

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
January 2008

ADDITIONAL SCIENCE
Unit Physics P2

PHYSICS
Unit Physics P2

Higher Tier

Monday 21 January 2008 1.30 pm to 2.15 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> a pencil and a ruler. <p>You may use a calculator.</p>
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Time allowed: 45 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- 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.

PHY2H
H

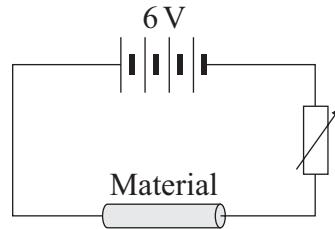


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Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



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

- 1 (a) The diagram shows the circuit used to investigate the resistance of a material. The diagram is incomplete: the ammeter and voltmeter are missing.



- (i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places. (2 marks)
- (ii) How can the current through the material be changed?

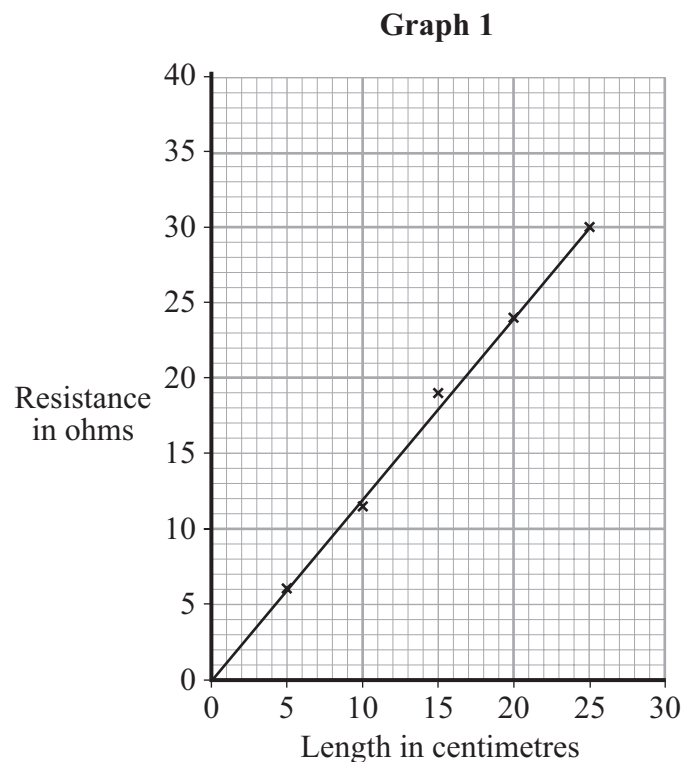
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(1 mark)

- (b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thicknesses.

Graph 1 shows how the resistance changes with length.



- (i) Why has the data been shown as a line graph rather than a bar chart?

.....
.....

(1 mark)

- (ii) The current through a 30 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 30 cm length of conducting putty.

Resistance = ohms
(1 mark)

- (iii) Use your answer to (b)(ii) and the equation in the box to calculate the potential difference across a 30 cm length of conducting putty.

potential difference = current \times resistance
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Show clearly how you work out your answer.

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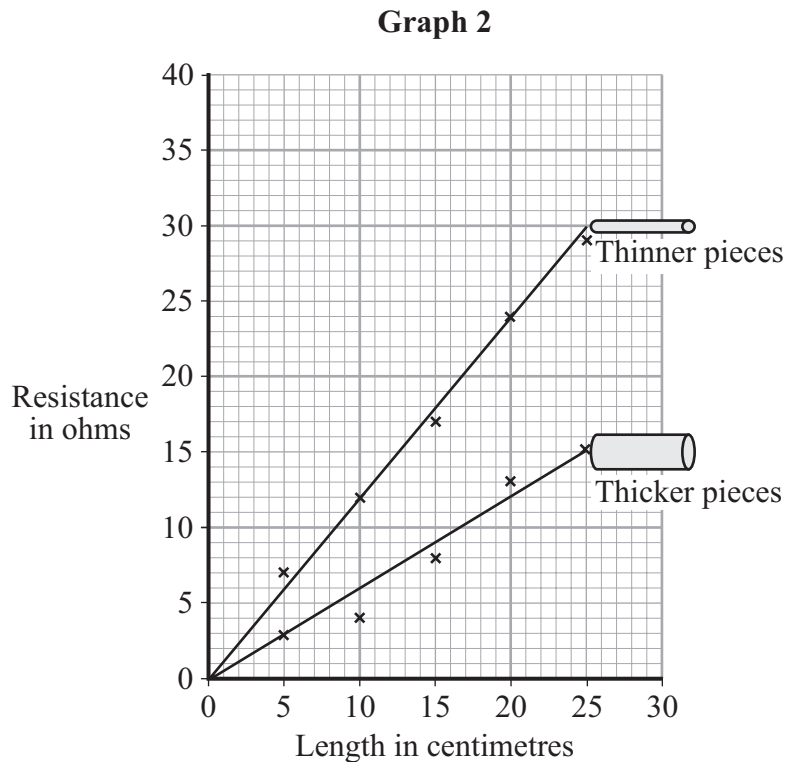
Potential difference = volts
(2 marks)

Question 1 continues on the next page

Turn over ►



- (c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.



- (i) What is the relationship between the resistance and the thickness of the conducting putty?

.....

 (1 mark)

- (ii) Name **one** error that may have reduced the accuracy of the results.

.....
 (1 mark)

- (iii) How could the reliability of the data have been improved?

.....

 (1 mark)



2 During car journeys, the driver will often become electrostatically charged. This is more noticeable on dry days than on damp, humid days.

(a) Explain what happens to cause the driver to become charged.

.....

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.....

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(2 marks)

(b) Scientists were asked to find out if the build up of charge on the driver depends on the type of material the driver's clothes are made from. The results of the investigation are given in the table.

Material	Humidity	Temperature in °C	Charge on the driver in millicoulombs
Nylon	48%	18	3.0 to 3.2
Wool	48%	18	2.4 to 2.5
Cotton	48%	18	1.4 to 1.7

Humidity is a measure of how much water vapour the air can hold.

(i) Why was it important that the scientists controlled the humidity?

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.....

(1 mark)

(ii) Does the data in the table show that the charge on the driver would always be less if they were to wear cotton clothing?

Give a reason for your answer.

.....

.....

(1 mark)

4

Turn over ►



- 3 The picture shows an advert for an electric mobility scooter.



Lightweight – only 40 kg
Maximum speed 2.5 m/s
Powered by two 12 V batteries
Maximum range 25 km

The ShopMobile Co.

- (a) The batteries are joined in series.

- (i) What is the potential difference provided by the batteries to the motor?

.....
(1 mark)

- (ii) The batteries supply a *direct current (d.c.)*.

What is a *direct current (d.c.)*?

.....
.....
(1 mark)

- (b) At 2.5 m/s on flat ground, the motor takes a current of 3.0 A from the batteries.

- (i) Explain why a bigger current is taken from the batteries when the scooter is going uphill at 2.5 m/s.

.....
.....
.....
.....
(2 marks)



- (ii) What effect does travelling uphill have on the range of the scooter?

.....
(1 mark)

- (c) The mass of the scooter driver is 80 kg.

Use the equation in the box to calculate the kinetic energy of the scooter **and** driver when they are travelling at maximum speed.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

.....
.....

Kinetic energy = J
(2 marks)

- (d) A battery which has run down is recharged in 8 hours. The average current delivered by the battery charger is 1.5 A.

Use the equation in the box to calculate the maximum charge stored by **both** batteries.

$$\text{charge} = \text{current} \times \text{time}$$

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

.....
.....

Charge stored =
(3 marks)

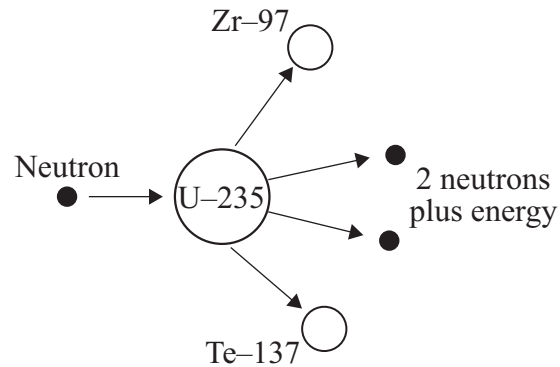
10

Turn over for the next question

Turn over ►



- 4 (a) The diagram shows what can happen when the nucleus of a uranium atom absorbs a neutron.



- (i) What name is given to the process shown in the diagram?

.....
(1 mark)

- (ii) Explain how this process could lead to a chain reaction.

You may wish to add further detail to the diagram to help your answer.

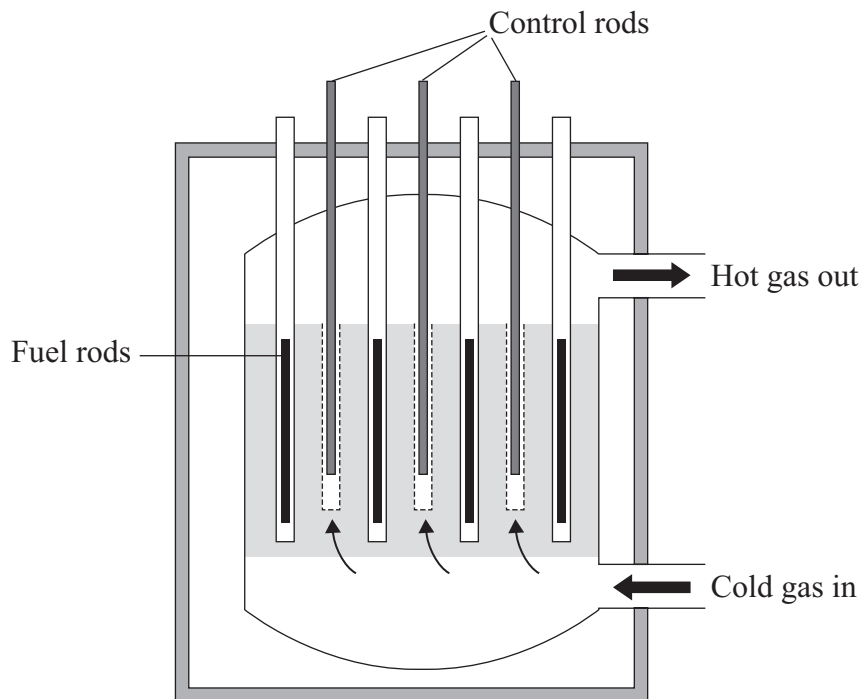
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(2 marks)

- (iii) How does the mass number of an atom change when its nucleus absorbs a neutron?

.....
(1 mark)



(b) Uranium-235 is used as a fuel in some nuclear reactors.



The reactor contains control rods used to absorb neutrons.

Suggest what happens when the control rods are lowered into the reactor.

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(2 marks)

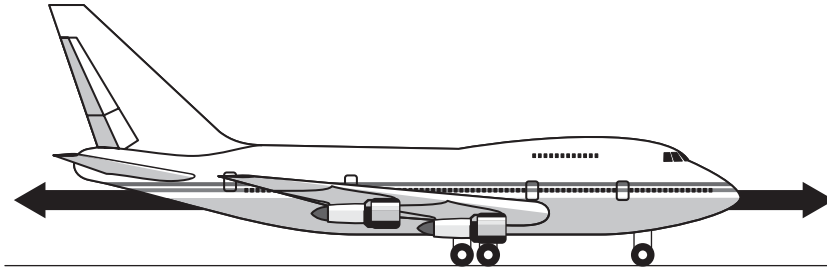
6

Turn over for the next question

Turn over ▶



- 5 (a) The diagram shows an aircraft and the horizontal forces acting on it as it moves along a runway. The *resultant force* on the aircraft is zero.



- (i) What is meant by the term *resultant force*?

.....

 (1 mark)

- (ii) Describe the movement of the aircraft when the resultant force is zero.

.....

 (1 mark)

- (b) The aircraft has a take-off mass of 320 000 kg. Each of the 4 engines can produce a maximum force of 240 kN.

Use the equation in the box to calculate the maximum acceleration of the aircraft.

$\text{resultant force} = \text{mass} \times \text{acceleration}$

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

.....

Acceleration =
 (3 marks)



- (c) As the aircraft moves along the runway to take off, its acceleration decreases even though the force from the engines is constant.

Explain why.

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(2 marks)

7

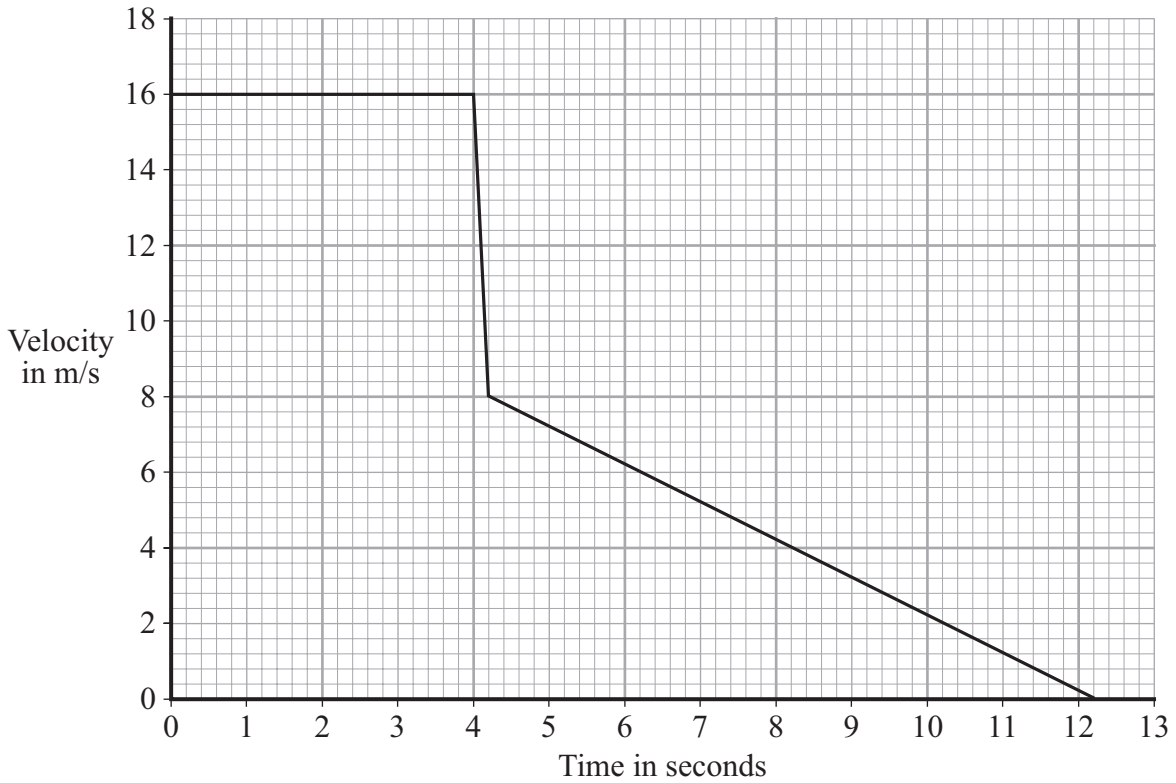
Turn over for the next question

Turn over ►



6 In an experiment at an accident research laboratory, a car driven by remote control was crashed into the back of an identical stationary car. On impact the two cars joined together and moved in a straight line.

(a) The graph shows how the *velocity* of the remote-controlled car changed during the experiment.



(i) How is the *velocity* of a car different from the speed of a car?

.....
(1 mark)

(ii) Use the graph to calculate the distance travelled by the remote-controlled car before the collision.

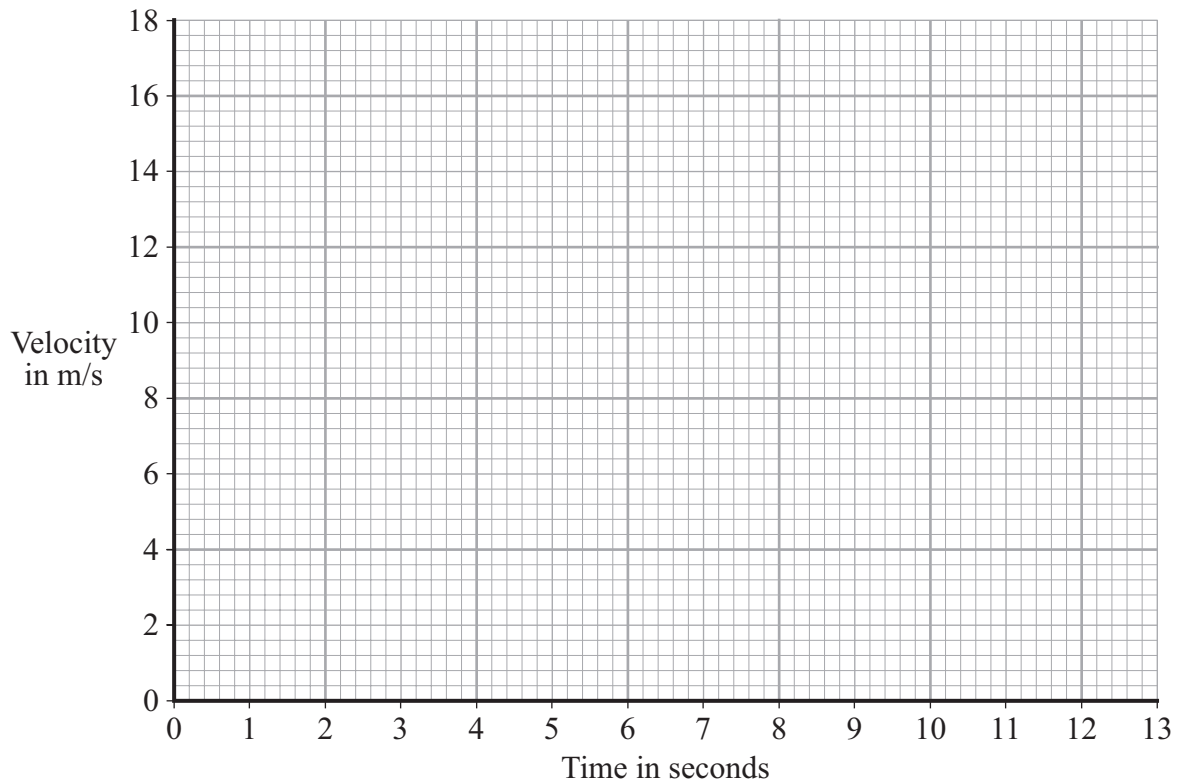
Show clearly how you work out your answer.

.....
.....

Distance = m
(2 marks)



- (iii) Draw, on the grid below, a graph to show how the velocity of the second car changed during the experiment.



(2 marks)

- (iv) The total momentum of the two cars was not conserved.

What does this statement mean?

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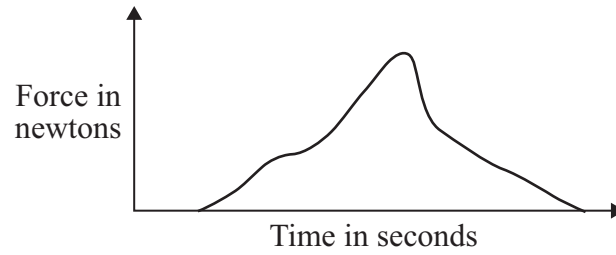
(1 mark)

Question 6 continues on the next page

Turn over ►



- (b) The graph line shows how the force from a seat belt on a car driver changes during a collision.



Scientists at the accident research laboratory want to develop a seat belt that produces a constant force throughout a collision.

Use the idea of momentum to explain why this type of seat belt would be better for a car driver.

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(2 marks)

8

END OF QUESTIONS



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