Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

AQA

General Certificate of Secondary Education
Higher Tier
January 2010

Additional Science PHY2H
Unit Physics P2

H

Physics
Unit Physics P2

Wednesday 20 January 2010 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 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 cyclist travelling along a straight level road accelerates at 1.2 m/s^2 for 5 seconds. The mass of the cyclist and the bicycle is 80 kg.

1 (a) Use the equation in the box to calculate the resultant force needed to produce this acceleration.

resultant force = mass × acceleration

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

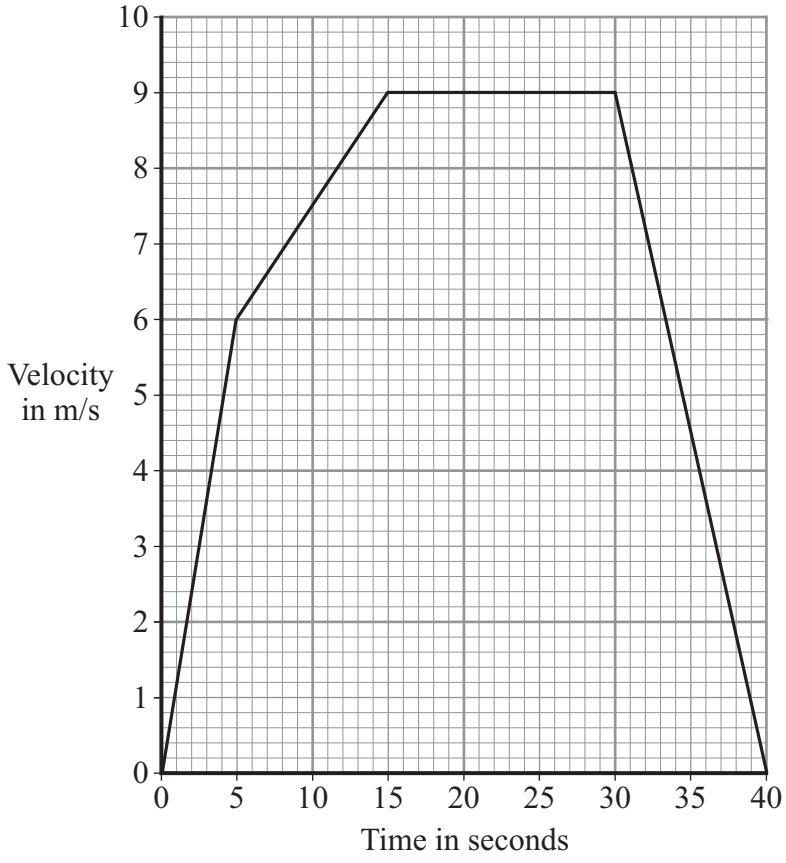
.....

.....

Resultant force = ...

(3 marks)

1 (b) The graph shows how the velocity of the cyclist changes with time.



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

The velocity includes both the speed and the ..... of the cyclist.

(1 mark)

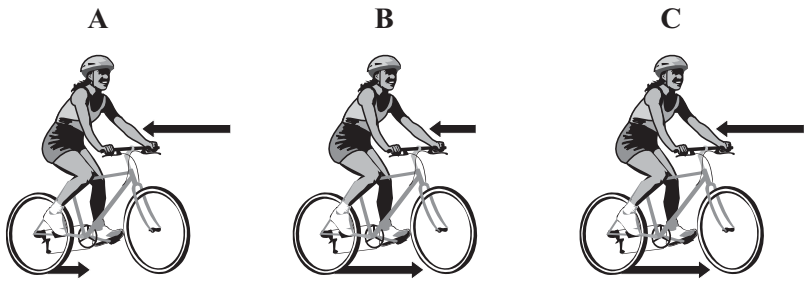
1 (b) (ii) Why has the data for the cyclist been shown as a line graph instead of a bar chart?

.....

.....

(1 mark)

1 (b) (iii) The diagrams show the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.



Which **one** of the diagrams, **A**, **B** or **C**, represents the forces acting when the cyclist is travelling at a constant 9 m/s?

.....

Explain the reason for your choice.

.....

.....

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.....

.....

.....

(3 marks)

8

2 (a) The process of nuclear fusion results in the release of energy.

2 (a) (i) Describe the process of nuclear fusion.

.....

.....

.....

.....

(2 marks)

2 (a) (ii) Where does nuclear fusion happen naturally?

.....

(1 mark)

2 (b) For many years, scientists have tried to produce a controlled nuclear fusion reaction that lasts long enough to be useful. However, the experimental fusion reactors use more energy than they produce.

2 (b) (i) From the information given, suggest **one** reason why nuclear fusion reactors are not used to produce energy in a nuclear power station.

.....

.....

(1 mark)

2 (b) (ii) Suggest **one** reason why scientists continue to try to develop a practical nuclear fusion reactor.

.....

.....

(1 mark)

2 (c) In 1989, two scientists claimed in a daily newspaper that they had produced nuclear fusion reactions in normal laboratory conditions. The process became known as 'cold fusion'. Other scientists thought that the evidence produced to support 'cold fusion' was unreliable.

2 (c) (i) Suggest **one** reason why other scientists thought that the evidence to support 'cold fusion' was unreliable.

.....

.....

(1 mark)

2 (c) (ii) In 2007, the results of a new 'cold fusion' research project were published in a respected scientific journal. This journal includes scientists such as Albert Einstein amongst its past authors.

Suggest why people may be more likely to believe an article published in a respected scientific journal than one published in a daily newspaper.

.....

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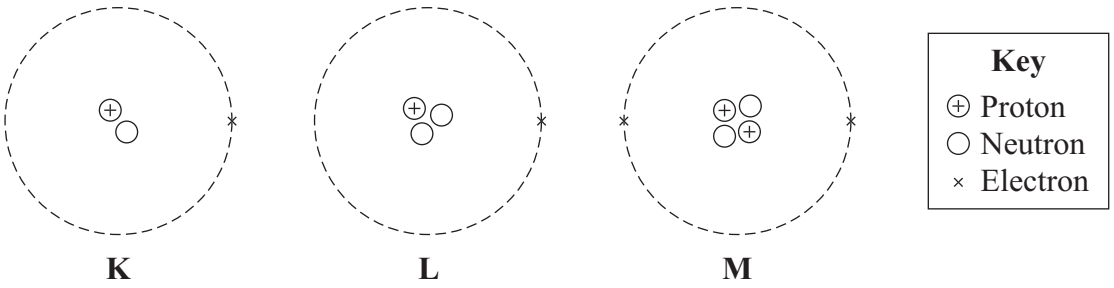
(1 mark)

7

Turn over for the next question

3 (a) The diagram represents 3 atoms, **K**, **L** and **M**.



K **L** **M**

3 (a) (i) Which **two** of the atoms are isotopes of the same element?

..... and .....

(1 mark)

3 (a) (ii) Give a reason why the **two** atoms that you chose in part (a)(i) are:

(1) atoms of the same element .....

.....

(2) different isotopes of the same element. .....

.....

.....

(2 marks)

3 (b) The table gives some information about the radioactive isotope thorium-230.

mass number	230
atomic number	90

3 (b) (i) How many electrons are there in an atom of thorium-230?

.....

(1 mark)

3 (b) (ii) How many neutrons are there in an atom of thorium-230?

.....

(1 mark)

3 (c) When a thorium-230 nucleus decays, it emits radiation and changes into radium-226.

$$^{230}_{90}\text{Th} \longrightarrow {}^{226}_{88}\text{Ra} + \boxed{\text{Radiation}}$$

What type of radiation, alpha, beta or gamma, is emitted by thorium-230?

.....

Explain the reason for your answer.

.....

.....

.....

.....

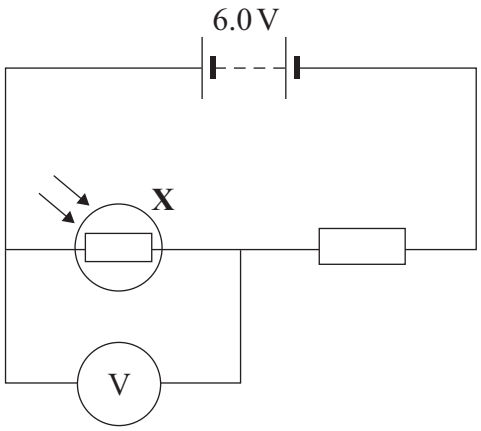
.....

(3 marks)

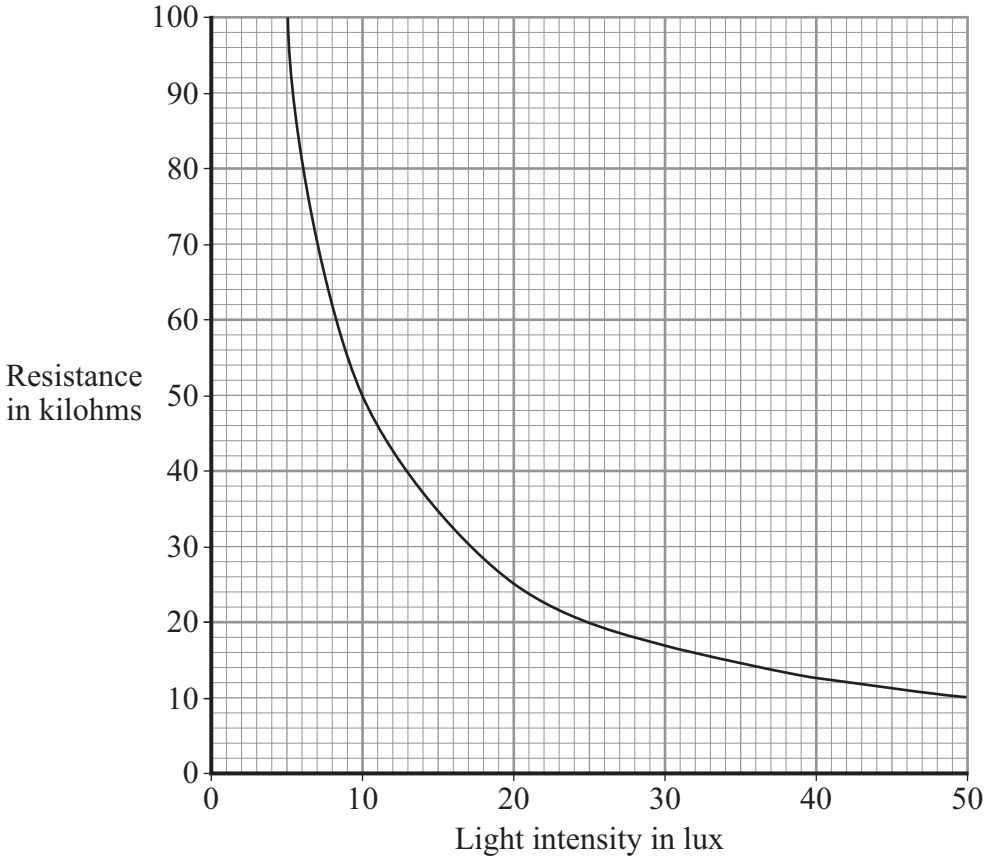
8

Turn over for the next question

4 The diagram shows a simple light-sensing circuit.



4 (a) The graph, supplied by the manufacturer, shows how the resistance of the component labelled **X** varies with light intensity.



4 (a) (i) What is component **X**?

.....

(1 mark)

4 (a) (ii) Use the graph to find the resistance of component **X** when the light intensity is 20 lux.

.....

(1 mark)

4 (a) (iii) When the light intensity is 20 lux, the current through the circuit is 0.0002 A.

Use the equation in the box to calculate the reading on the voltmeter when the light intensity is 20 lux.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

.....

Voltmeter reading = ... volts

(2 marks)

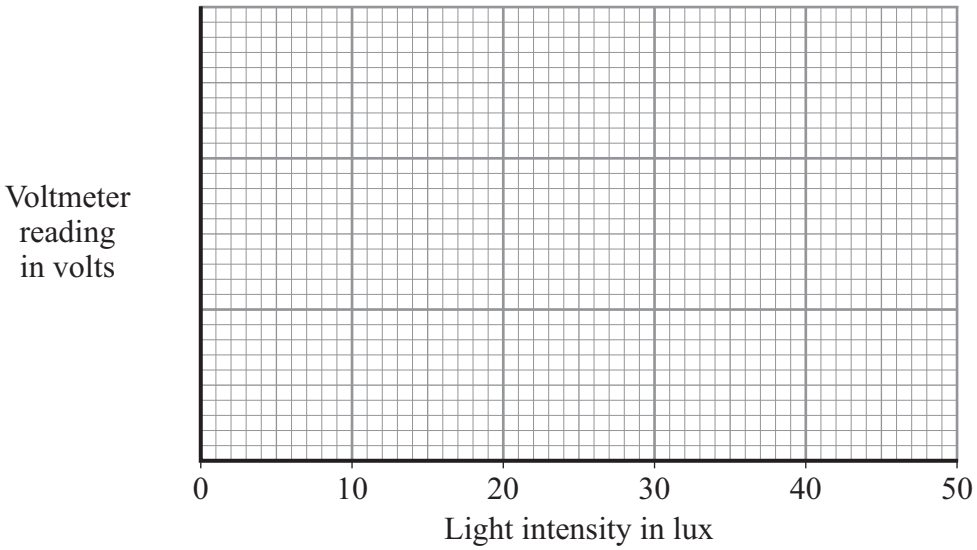
Question 4 continues on the next page

4 (b) Use the grid below to show how the voltmeter reading in the light-sensing circuit varies with light intensity.

4 (b) (i) Add a suitable scale to the *y*-axis (vertical axis).

(1 mark)

4 (b) (ii) Complete the sketch graph by drawing a line on the grid to show how the voltmeter reading will vary with light intensity.



(2 marks)

4 (c) The following passage is taken from the technical data supplied for component **X** by the manufacturer.

> For any given light intensity, the resistance of this component can vary by plus or minus 50% of the value shown on the **graph of light intensity and resistance**.

4 (c) (i) Calculate the maximum resistance that component **X** could have at 20 lux light intensity.

.....

Maximum resistance = ... kilohms

(1 mark)

4 (c) (ii) Explain why this light-sensing circuit would **not** be used to measure values of light intensity.

.....

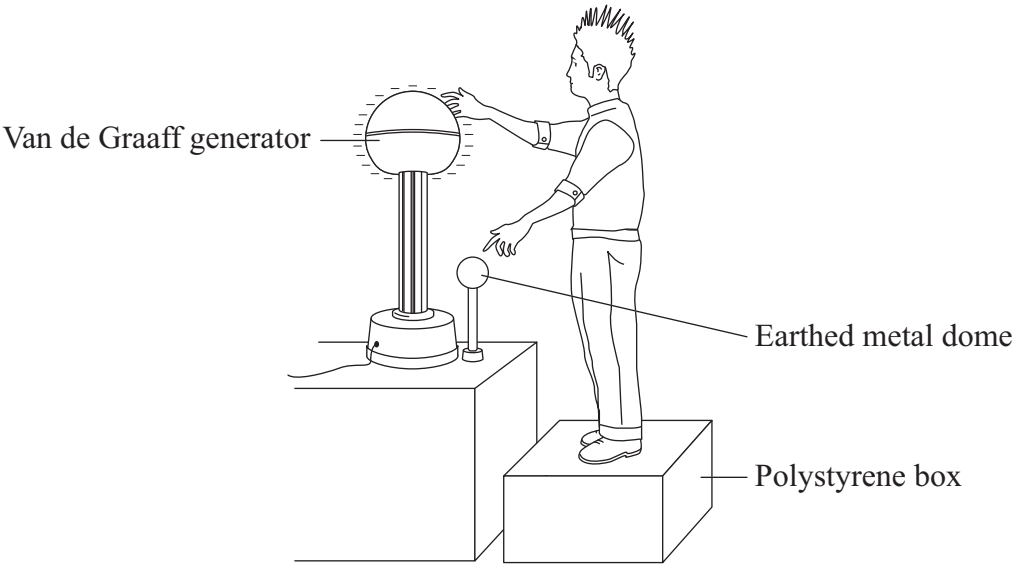
.....

.....

(2 marks)

10

5 (a) The diagram shows a student touching the metal dome of a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain why the student's hair stands on end when the generator is switched on.

.....

.....

.....

(2 marks)

5 (b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Use the equation in the box to calculate the charge carried by the spark.

energy transformed = potential difference × charge

.....

.....

Charge transferred = ... coulombs

(2 marks)

5 (c) What name is given to the rate of flow of charge?

.....

(1 mark)

5

Turn over ▶

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'?

.....

.....

(1 mark)

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

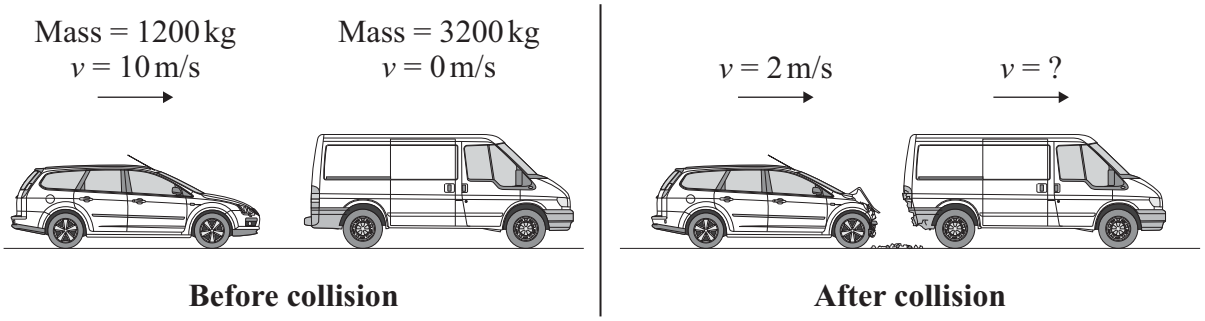
Why?

.....

.....

(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.

.....

.....

.....

.....

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.

.....

.....

.....

Velocity = ... m/s forward

(2 marks)

7

END OF QUESTIONS

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