Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

ADDITIONAL SCIENCE
Unit Physics P2

PHY2H

H

PHYSICS
Unit Physics P2

Higher Tier

Monday 19 January 2009 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

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. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

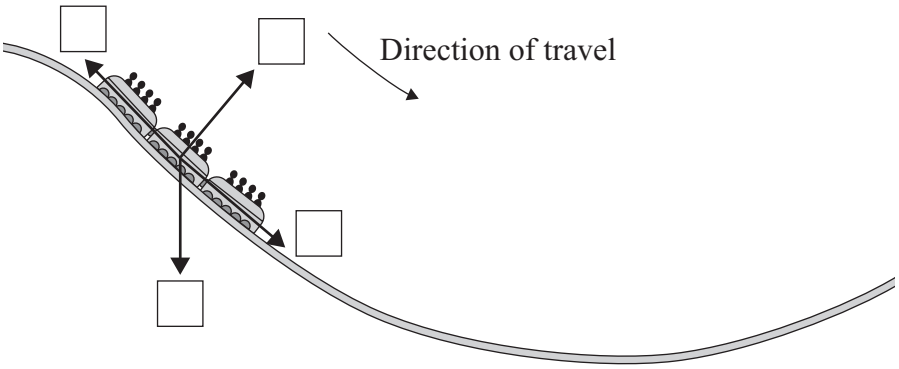
For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
		7	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 The diagram shows the passenger train on part of a rollercoaster ride.

1 (a) Which arrow shows the direction of the resultant force acting on the passenger train?

Put a tick (✓) in the box next to your choice.



(1 mark)

1 (b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

.....

.....

(1 mark)

1 (c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

1 (c) (i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1 mark)

1 (c) (ii) One of the passengers has a mass of 80 kg.

Use the equation in the box to calculate the maximum weight this passenger seems to have during the ride.

weight = mass × gravitational field strength

Show clearly how you work out your answer.

.....

.....

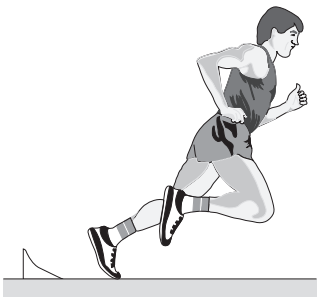
Maximum weight = ... N

(2 marks)

5

Turn over for the next question

2 (a) The diagram shows an athlete at the start of a race. The race is along a straight track.



In the first 2 seconds, the athlete accelerates constantly and reaches a speed of 9 m/s.

2 (a) (i) Use the equation in the box to calculate the acceleration of the athlete.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken for change}}$$

Show clearly how you work out your answer.

.....

.....

.....

Acceleration = ...

(2 marks)

2 (a) (ii) Which **one** of the following is the unit for acceleration?

Draw a ring around your answer.

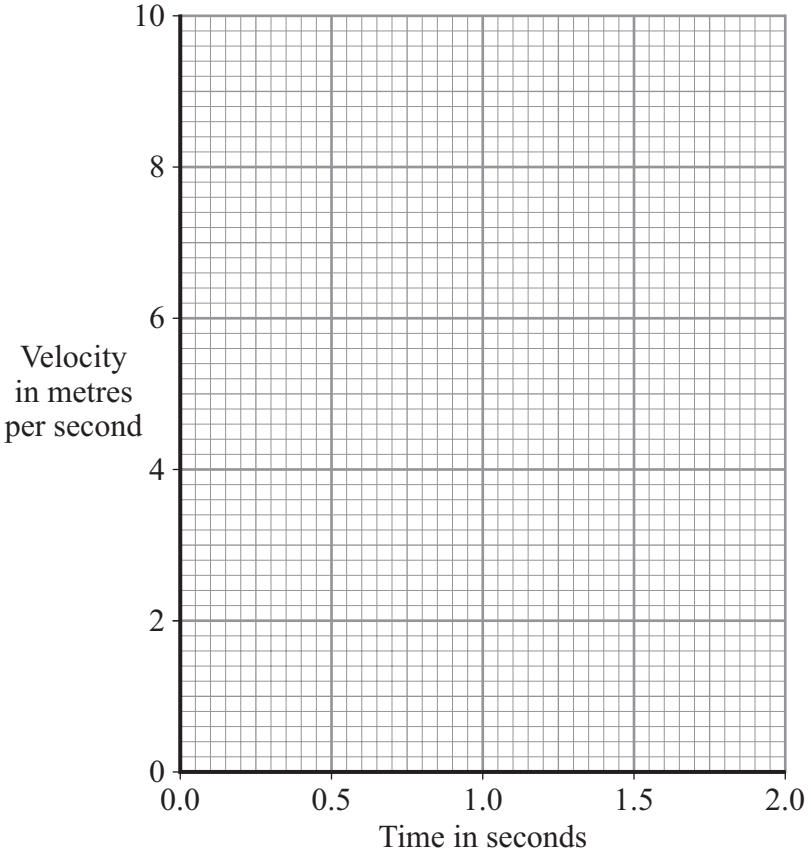
J/s **m/s** **m/s^2** **Nm**

(1 mark)

2 (a) (iii) Complete the following sentence.

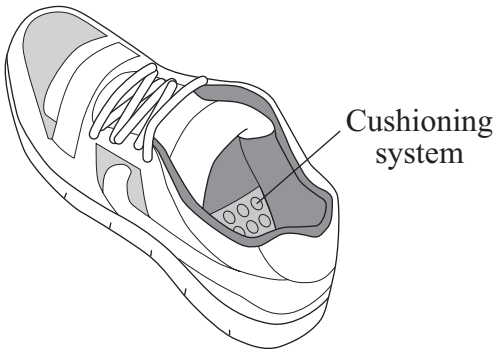
The velocity of the athlete is the ..... of the athlete in a given direction. *(1 mark)*

2 (a) (iv) Complete the graph to show how the velocity of the athlete changes during the first 2 seconds of the race.



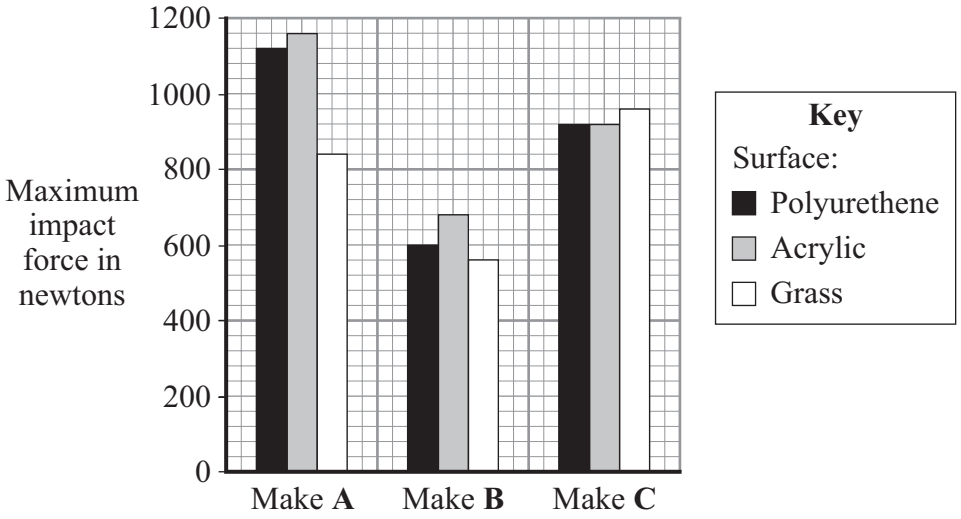
(2 marks)

2 (b) Many running shoes have a cushioning system. This reduces the impact force on the athlete as the heel of the running shoe hits the ground.



Question 2 continues on the next page

The bar chart shows the maximum impact force for three different makes of running shoe used on three different types of surface.



2 (b) (i) Which **one** of the three makes of running shoe, **A**, **B** or **C**, has the best cushioning system?

.....

Explain the reason for your answer.

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(3 marks)

2 (b) (ii) The data needed to draw the bar chart was obtained using a robotic athlete fitted with electronic sensors.

Why is this data likely to be more reliable than data obtained using human athletes?

.....

.....

(1 mark)

10

Turn over for the next question

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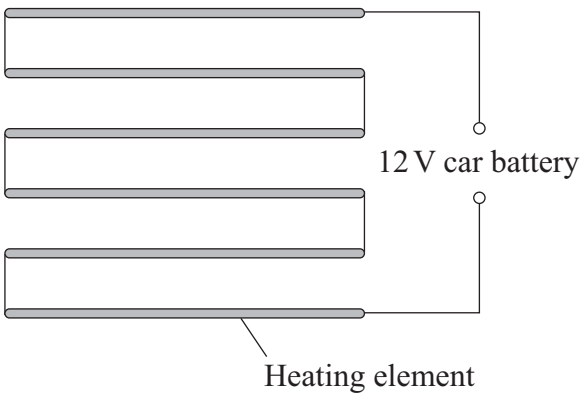
ANSWER IN THE SPACES PROVIDED

3 The diagram shows a simple type of car rear window heater. The six heating elements are exactly the same.



3 (a) Each heating element has a resistance of 5 Ω. The current passing through each element is 0.4 A.

3 (a) (i) Calculate the total resistance of the six heating elements.

Show clearly how you work out your answer.

.....

.....

Total resistance = ... ohms

(2 marks)

3 (a) (ii) Why is the current passing through each element the same?

.....

.....

(1 mark)

3 (a) (iii) What is the total current passing through the whole circuit?

.....

(1 mark)

3 (a) (iv) How is the 12 volt potential difference of the car battery shared between the six heating elements?

.....

.....

(1 mark)

3 (b) It takes the heater two minutes to demist the car window.

Use the equation in the box to calculate how much charge flows through the heater in this time.

charge = current × time

Show clearly how you work out your answer and give the unit.

.....

.....

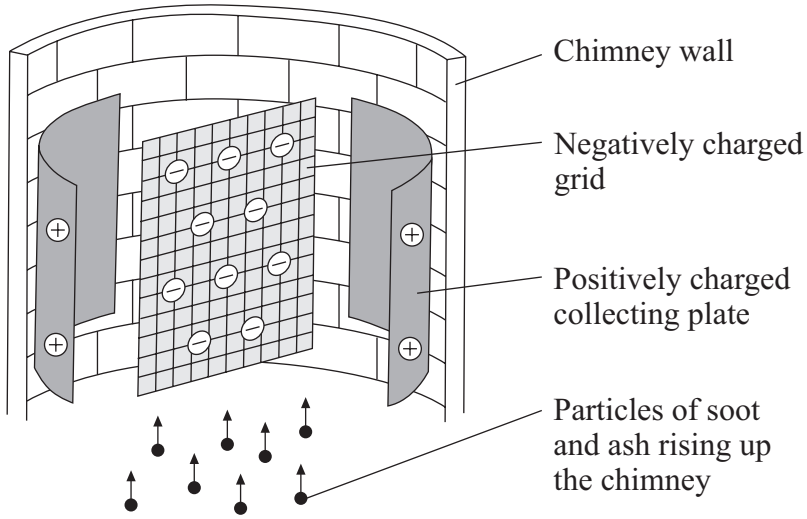
Charge = ...

(3 marks)

8

Turn over for the next question

4 (a) Burning coal produces soot, ash and waste gases.
The diagram shows an electrostatic precipitator used to separate the particles of soot and ash from the waste gases.



Explain how the electrostatic precipitator separates the particles of soot and ash from the waste gases.

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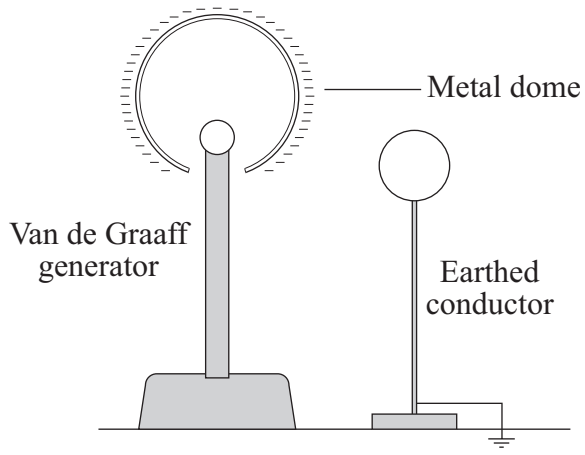
(3 marks)

4 (b) The diagram shows a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain what must happen to cause a spark to jump from the dome of the generator to an earthed conductor nearby.

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(2 marks)

5

Turn over for the next question

5 (a) Describe the difference between an alternating current (a.c.) and a direct current (d.c.).

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(2 marks)

5 (b) The diagram shows the information plate on the bottom of an electric wallpaper steamer.

230 V a.c.	50 Hz	2.3 kW

5 (b) (i) Use the equation in the box to calculate the current used by the steamer.

power = current × potential difference

Show clearly how you work out your answer.

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Current ..... A

(2 marks)

5 (b) (ii) Which **one** of the following fuses should be used inside the plug of the steamer?

Draw a ring around your answer.

1 A **3 A** **5 A** **10 A** **13 A**

(1 mark)

5

6 (a) Complete the following table for an atom of uranium-238 ($^{238}_{92}U$).

mass number	238
number of protons	92
number of neutrons	

(1 mark)

6 (b) Complete the following sentence.

The name given to the number of protons in an atom is the proton number or the

..... .

(1 mark)

6 (c) An atom of uranium-238 ($^{238}_{92}U$) decays to form an atom of thorium-234 ($^{234}_{90}Th$).

6 (c) (i) What type of radiation, alpha, beta or gamma, is emitted by uranium-238?

.....

(1 mark)

6 (c) (ii) Why does an atom that decays by emitting alpha or beta radiation become an atom of a different element?

.....

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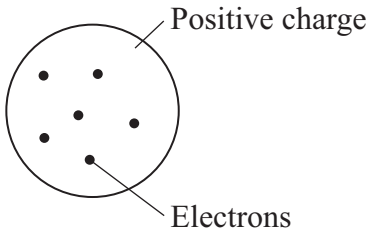
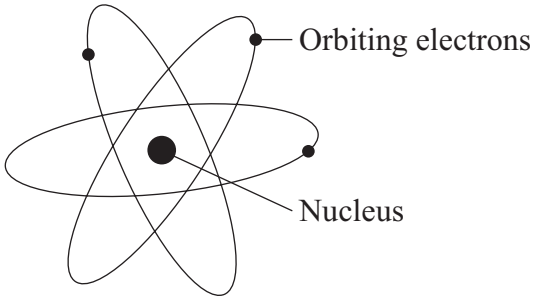
(1 mark)

4

7 In the early part of the 20th century, scientists used the 'plum pudding' model to explain the structure of the atom.



Following work by Rutherford and Marsden, a new model of the atom, called the 'nuclear' model, was suggested.



7 (a) Describe the differences between the two models of the atom.

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(4 marks)

7 (b) In their investigation, Rutherford and Marsden fired positively charged alpha particles at a very thin sheet of gold. Over a period of several months, the scientists made over 100 000 measurements. These measurements showed that:

- a very small number of alpha particles were deflected backwards from the gold foil.

Use the nuclear model to explain this experimental result.

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(2 marks)

7 (c) Why did the work of Rutherford and Marsden convince many scientists that the 'plum pudding' model of the atom was incorrect?

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(2 marks)

8

END OF QUESTIONS

There are no questions printed on this page

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