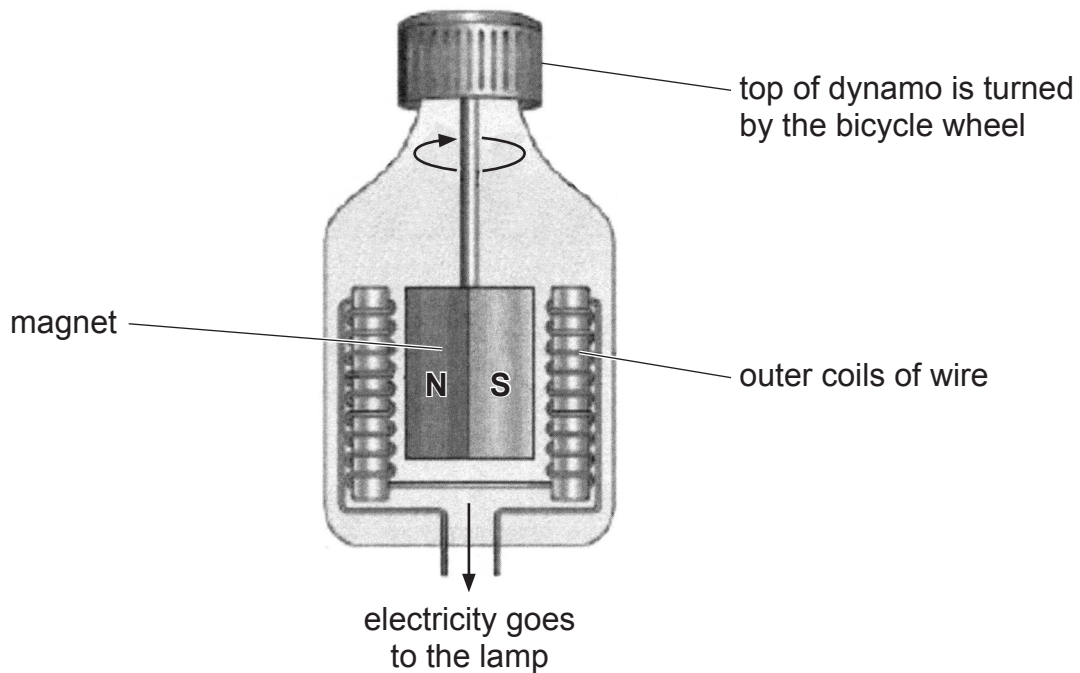
(ii) Suggest **one** reason for having a lower speed limit near a school.

_____ [1]

[Turn over



- 5 A small electrical generator can be fitted to a bicycle wheel to provide energy to light a lamp.
The diagram below shows how this small generator works.



The table below shows the steps involved in powering the bicycle lamp, but they are **not** in the correct order.

A	electricity is generated
B	top of dynamo turns
C	the magnet spins inside the coil of wire
D	electricity lights the lamp
E	bicycle wheel turns

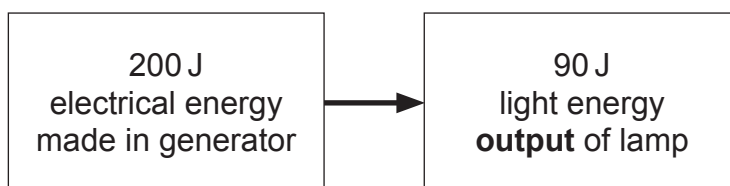
(a) Put the steps in the correct order. The first one has been done for you.



[2]



(b) Given below is the useful energy change in the bicycle lamp.



(i) Use the equation:

$$\text{efficiency} = \frac{\text{useful energy out}}{\text{total energy in}}$$

to calculate the efficiency of the bicycle lamp.

Show your working out.

_____ [2]

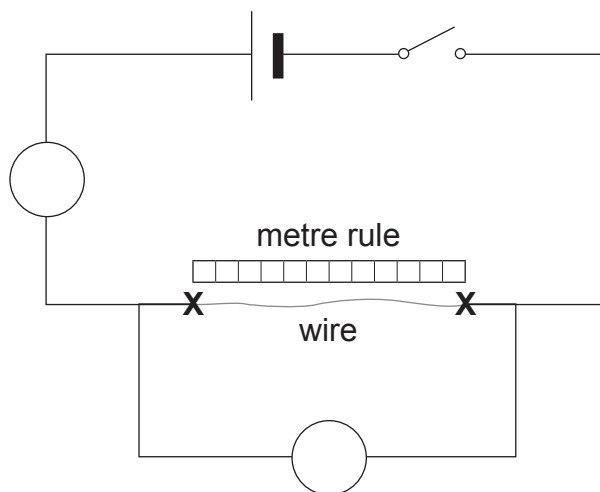
(ii) Name the wasted energy produced by the lamp.

_____ [1]

[Turn over



- 6 (a) A student used the following circuit to investigate how the length of a piece of wire affects resistance.



Measurements of current and voltage were recorded for different lengths of wire.

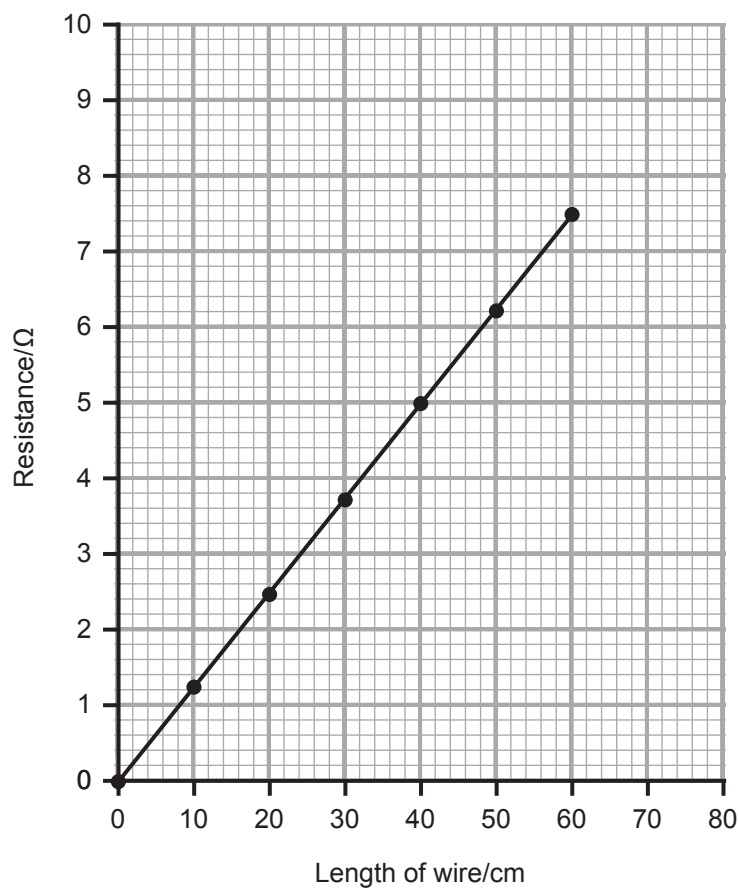
- (i) On the diagram above, complete the symbols for the meters used to measure the current and voltage. [2]

When electricity is flowing, the wire will become hot and its resistance will change.

- (ii) Name the component in the circuit that controls when the current flows. [1]
- _____



The graph below shows the results of this investigation.



(iii) Use the graph to predict the resistance of an 80 cm length of this wire.

_____ Ω [1]

When there is a voltage of 5 V across a wire, a current of 0.5 A flows.

(b) Use the equation:

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

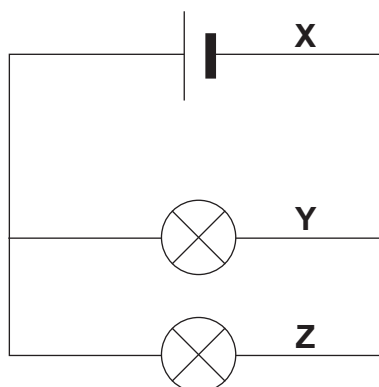
to calculate the resistance of this piece of wire.

Show your working out.

_____ Ω [2]
[Turn over]



(c) A student set up the circuit below using two identical bulbs.



(i) Complete the following sentence.

The bulbs in this circuit are connected in _____ . [1]

The current was measured at points **X**, **Y** and **Z** in the circuit.

(ii) Complete the table below to give the current measured at positions **X** and **Y**.

Circuit position	Current/A
X	
Y	
Z	0.5

[2]

(d) Which diagram below shows the correct polarity for a cell?

Circle your answer.



[1]





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[Turn over



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7 The table below shows information about four of the planets in the Solar System.

	Distance from Sun/ million km	Orbital time/ years	Average Temperature/°C
Jupiter	778	12	-110
Saturn	1434	29	-140
Uranus	2873	84	-195
Neptune	4495	164	-200

(a) State **two** trends shown by this data.

1. _____

2. _____
_____ [2]

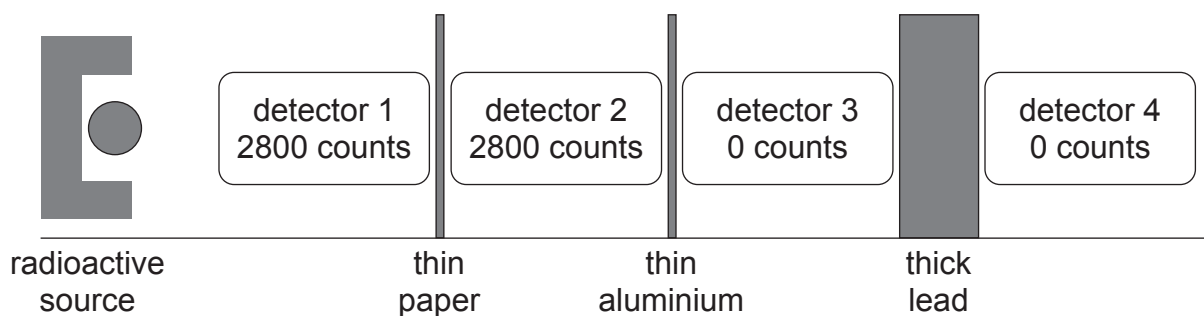
The table below gives information about an astronaut travelling from the Earth to the Moon.

	Mass/ kg	Gravity/ N/kg	Weight/ N
Earth	70	10	700
Space		0	0
Moon	70	1.7	119

(b) Complete the table to give the mass of this astronaut in Space. [1]



- 8 (a) The diagram below shows four detectors used to measure radiation as it passes through different materials.



- (i) Name the type of radiation emitted by this source.

_____ [1]

- (ii) Complete the following sentence.

A nucleus is radioactive because the combination of protons
and _____ is unstable and causes
it to disintegrate.

[1]

- (b) Give **one** use of radioactivity in medicine.

_____ [1]

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Sources:

- Question 1(a) . . . Principal Examiner
- Question 1(b) . . . Principal Examiner
- Question 1(c) . . . Principal Examiner
- Question 1(d) . . . Principal Examiner
- Question 3(d) . . . Principal Examiner
- Question 5(a) . . . Principal Examiner
- Question 6(a) . . . Principal Examiner
- Question 6(c) . . . Principal Examiner
- Question 8(a) . . . Principal Examiner

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For Examiner's use only	
Question Number	Marks
1	
2	
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8	
Total Marks	

Examiner Number

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