Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Secondary Education
Higher Tier
January 2013

Additional Science PHY2H

Unit Physics P2

H

Physics

Unit Physics P2

Wednesday 30 January 2013 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

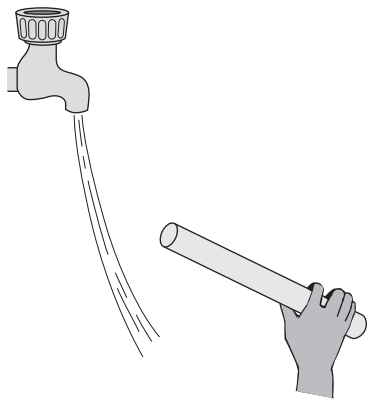
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work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

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- 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.

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

1 (a) The diagram shows a negatively charged plastic rod held near to a thin stream of water. The water is attracted towards the rod.



Which **one** of the following statements explains what is happening to the charge in the water?

Tick (✓) **one** box.

The positive and the negative charges in the water are attracted to the rod. ☐

The positive and the negative charges in the water are repelled by the rod. ☐

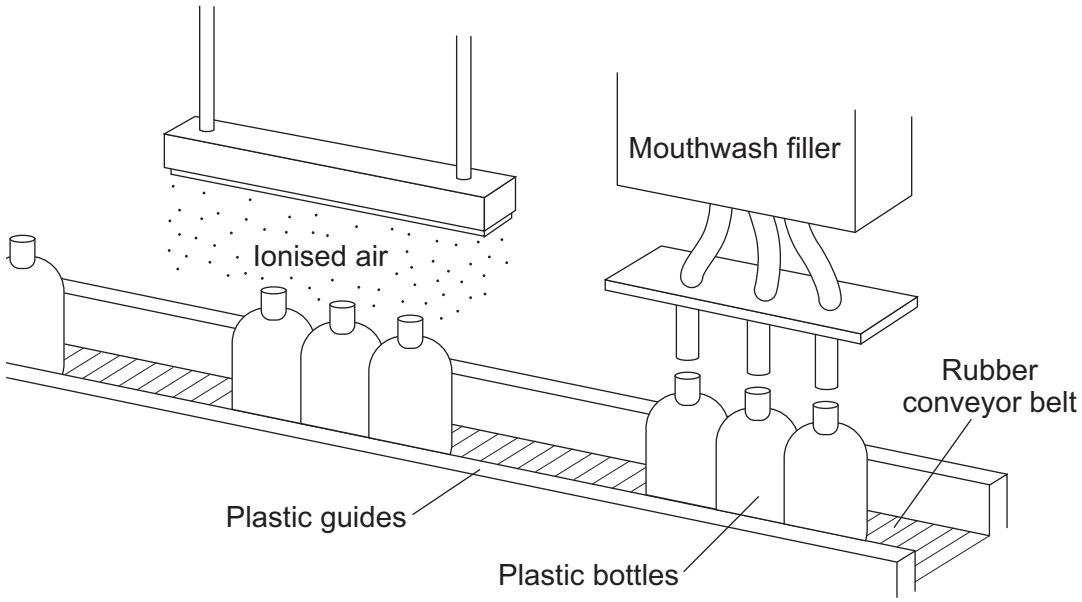
The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod. ☐

The negative charge in the water is attracted to the rod and the positive charge is repelled by the rod. ☐

(1 mark)

1 (b) A company that produces bottles of mouthwash found a problem with the automatic filling system.

As the bottles go towards the filler, the bottles move around on the conveyor belt and become electrostatically charged. This causes the stream of mouthwash to move sideways, missing the open top of the bottle.



The company came up with an answer to the problem. Before the bottles reach the filler, the bottles pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

1 (b) (i) Explain why the plastic bottles became charged.

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(2 marks)

1 (b) (ii) What happens to the structure of an atom to change the atom into an ion?

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(1 mark)

1 (b) (iii) Earthing the conveyor belt with a conducting wire would not have solved this problem. Give a reason why.

.....

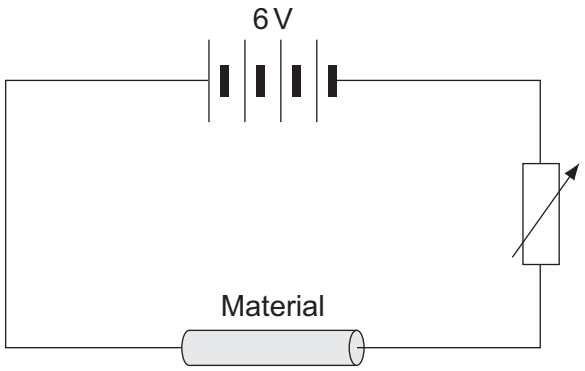
.....

(1 mark)

5

Turn over ▶

2 (a) The diagram shows the circuit used to investigate the resistance of a sample of a material.
The diagram is not complete; the ammeter and voltmeter are missing.



2 (a) (i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places.
(2 marks)

2 (a) (ii) How can the current through the material be changed?

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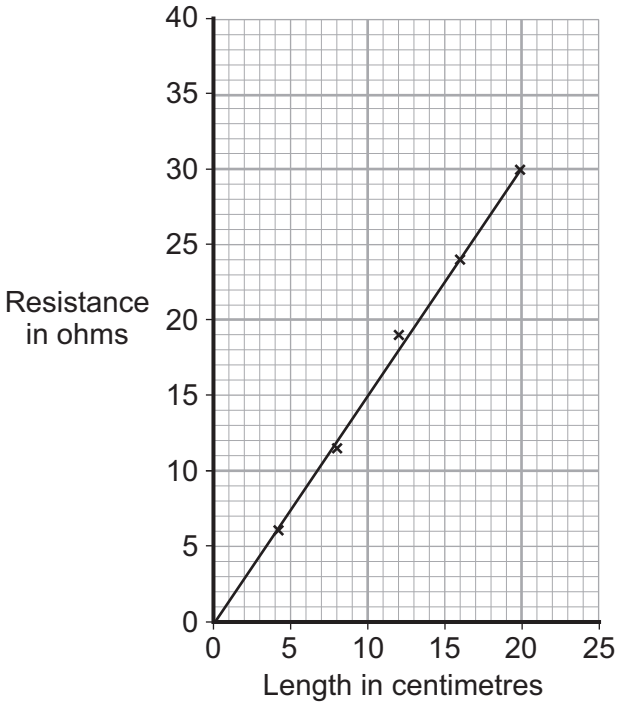
(1 mark)

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

Graph 1 shows how the resistance changes with length.

Graph 1



2 (b) (i) The current through a 25 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 25 cm length of conducting putty.

Resistance = ... ohms

(1 mark)

2 (b) (ii) Use your answer to **(b) (i)** and the equation in the box to calculate the potential difference across a 25 cm length of conducting putty.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

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Potential difference = ... volts

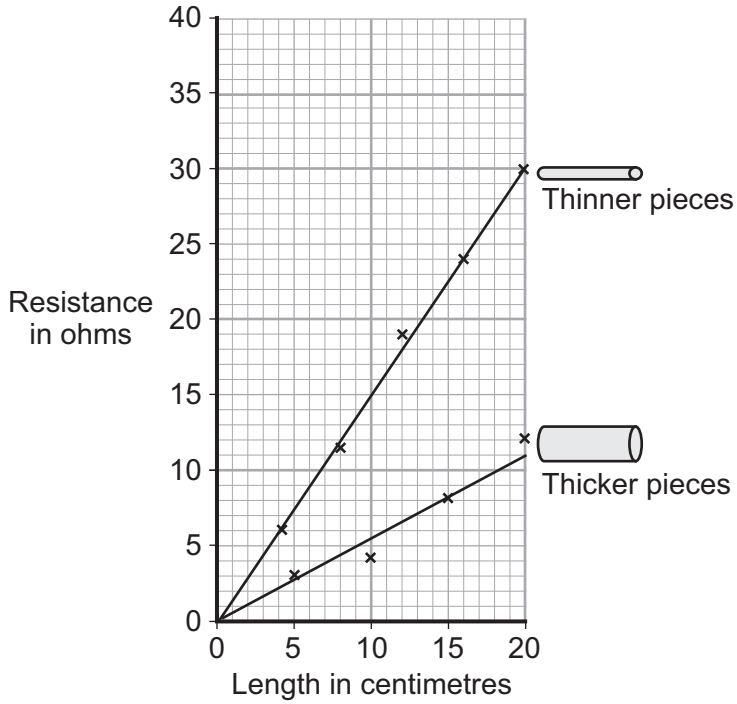
(2 marks)

Question 2 continues on the next page

Turn over ▶

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

Graph 2



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

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(1 mark)

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

.....

(1 mark)

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

.....

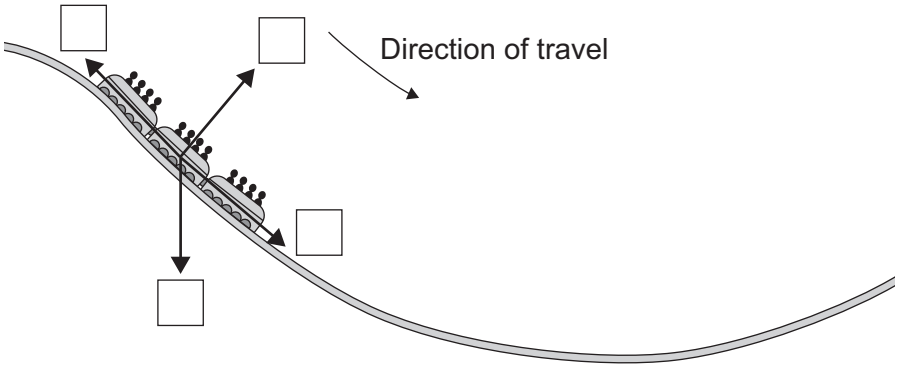
.....

(1 mark)

9

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

3 (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)

3 (b) 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

3 (b) (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)

3 (b) (ii) One of the passengers has a mass of 75 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.

.....

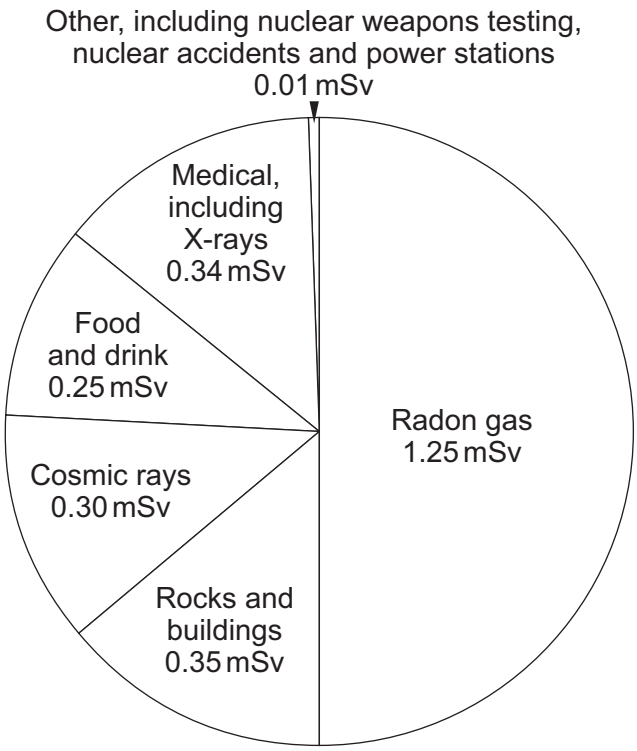
.....

Maximum weight = ... N
(2 marks)

4

Turn over ▶

4 The pie chart shows the sources of the background radiation and the radiation doses that the average person in the UK is exposed to in one year.
Radiation dose is measured in millisieverts (mSv).



4 (a) (i) What is the total radiation dose that the average person in the UK receives?

.....

.....

Total radiation dose = ... mSv

(1 mark)

4 (a) (ii) A student looked at the pie chart and then wrote down three statements.

Which **one** of the following statements is a correct conclusion from this data?

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

In the future, more people will be exposed to a greater proportion of radon gas. ☐

People that have never had an X-ray get 50 % of their radiation dose from radon gas. ☐

The radiation dose from natural sources is much greater than from artificial sources. ☐

(1 mark)

4 (b) The concentration of radon gas inside a home can vary from day to day.

The table gives data for the radiation measured in homes in four different parts of the UK. The radiation was measured using two detectors, one in the living room and one in the bedroom. The measurements were taken over 3 months.

Area of the UK	Number of homes in the area	Number of homes in the sample	Average radiation in Bq/m^3	Maximum radiation in Bq/m^3
A	590 000	160	15	81
B	484 000	130	18	92
C	221 000	68 000	162	10 000
D	318 000	35 300	95	6 900

4 (b) (i) Give **one** reason why the measurements were taken over 3 months using detectors in different rooms.

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(1 mark)

4 (b) (ii) Use information from the table to suggest why a much higher proportion of homes were sampled in areas **C** and **D** than in areas **A** and **B**.

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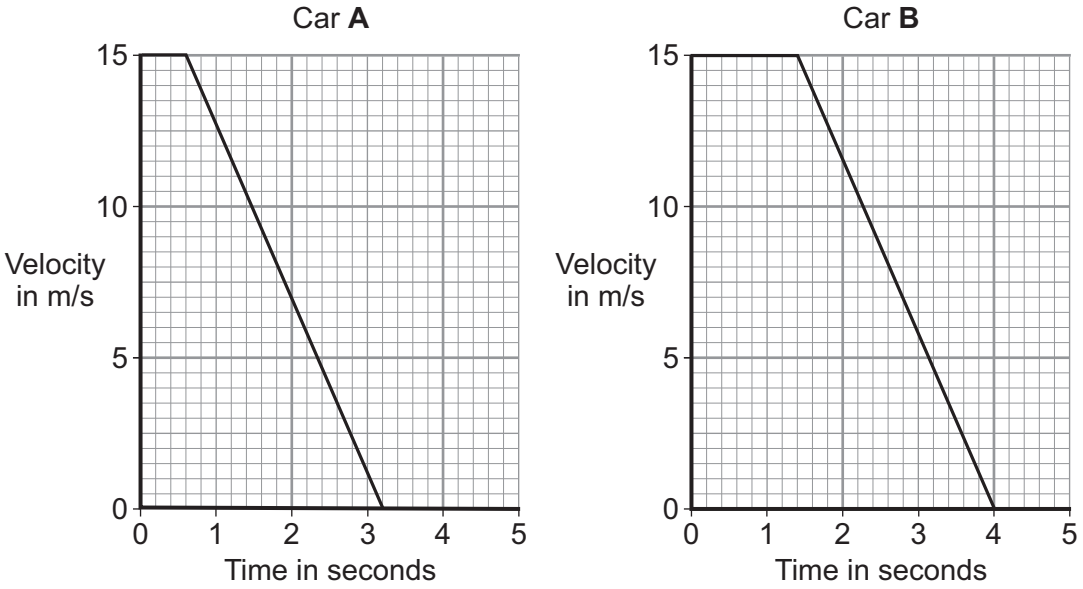
(2 marks)

5

Turn over for the next question

5 (a) The graphs show how the velocity of two cars, **A** and **B**, change from the moment the car drivers see an obstacle blocking the road.



One of the car drivers has been drinking alcohol. The other driver is wide awake and alert.

5 (a) (i) How does a comparison of the two graphs suggest that the driver of car **B** is the one who has been drinking alcohol?

.....

.....

(1 mark)

5 (a) (ii) How do the graphs show that the two cars have the same deceleration?

.....

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(1 mark)

5 (a) (iii) Use the graphs to calculate how much further car **B** travels before stopping compared to car **A**.

Show clearly how you work out your answer.

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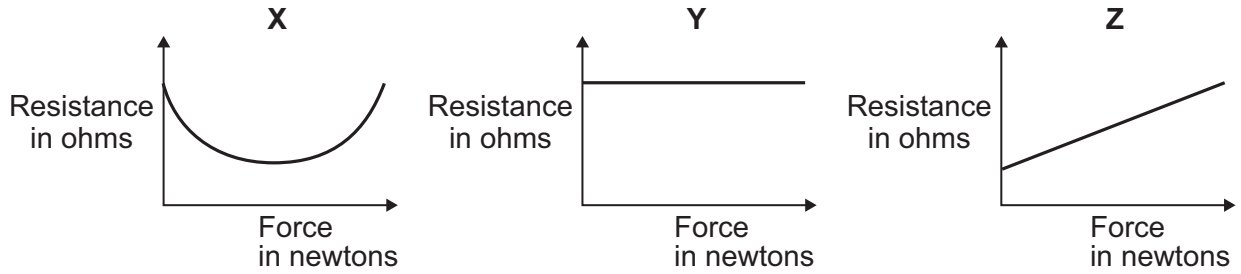
Additional stopping distance = ... m

(3 marks)

5 (b) In a crash-test laboratory, scientists use sensors to measure the forces exerted in collisions. The graphs show how the electrical resistance of 3 experimental types of sensor, **X**, **Y**, and **Z**, change with the force applied to the sensor.



Which of the sensors, **X**, **Y** or **Z**, would be the best one to use as a force sensor?

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Give a reason for your answer.

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(2 marks)

7

Turn over for the next question

6 (a) In any collision, the total momentum of the colliding objects is usually conserved.

6 (a) (i) What is meant by the term 'momentum is conserved'?

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(1 mark)

6 (a) (ii) In a collision, momentum is **not always** conserved.

Why?

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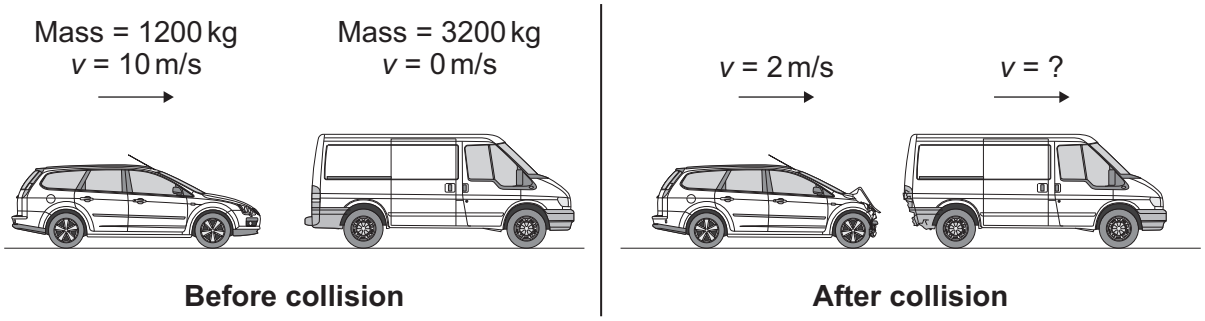
(1 mark)

6 (b) The diagram shows a car and a van, just before and just after the car collided with the van.



Before collision **After collision**

6 (b) (i) Use the information in the diagram and the equation in the box to calculate the **change** in the momentum of the car.

momentum = mass × velocity

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

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Change in momentum = ...

(3 marks)

6 (b) (ii) Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

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Velocity = ... m/s forward

(2 marks)

7

Turn over for the next question

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

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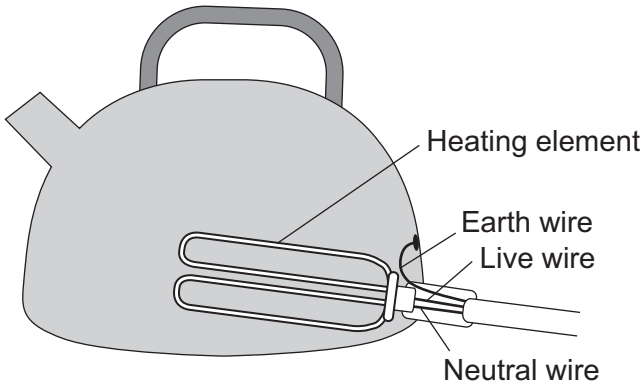
(2 marks)

7 (b) The diagram shows how the electric supply cable is connected to an electric kettle. The earth wire is connected to the metal case of the kettle.



If a fault makes the metal case live, the earth wire and the fuse inside the plug protect anyone using the kettle from an electric shock.

Explain how.

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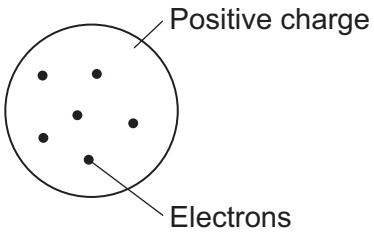
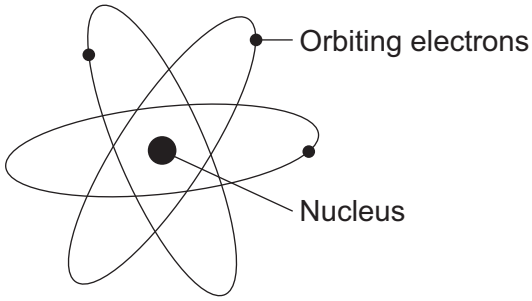
(2 marks)

4

8 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.



Describe the differences between the two models of the atom.

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(4 marks)

4

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED