AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE

ADDITIONAL SCIENCE PHYSICS

H

Higher Tier Unit Physics P2

Friday 16 June 2017 Morning Time allowed: 1 hour

Materials
For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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

1 (a) Plutonium-239 is used as a fuel in some nuclear reactors.

Name the substance used as a fuel in most nuclear reactors.

[1 mark]

_____

1 (b) Energy is released from nuclear fuels by the process of nuclear fission.

1 (b) (i) Complete the following sentence.

[1 mark]

Nuclear fission occurs after the nucleus of a plutonium-239 atom has

absorbed a _____ .

1 (b) (ii) Describe what happens when the nucleus of an atom undergoes nuclear fission.

[2 marks]

_____

_____

_____

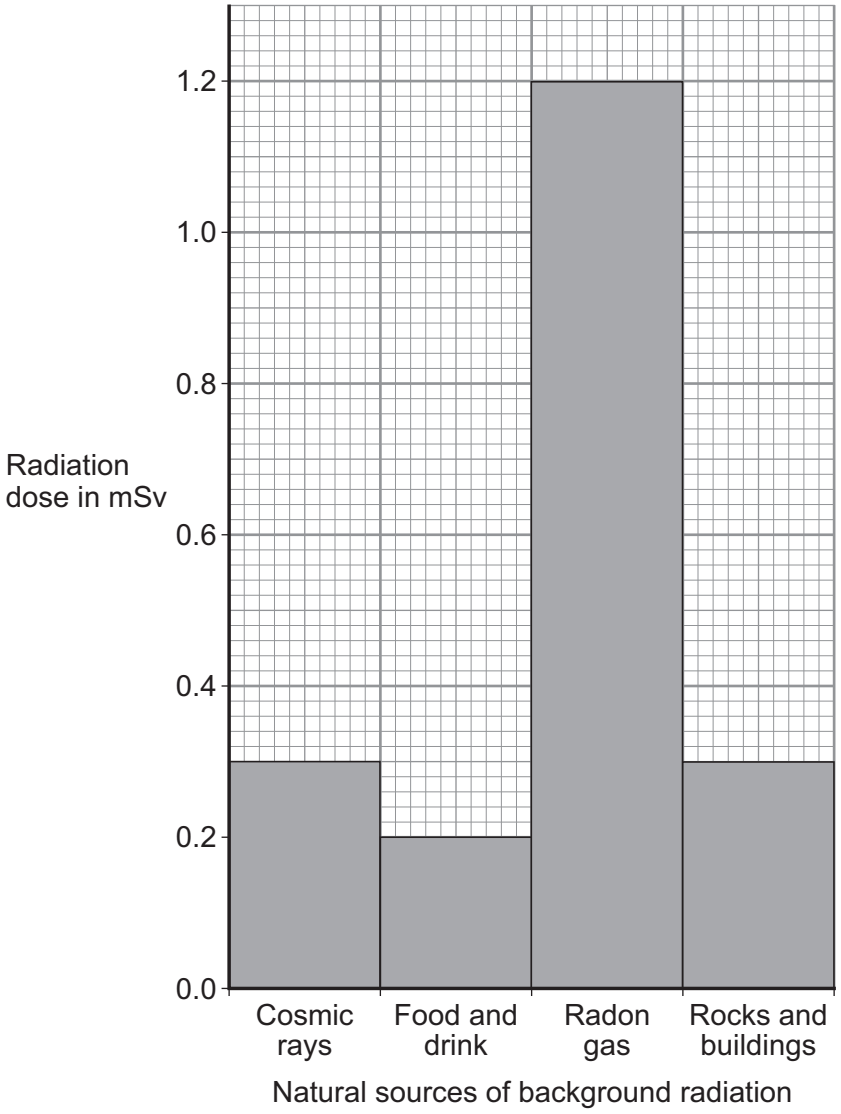
_____

4

Turn over for the next question

2 **Figure 1** shows the total radiation dose that the average person in the UK gets from natural background radiation sources in one year.

Figure 1



2 (a) (i) Calculate the percentage of the total radiation dose the average person in the UK receives from cosmic rays.

[2 marks]

Percentage radiation dose from cosmic rays = _____ %

2 (a) (ii) Over one year, a person may get a higher than average dose of radiation from cosmic rays.

Suggest **one** reason why.

[1 mark]

_____

_____

2 (a) (iii) Some sources of background radiation are man-made.

Name **one** man-made source of background radiation.

[1 mark]

_____

_____

2 (b) Before using a radioactive source a teacher measured the background radiation in her laboratory. She did this three times. The measurements were taken correctly but the three measurements were different.

Why were the three background measurements different?

[1 mark]

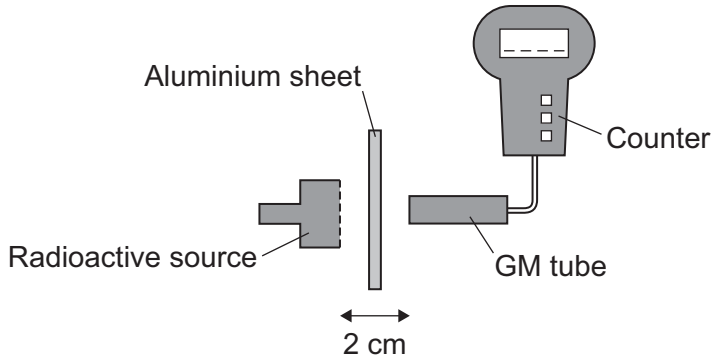
_____

_____

Question 2 continues on the next page

2 (c) **Figure 2** shows the apparatus the teacher used to investigate the radiation emitted by a source.

Figure 2



The teacher changed the thickness of the aluminium between the source and the Geiger-Müller (GM) tube.

The number of counts recorded for each thickness is given in **Table 1**.
The mean background measurement was 20 counts in one minute.

Table 1

Thickness of aluminium in millimetres	**Counts in one minute**
2	350
4	68
6	20

2 (c) (i) A student concluded that the radioactive source emits beta radiation.

Explain how the information in **Table 1** supports this conclusion.

[2 marks]

2 (c) (ii) The teacher said that the source also emits alpha radiation.

Describe how the investigation could be changed in order to show that the source emits alpha radiation.

[2 marks]

9

Turn over for the next question

3 The lifecycle of some stars includes a supernova stage.

3 (a) (i) What happens to a star during the supernova stage?

[1 mark]

_____

3 (a) (ii) Complete the following sentence.

[1 mark]

After the supernova stage either a black hole or a _____ star will be formed.

3 (a) (iii) The lifecycle of the Sun will **not** include a supernova stage.

Give the reason why.

[1 mark]

_____

_____

3 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Describe what happens to a star like the Sun as it passes through its lifecycle.

Your answer should include how the star was formed and the names of the stages the star passes through.

[6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

Extra space

3 (c) There are a number of theories about how the Universe will end.
A recent theory suggests that 22 billion years from now the Universe will rip itself apart.

Suggest why scientists may support one particular theory and reject others.

[2 marks]

11

Turn over for the next question

4 A lorry driver sees the traffic lights at a road junction change to red.
The driver applies the brakes to stop the lorry.

The stopping distance is the thinking distance plus the braking distance.

4 (a) (i) Which statement describes the thinking distance?

[1 mark]

Tick (✓) **one** box.

The time it takes for the lorry to stop after the brakes are applied. ☐

The time it takes the driver to react and apply the brakes. ☐

The distance the lorry travels once the brakes are applied. ☐

The distance the lorry travels during the driver's reaction time. ☐

4 (a) (ii) How does thinking distance depend on the speed of the lorry?

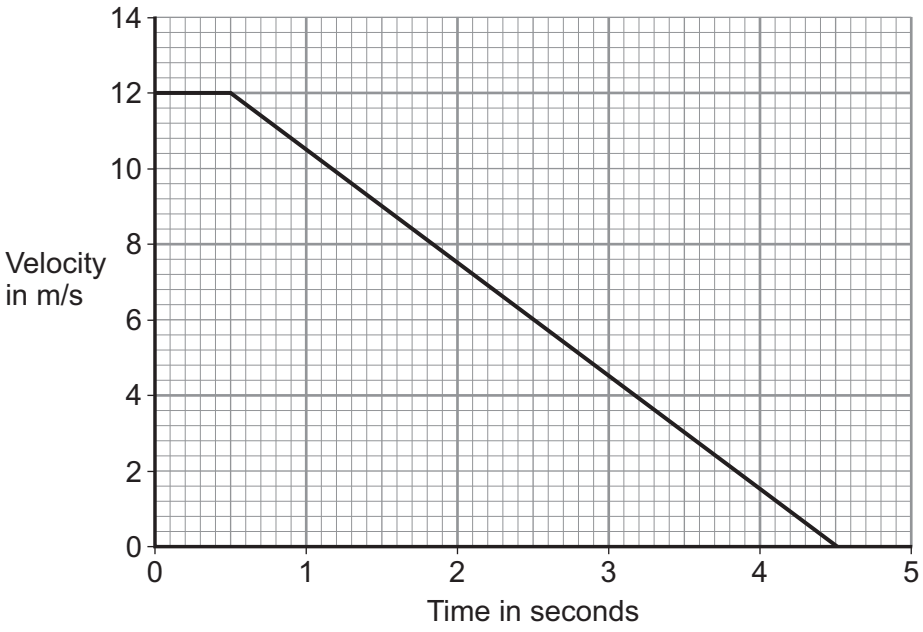
[1 mark]

_____

_____

4 (b) **Figure 3** shows how the velocity of the lorry changes from just after the driver sees the traffic lights change to red.

Figure 3



4 (b) (i) Calculate the braking distance of the lorry.

Show how you used **Figure 3** to obtain your answer.

[2 marks]

Distance = _____ m

4 (b) (ii) The work done to stop the lorry is 360 kJ

Calculate the braking force used to stop the lorry.

Use the correct equation from the Physics Equations Sheet.

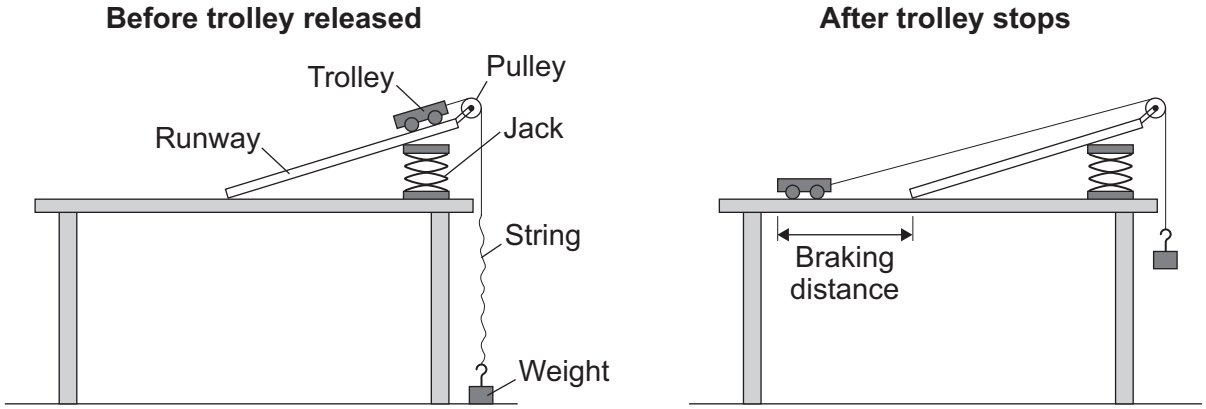
[2 marks]

Braking force = _____ N

Question 4 continues on the next page

4 (c) A student investigated how braking distance depends on braking force. The student used the apparatus shown in **Figure 4**.

Figure 4



The student released the trolley from the top of the runway. When the trolley reached the bottom of the runway the string became taut and the trolley started to lift a weight from the floor. The weight being lifted was equal to the braking force on the trolley.

The student changed the weight being lifted and measured the new braking distance.

4 (c) (i) State **one** control variable in this investigation.

[1 mark]

_____

_____

4 (c) (ii) **Figure 4** shows the braking distance measured by the student.

What else could the student have measured that would also have given the braking distance?

[1 mark]

_____

_____

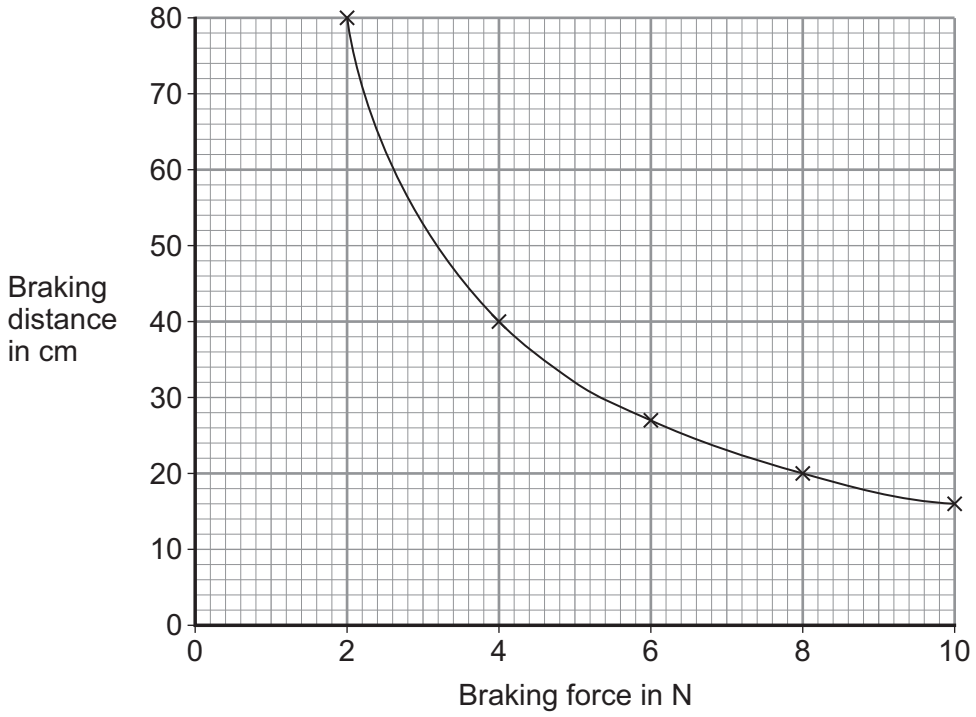
_____

4 (c) (iii) Measuring each braking distance at least twice would improve the investigation. Suggest why.

[2 marks]

4 (c) (iv) The results of the investigation are plotted as a graph in **Figure 5**.

Figure 5



What conclusions should be made from this investigation about the relationship between braking distance and braking force?

Use data from **Figure 5** to justify your conclusion.

[2 marks]

12

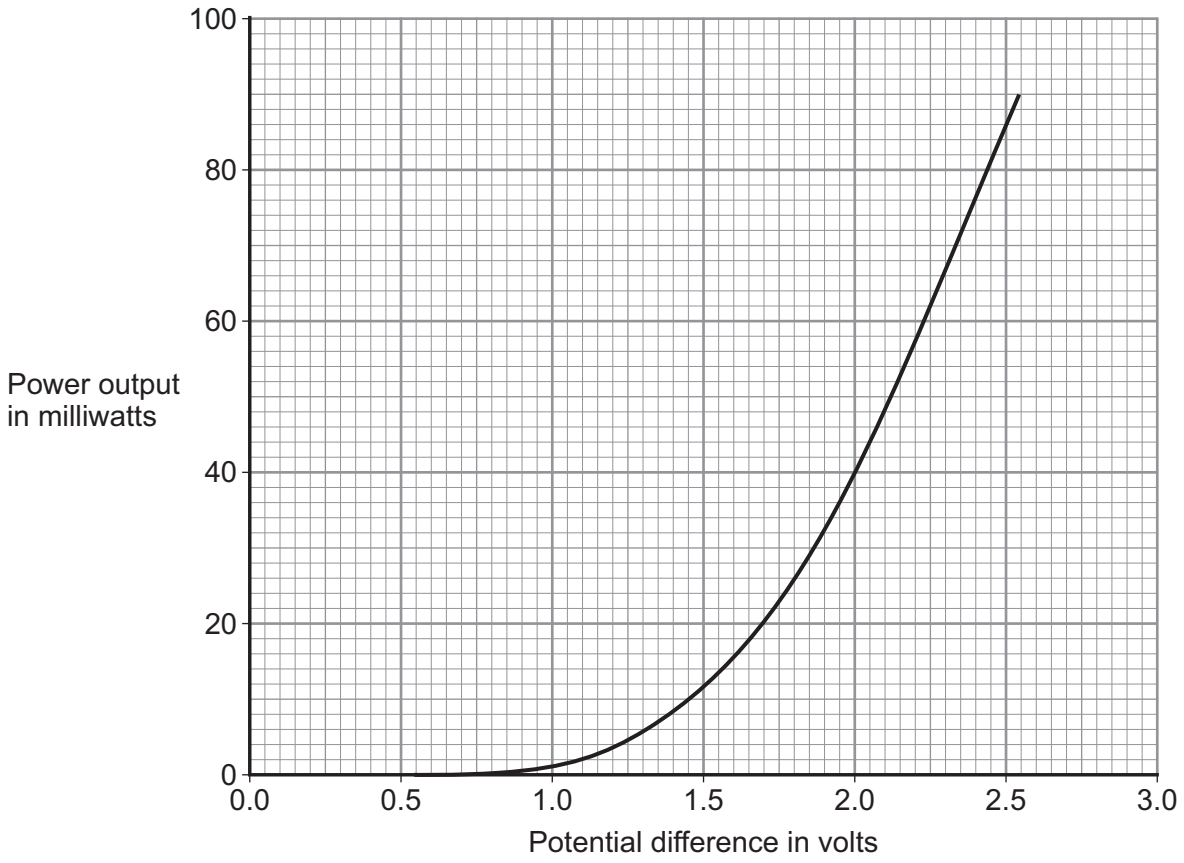
5 The lighting in a home may be provided by LED bulbs, filament bulbs or halogen bulbs.

5 (a) (i) In the box below, draw the circuit symbol for an LED.

[1 mark]

5 (a) (ii) **Figure 6** shows how the power output from one type of LED varies with the potential difference across the LED.

Figure 6



1 milliwatt = 0.001 W

The LED is connected in series with a battery and resistor.
The potential difference across the LED is 2.0 V

Use data from **Figure 6** to calculate the energy transferred by the LED in 5 minutes.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Energy transferred = _____ J

5 (b) The resistance of a filament bulb increases as the temperature of the filament increases.

Explain, in terms of the electrons and ions inside the filament, why the resistance increases.

[2 marks]

5 (c) Why are LED bulbs cheaper to use than filament bulbs or halogen bulbs that produce the same brightness of light?

[1 mark]

7

Turn over for the next question

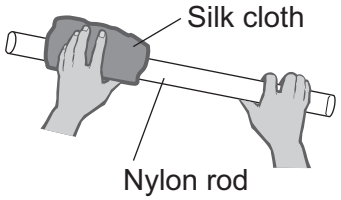
6 When two different materials listed in **Table 2** are rubbed together they become electrostatically charged. The polarity of the material that is higher in **Table 2** would become positive.

Table 2

glass
nylon
wool
silk
polyester
PVC

6 (a) **Figure 7** shows a nylon rod being rubbed with a silk cloth.

Figure 7



6 (a) (i) Explain why both materials become electrostatically charged.
Include in your answer the polarity of each material.

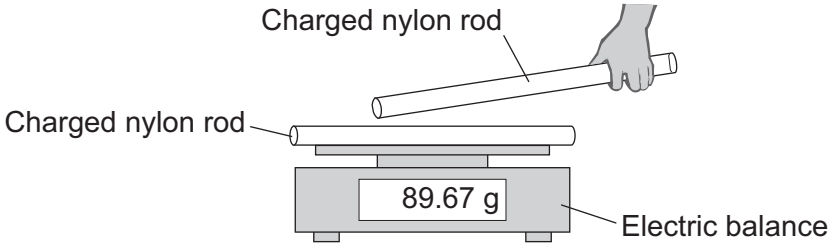
[3 marks]

6 (a) (ii) What difference would it have made if a PVC rod had been rubbed with the silk cloth rather than a nylon rod?

[1 mark]

6 (b) The charged nylon rod is put onto an electric balance.

Figure 8



A second identically charged nylon rod is moved towards the rod on the balance, as shown in **Figure 8**.

What will happen to the reading on the balance as the two rods get closer to each other?

The rods do not touch or discharge.

[3 marks]

Tick (✓) **one** box.

The reading will decrease. ☐

The reading will not change. ☐

The reading will increase. ☐

Explain the reason for your answer.

Question 6 continues on the next page

6 (c) A driver often becomes electrostatically charged when in a car. This happens because the driver's clothing rubs against the car seat.

6 (c) (i) The charge on a driver who has just got out of his car is 3.0×10^{-3} coulombs. When the driver starts to close the car door a spark jumps across the air gap between the driver and the door. The spark transfers 27 joules of energy.

Calculate the potential difference between the driver and the car as the driver starts to close the door.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Potential difference = _____ volts

6 (c) (ii) A scientist investigated how the charge on a driver changed when the driver wore clothes made from different materials. The results from the investigation are given in **Table 3**.

Table 3

Type of material	**Charge on the driver $\times 10^{-3}$ coulombs**
cotton	1.4 to 1.7
wool	2.4 to 2.5
polyester	3.5 to 3.8

A student looked at the data in **Table 3** and concluded:

'The charge on a driver will always be less if the driver wears clothes made from cotton rather than any other type of material.'

Suggest **two** reasons why this may **not** be a valid conclusion.

[2 marks]

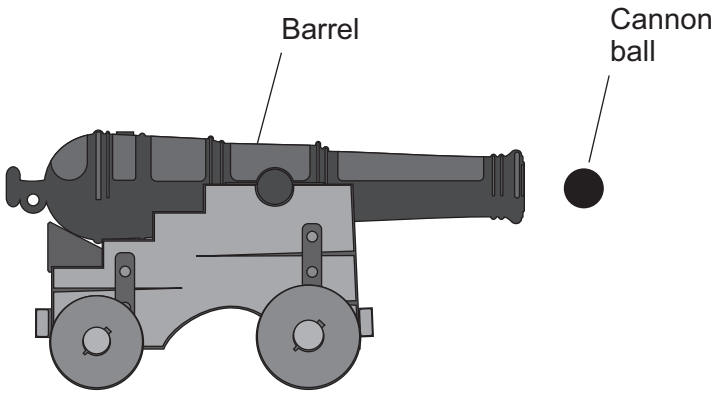
1 _____

2 _____

11

7 **Figure 9** shows one type of cannon.

Figure 9



7 (a) When the cannon is fired, there is an explosion inside the barrel. The explosion causes the cannon ball to move forwards and the cannon to move backwards.

Explain, using the idea of momentum, why the cannon moves backwards after firing.

[3 marks]

Question 7 continues on the next page

7 (b) When the cannon is fired, the cannon ball accelerates at 2500 m/s^2 for 0.05 seconds. The cannon ball has a mass of 8 kg

Calculate the momentum of the cannon ball 0.05 seconds after the cannon is fired.

Use the correct **equations** from the Physics Equations Sheet.

[3 marks]

Momentum = _____ kg m/s

6

END OF QUESTIONS