AQA GCSE PHYSICS (4451)

PHYSICS



EXAM QUESTION PACK

UNIT P2 FOUNDATION TIER PHY2F PAPERS

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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
Foundation Tier
June 2012

Additional Science PHY2F
Unit Physics P2

F

Physics
Unit Physics P2

Written Paper

Wednesday 30 May 2012 1.30 pm to 2.15 pm

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.

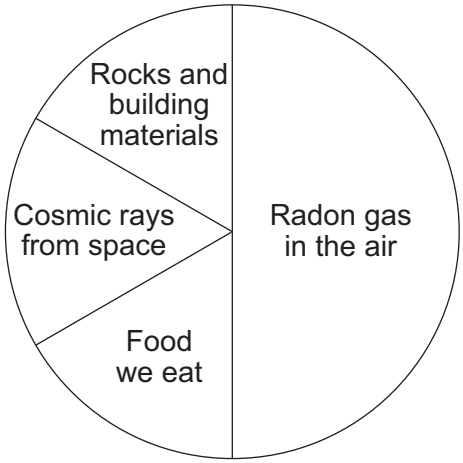
Advice
- In all calculations, show clearly how you work out your answer.

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

1 The pie chart shows the average proportions of natural background radiation from various sources in the UK.



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

On average, ... of the natural background radiation in the UK comes from radon gas.

(1 mark)

1 (a) (ii) Radon gas is found inside homes.

The table shows the results from measuring the level of radon gas inside four homes in one area of the UK.

Home	Level of radon gas in Bq per m^3 of air
1	25
2	75
3	210
4	46
Mean	89

Do not write outside the box

One of the homes has a much higher level of radon gas than the other three homes.

What should be done to give a more reliable mean for the homes in this area of the UK?

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

ignore the data for home number 3 ☐

measure the radon gas level in more homes in this area ☐

include data for homes from different areas of the UK ☐

(1 mark)

1 (b) Each atom of radon has 86 protons and 136 neutrons.

1 (b) (i) How many electrons does each atom of radon have?

Draw a ring around your answer.

50 **86** **136** **222**

(1 mark)

1 (b) (ii) How many particles are there in the nucleus of a radon atom?

Draw a ring around your answer.

50 **86** **136** **222**

(1 mark)

4

Turn over for the next question

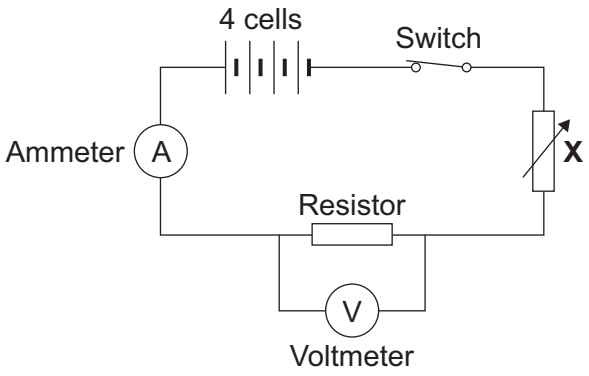
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ANSWER IN THE SPACES PROVIDED

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2 (a) The diagram shows the circuit that a student used to investigate how the current through a resistor depends on the potential difference across the resistor.



2 (a) (i) Each cell provides a potential difference of 1.5 volts.

What is the total potential difference provided by the four cells in the circuit?

.....

Total potential difference = ... volts

(1 mark)

2 (a) (ii) The student uses the component labelled **X** to change the potential difference across the resistor.

What is component **X**?

Draw a ring around your answer.

light-dependent resistor **thermistor** **variable resistor**

(1 mark)

2 (a) (iii) Name a component connected in parallel with the resistor.

.....

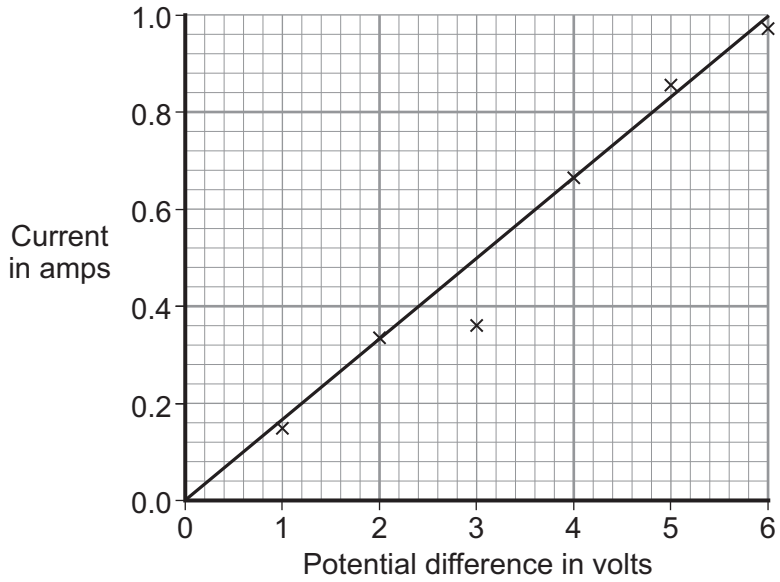
(1 mark)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

2 (b) The results obtained by the student have been plotted on a graph.



2 (b) (i) One of the results is anomalous.

Draw a ring around the anomalous result.

(1 mark)

2 (b) (ii) Which **one** of the following is the most likely cause of the anomalous result?

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

The student misread the ammeter. ☐

The resistance of the resistor changed. ☐

The voltmeter had a zero error. ☐

(1 mark)

2 (b) (iii) What was the interval between the potential difference values obtained by the student?

.....

.....

(1 mark)

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2 (c) Describe the relationship between the potential difference across the resistor and the current through the resistor.

.....

.....

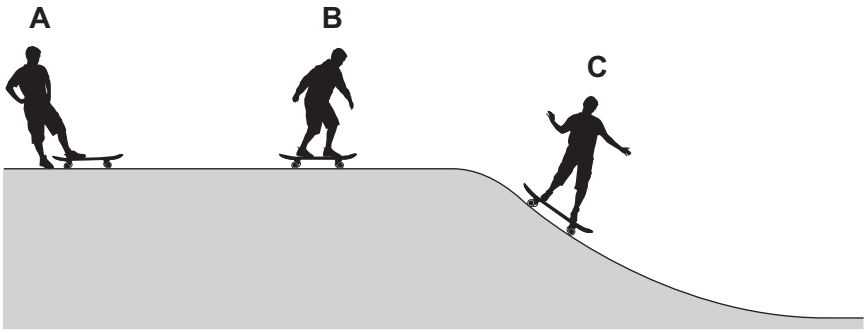
(1 mark)

7

Turn over for the next question

Do not write outside the box

3 The picture shows three skateboarders, **A**, **B** and **C**.



Skateboarder **A** is not moving.
Skateboarder **B** is moving towards the ramp at a constant speed.
Skateboarder **C** is moving on the ramp at a constant speed.

3 (a) The skateboarders have different amounts of kinetic energy.

Which **two** factors affect the kinetic energy of the skateboarders?

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

direction and mass ☐

mass and speed ☐

speed and direction ☐

(1 mark)

3 (b) The skateboarders also have different amounts of momentum.

3 (b) (i) Which **one** of the skateboarders has the smallest amount of momentum?

Draw a ring around your answer.

A **B** **C**

Give a reason for your answer.

.....

.....

(2 marks)

Do not write outside the box

3 (b) (ii) Skateboarder **B** has a mass of 55 kg.

Use the equation in the box to calculate the momentum of skateboarder **B** when moving at 4 m/s.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ... kg m/s

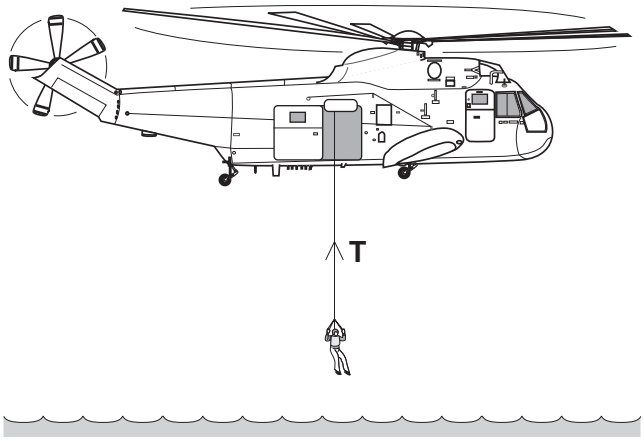
(2 marks)

5

Turn over for the next question

Do not write outside the box

4 The diagram shows a helicopter being used to rescue a person from the sea.



4 (a) (i) The mass of the rescued person is 72 kg.

Use the equation in the box to calculate the weight of the rescued person.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

Show clearly how you work out your answer.

.....

.....

Weight = ... N

(2 marks)

4 (a) (ii) An electric motor is used to lift the person up to the helicopter.
The motor lifts the person at a constant speed.

State the size of the force, **T**, in the cable.

Force **T** = ... N

(1 mark)

Do not write outside the box

4 (b) To lift the person up to the helicopter, the electric motor transformed 21 600 joules of energy usefully.

4 (b) (i) Use a form of energy from the box to complete the following sentence.

gravitational potential	heat	sound

The electric motor transforms electrical energy to kinetic energy. The kinetic energy is then transformed into useful ..... energy.

(1 mark)

4 (b) (ii) It takes 50 seconds for the electric motor to lift the person up to the helicopter.

Use the equation in the box to calculate the power of the electric motor.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

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

Choose the unit from the list below.

coulomb (C) **hertz (Hz)** **watt (W)**

.....

.....

Power = ...

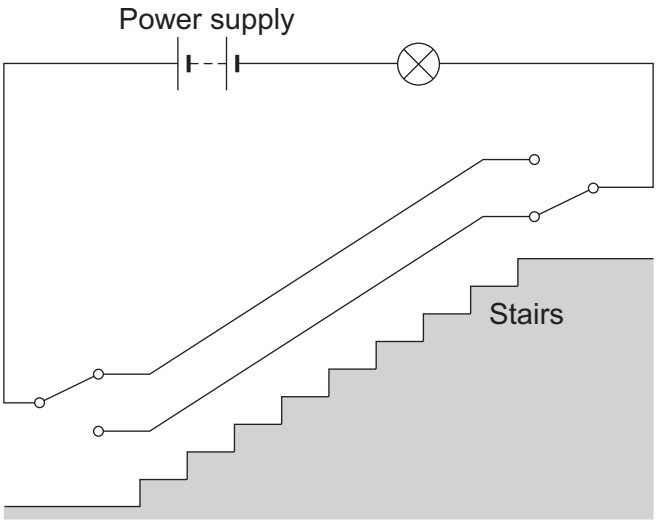
(3 marks)

7

Turn over for the next question

Do not write outside the box

5 The diagram shows an electric circuit used in a dolls' house.
The switches are 2-way switches; this means that each switch has a connecting wire that can be in one of two positions.



5 (a) (i) With the connecting wire in each switch in the position shown in the diagram, the lamp is off. Why?

.....

.....

(1 mark)

5 (a) (ii) When switched on, the lamp has a resistance of 18 Ω and draws a current of 0.5 A from the power supply.

Use the equation in the box to calculate the potential difference of the power supply used in the circuit.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

.....

Potential difference = ... V

(2 marks)

Do not write outside the box

5 (a) (iii) A second, identical lamp is added to the circuit. The two lamps are joined in series.

Calculate the total resistance of the two lamps.

.....

Total resistance = ... Ω

(1 mark)

5 (b) This type of circuit is also used in real houses. One of the switches is at the top of the stairs, and the other switch is at the bottom of the stairs.

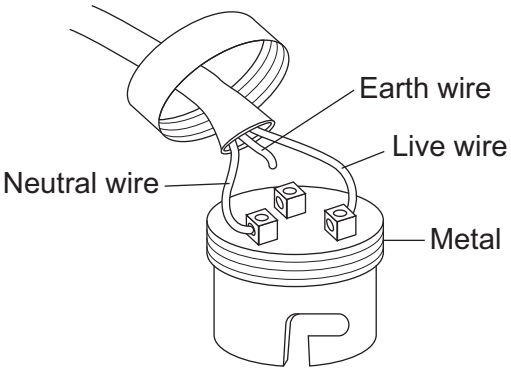
What is the advantage of using this circuit to switch a lamp on or off, rather than using a more simple circuit that has only one switch?

.....

.....

(1 mark)

5 (c) The diagram shows an old type of metal lamp fitting.



The cable has been connected to the lamp fitting in a way that makes the lamp fitting unsafe.

5 (c) (i) What is the possible risk to someone touching the lamp fitting while the lamp is switched on?

.....

.....

(1 mark)

5 (c) (ii) What should be done to make **this** lamp fitting safe to use?

.....

.....

(1 mark)

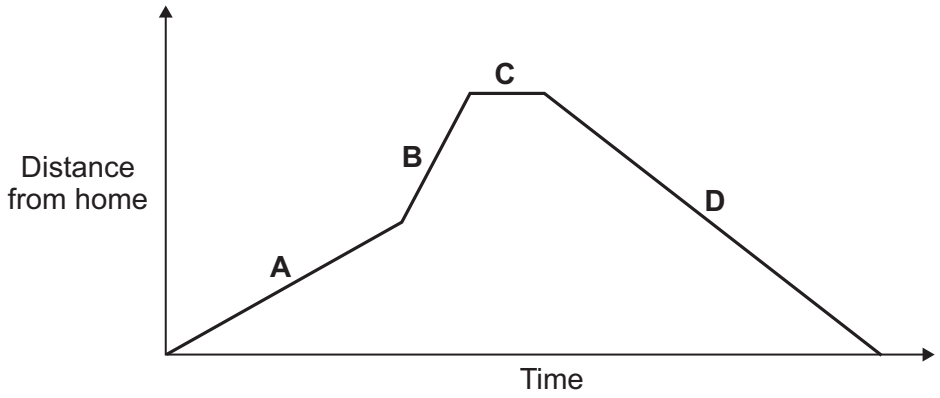
7

Turn over ▶

Do not write outside the box

6 (a) A person takes their dog for a walk.

The graph shows how the distance from their home changes with time.



Which part of the graph, **A**, **B**, **C** or **D**, shows them walking the fastest?

Write your answer in the box. ☐

Give the reason for your answer.

.....

.....

(2 marks)

6 (b) During the walk, both the speed and the velocity of the person and the dog change.

How is *velocity* different from *speed*?

.....

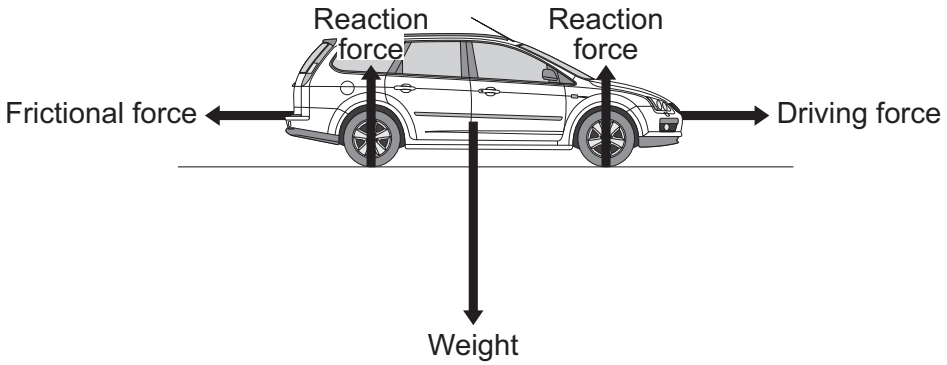
.....

(1 mark)

3

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7 The diagram shows the forces acting on a car. The car is being driven along a straight, level road at a constant speed of 12 m/s.



7 (a) The driver then accelerates the car to 23 m/s in 4 seconds.

Use the equation in the box to calculate the acceleration of the car.

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

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

.....

.....

Acceleration = ...

(3 marks)

7 (b) Describe how the horizontal forces acting on the car change during the first **two** seconds of the acceleration.

.....

.....

.....

.....

.....

.....

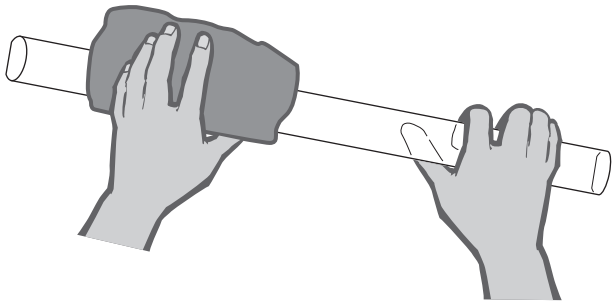
(3 marks)

6

Turn over ▶

Do not write outside the box

8 (a) The diagram shows a polythene rod being rubbed with a woollen cloth.



The polythene rod becomes negatively charged.

Explain how this happens.

.....

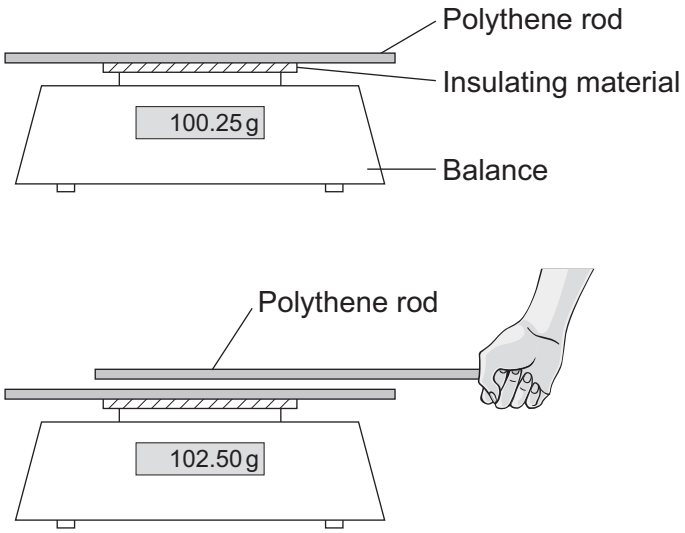
.....

.....

.....

(2 marks)

8 (b) A student put the charged polythene rod on to a balance. The rod was separated from the metal pan of the balance by a thin block of insulating material.
The student then held a second charged polythene rod above, but **not** touching, the first rod. The reading on the balance increased.



Do not write outside the box

8 (b) (i) Explain why the reading on the balance increases.

.....

.....

.....

.....

(2 marks)

8 (b) (ii) The student observed that the nearer the two rods are to each other, the bigger the increase in the balance reading.

What should the student conclude from this observation?

.....

.....

.....

.....

(2 marks)

6

END OF QUESTIONS

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General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F **Unit Physics 2**

Mark Scheme

2012 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Quality of Written Communication and levels marking

In Question 8 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

PHY2F

Question 1

question	answers	extra information	mark
1(a)(i)	half / 50 %		1
1(a)(ii)	Measure the radon gas level in more homes in this area		1
1(b)(i)	86		1
1(b)(ii)	222		1
Total			**4**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)(i)	6		1
2(a)(ii)	variable resistor		1
2(a)(iii)	voltmeter		1
2(b)(i)	point at 3 V ringed		1
2(b)(ii)	The student misread the ammeter.		1
2(b)(iii)	1 (volt)	accept every volt	1
2(c)	as one increases so does the other **or** directly proportional **or** positive correlation	accept a numerical description, eg when one doubles the other also doubles	1
Total			**7**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)	mass and speed		1
3(b)(i)	**A** velocity = 0 (m/s)	reason cannot score if B or C chosen accept speed for velocity accept not moving accept lowest velocity / speed	1 1
3(b)(ii)	220	allow **1** mark for correct substitution, ie 55 × 4 provided no subsequent step shown	2
Total			**5**

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PHY2F

Question 4

question	answers	extra information	mark
4(a)(i)	720	allow **1** mark for correct substitution, ie 72 × 10 provided no subsequent step shown	2
4(a)(ii)	720 **or** their **(a)(i)**		1
4(b)(i)	gravitational potential	allow gravitational allow potential	1
4(b)(ii)	432 watt / W	allow **1** mark for correct substitution, ie $\frac{21\,600}{50}$ provided no subsequent step shown	2 1
Total			**7**

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PHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	circuit not complete	accept circuit is broken accept switch / s are open / off	1
5(a)(ii)	9	allow **1** mark for correct substitution, ie 0.5 × 18 provided no subsequent step shown	2
5(a)(iii)	36		1
5(b)	can be switched on / off from top or bottom of stairs		1
5(c)(i)	(electric) shock	accept fitting becomes live accept answers giving a possible consequence of electric shock, eg death	1
5(c)(ii)	connect the earth wire		1
Total			**7**

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PHY2F

Question 6

question	answers	extra information	mark
6(a)	**B** gradient / slope is the steepest / steeper	reason only scores if B is chosen answers must be comparative accept steepest line ignore greatest speed	1 1
6(b)	(velocity includes) direction	'it' refers to velocity	1
Total			**3**

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PHY2F

Question 7

question	answers	extra information	mark
7(a)	2.75	allow **1** mark for correct substitution, ie $\frac{11}{4}$ **or** $\frac{23 - 12}{4}$ provided no subsequent step shown	2
	m/s^2		1
7(b)	driving force increases		1
	frictional force increases	accept air resistance / drag for frictional force	1
	driving force > frictional force		1
Total			**6**

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PHY2F

Question 8

question	answers	extra information	mark
8(a)	electrons transfer / removed	do **not** accept negatively charged atoms for electrons	1
	to the rod / from the cloth	this only scores if first mark given this does not score if there is reference to any original charge on cloth or rod 'it' refers to the rod accept negative charge transfer to rod / removed from cloth for **1** mark transfer of positive charge / positive electrons scores zero	1
8(b)(i)	rods / charges repel		1
	creating downward / extra force (on the balance)	accept pushing (bottom) rod downwards do not accept increasing the weight / mass charges attracting scores zero	1

Question 8 continues on the next page

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PHY2F

Question 8 continued

question	answers	extra information	mark
8(b)(ii)	the (repulsion) force increases as the distance between the charges decreases	accept there is a negative correlation between (repulsion) force and distance between charges **or** (repulsion) force and distance between charges are inversely proportional for both marks examples of **1** mark answers force increases as distance decreases force and distance are inversely proportional negative correlation between force and distance repels more as distance decreases if given in terms of attracting or attraction force this mark does not score	2
Total			**6**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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Question	Mark
1	
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TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2012

Additional Science PHY2F
Unit Physics P2

F

Physics
Unit Physics P2

Monday 30 January 2012 1.30 pm to 2.15 pm

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- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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- 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.

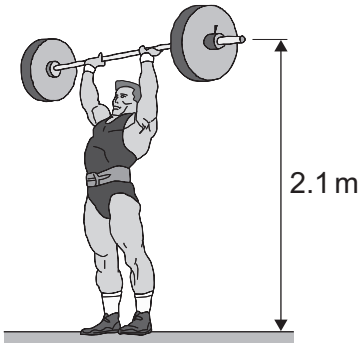
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 A powerlifter lifts a 180 kg bar from the floor to above his head.



1 (a) Use the equation in the box to calculate the weight of the bar.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

Show clearly how you work out your answer.

.....

.....

Weight = ... N

(2 marks)

Do not write outside the box

1 (b) The powerlifter uses a constant force to lift the bar a distance of 2.1 m.

Use the equation in the box to calculate the work done by the powerlifter.

work done = force applied × distance moved in direction of force

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

Choose the unit from the list below.

joule **newton** **watt**

.....

.....

Work done = ...

(3 marks)

1 (c) At the end of the lift, the powerlifter holds the bar stationary, above his head, for two seconds.

How much work does the powerlifter do on the bar during these two seconds?

Draw a ring around your answer.

0 **90** **360** **900**

Give a reason for your answer.

.....

.....

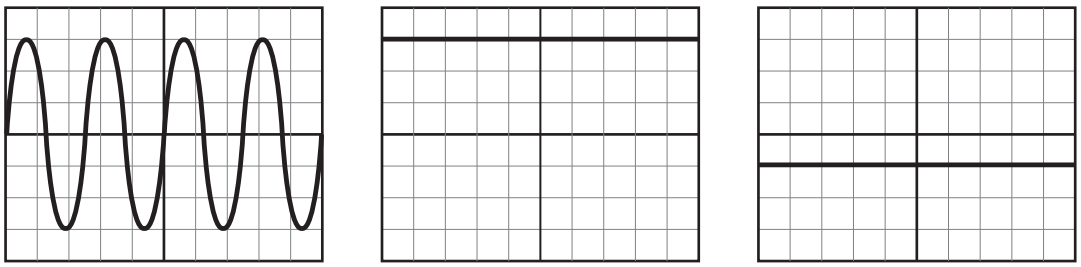
(2 marks)

7

Turn over for the next question

Do not write outside the box

2 (a) The diagram shows the traces produced on an oscilloscope when it is connected across different electricity supplies.



A **B** **C**

Which of the traces could have been produced by the mains electricity supply?

.....

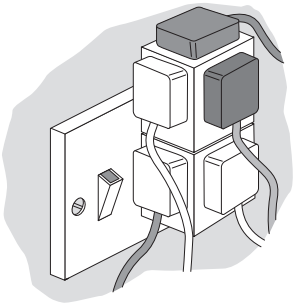
Give a reason for your answer.

.....

.....

(2 marks)

2 (b) The picture shows two adaptors being used to plug five electrical appliances into the same socket.



Explain why it is dangerous to have all five appliances switched on and working at the same time.

.....

.....

.....

.....

(2 marks)

4

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

3 (a) The diagram shows a cricketer bowling a ball.



3 (a) (i) The cricketer bowls the ball at 20 m/s.

How could the kinetic energy of **this** ball have been increased?

.....

(1 mark)

3 (a) (ii) The ball has a mass of 0.16 kg.

Use the equation in the box to calculate the momentum of the ball when it is bowled at 20 m/s.

momentum = mass × velocity

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

Choose the unit from the list below.

kg m/s **m/s^2** **Nm**

.....

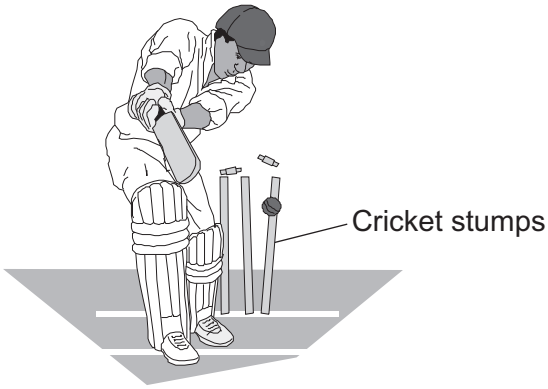
.....

Momentum = ...

(3 marks)

Do not write outside the box

3 (b) The batsman misses the ball and the ball hits the cricket stumps.



As the ball hits the stumps, the ball loses both kinetic energy and momentum.

3 (b) (i) What happens to the kinetic energy lost by the ball?

.....

.....

(1 mark)

3 (b) (ii) Even though the ball loses momentum, the total momentum of the ball **and** stumps just before the ball hits the stumps is the same as the total momentum of the ball **and** stumps just after the collision.

Explain how this is possible.

.....

.....

.....

.....

.....

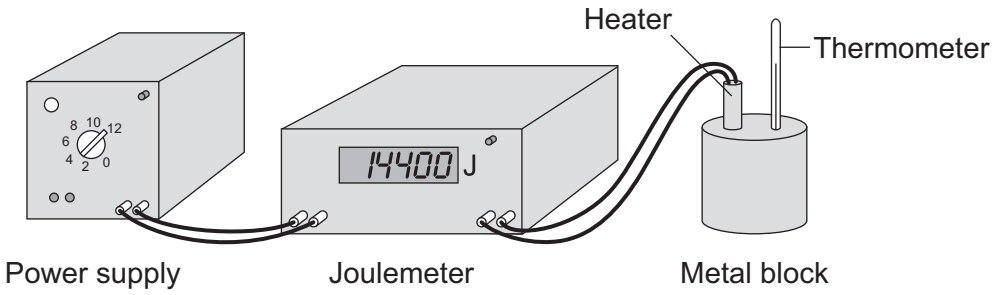
(2 marks)

7

Turn over for the next question

Do not write outside the box

4 A student used an electric heater to heat a metal block. The student measured the energy input to the heater with a joulemeter.



Before starting the experiment, the student reset the joulemeter to zero. The student switched the power supply on for exactly 10 minutes. During this time, the reading on the joulemeter increased to 14400.

4 (a) (i) Calculate the energy transferred each second from the power supply to the heater.

Show clearly how you work out your answer.

.....

.....

Energy transferred each second = ... J/s

(2 marks)

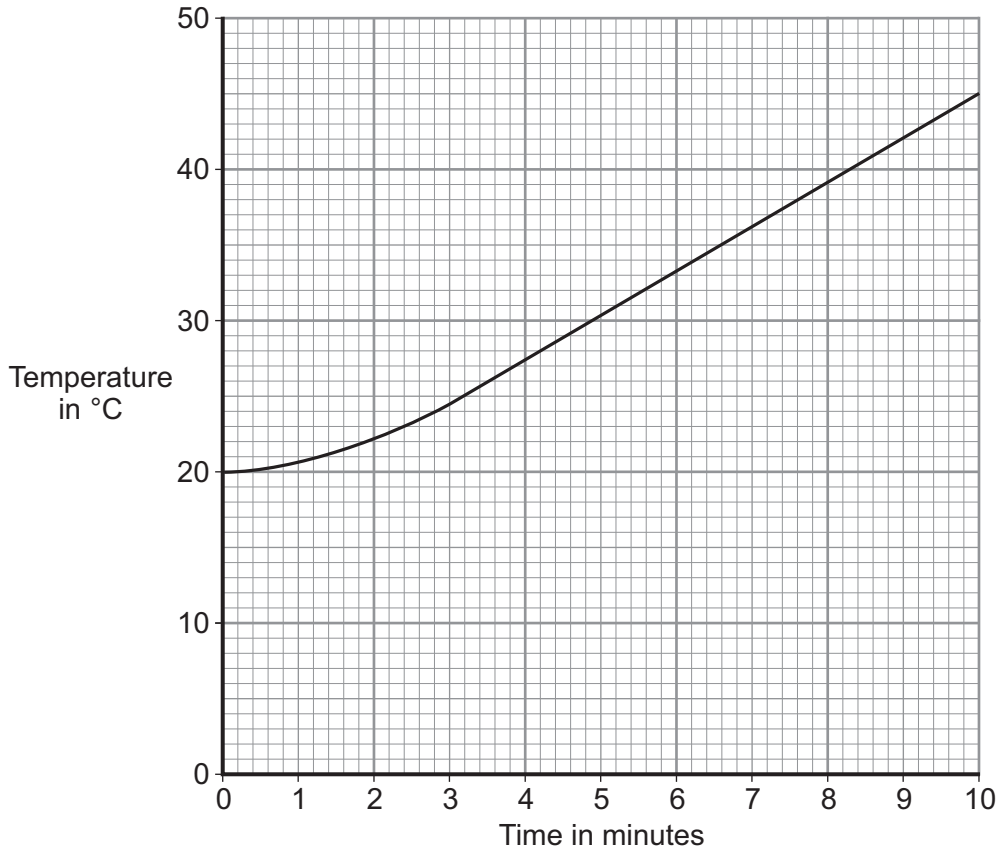
4 (a) (ii) What is the power of the heater?

.....

(1 mark)

Do not write outside the box

4 (b) The student measured the temperature of the metal block every minute. The data obtained by the student is displayed in the graph.



4 (b) (i) What range of temperatures did the student measure?

From ..... °C to ..... °C *(1 mark)*

4 (b) (ii) Before starting the experiment, the student had calculated that the temperature of the block would go up by 36 °C.

The student's data shows a smaller increase.

Which **one** of the following statements gives the most likely reason for this?

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

The student does not read the thermometer accurately. ☐

The block transfers energy to the surroundings. ☐

The power supply is not connected correctly to the joulemeter. ☐

(1 mark)

5

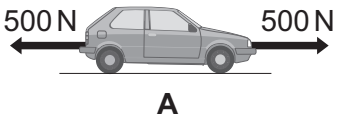
Turn over ▶

Do not write outside the box

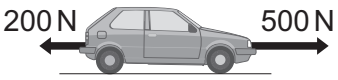
5 (a) The diagrams, **A**, **B** and **C**, show the horizontal forces acting on a **moving** car.

Draw a line to link each diagram to the description of the car's motion at the moment when the forces act.

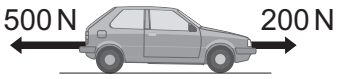
Draw only **three** lines.



A



B



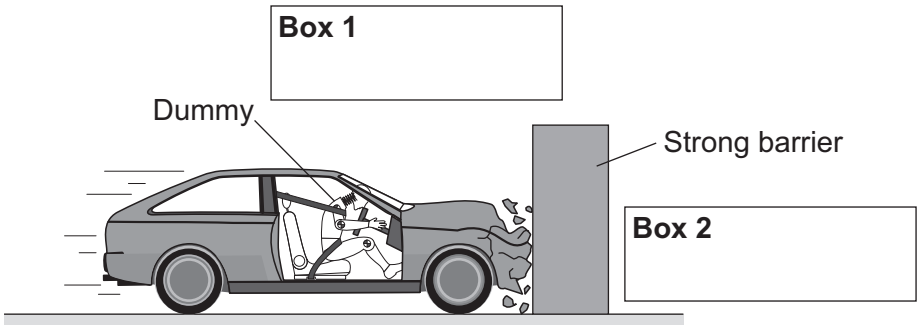
C

stationary	
constant speed	
slowing down	
accelerating forwards	

(3 marks)

Do not write outside the box

5 (b) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to a dummy inside the car.



5 (b) (i) Draw an arrow in **Box 1** to show the direction of the force that the car exerts on the barrier.

(1 mark)

5 (b) (ii) Draw an arrow in **Box 2** to show the direction of the force that the barrier exerts on the car.

(1 mark)

5 (b) (iii) Complete the following by drawing a ring around the correct line in the box.

The car exerts a force of 5000N on the barrier. The barrier does not move. The force exerted by the barrier on the car will be

more than
equal to
less than

5000N.

(1 mark)

5 (b) (iv) Which **one** of the following gives the most likely reason for attaching electronic sensors to the dummy?

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

To measure the speed of the car just before the impact. ☐

To measure the forces exerted on the dummy during the impact. ☐

To measure the distance the car travels during the impact. ☐

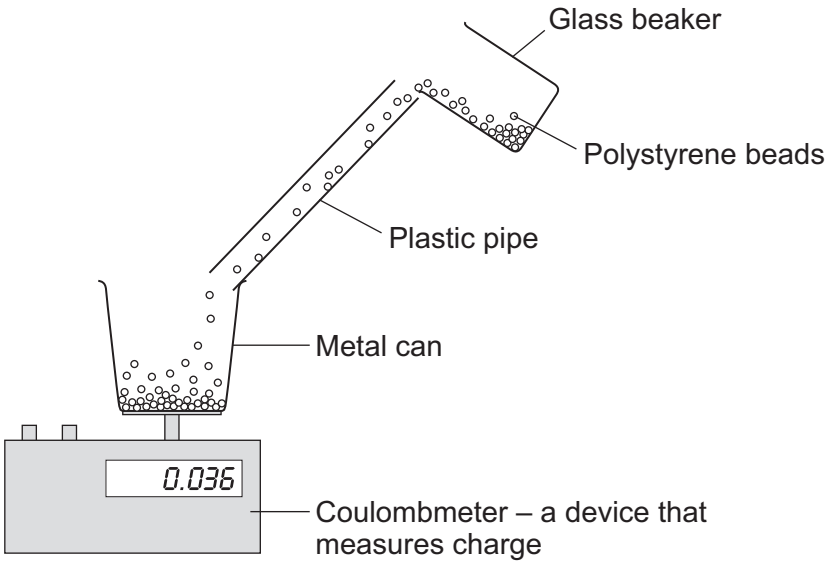
(1 mark)

7

Turn over ▶

Do not write outside the box

6 (a) Fine powders poured through a pipe can become charged. The diagram shows the apparatus used by a student to investigate this effect.



The student poured 75 cm^3 of polystyrene beads down the pipe. The beads fell into a metal can and the charge on them was measured directly using a coulombmeter.

The student repeated this twice more, but each time used 75 cm^3 of beads of a different size.

6 (a) (i) When they fell through the pipe, the polystyrene beads became negatively charged.

Explain how this happened.

.....

.....

.....

.....

.....

.....

(3 marks)

Do not write outside the box

6 (a) (ii) Give **one** control variable in the student's investigation.

.....

.....

(1 mark)

6 (b) The results obtained by the student are shown in the table.

Diameter of polystyrene beads in mm	Charge in microcoulombs
1.0	0.080
2.0	0.044
3.0	0.012

(1 000 000 microcoulombs = 1 coulomb)

6 (b) (i) Describe the connection between the size of the polystyrene beads and the total charge on the beads.

.....

.....

(1 mark)

6 (b) (ii) Explain how these results might be different if the student had used a shorter pipe.

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

Do not write outside the box

6 (c) In industry, powders are often pumped through pipes. If the static charge caused a spark, the powder could ignite and cause an explosion.

6 (c) (i) Is an explosion more likely to happen when pumping very fine powders or when pumping powders that consist of much larger particles?

.....

Give a reason for your answer.

.....

.....

(1 mark)

6 (c) (ii) Suggest **one** way that the risk of an explosion could be reduced.

.....

.....

(1 mark)

6 (d) The table gives the minimum ignition energy (MIE) value for a number of fine powders. The MIE is the minimum amount of energy required to cause a fine powder to ignite.

Type of powder	MIE in millijoules
Coal dust	60.00
Aluminium powder	10.00
Cornstarch dust	0.30
Iron powder	0.12

The MIE values for different substances are all measured in the same way and under the same conditions of pressure and temperature.

Why is this important?

.....

.....

(1 mark)

10

Do not write outside the box

7 (a) Nuclear fission is used in nuclear power stations to generate electricity. Nuclear fusion happens naturally in stars.

7 (a) (i) Explain briefly the difference between *nuclear fission* and *nuclear fusion*.

.....

.....

.....

.....

.....

(2 marks)

7 (a) (ii) What is released during both nuclear fission and nuclear fusion?

.....

(1 mark)

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

7 (b) (i) Name another substance used as a fuel in some nuclear reactors.

.....

(1 mark)

7 (b) (ii) There are many isotopes of plutonium.

What do the nuclei of different plutonium isotopes have in common?

.....

(1 mark)

5

END OF QUESTIONS

There are no questions printed on this page

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Version1.0: 29/02/2012

General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2012 Examination – January Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY2F

Question 1

question	answers	extra information	mark
1(a) (E)	1800 (N)	allow **1** mark for correct substitution ie 180 × 10 provided no further steps shown	2
1(b) (E)	3780 **or** their (a) × 2.1 correctly calculated	allow **1** mark for correct substitution ie 1800 **or** their (a) × 2.1 provided no further steps shown	2
	joule	accept J accept any clear indication of correct answer	1
1(c) (E)	0	reason does not score if 0 not chosen	1
	work is only done when a force makes an object move	accept distance moved is zero accept no energy transfer (to the bar) accept the bar is not moving/is stationary 'it' refers to the bar/weights	1
Total			**7**

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PHY2F

Question 2

question	answers	extra information	mark
2(a) (E)	**A**		1
		only scores if **A** chosen	
	it is alternating / a.c.	accept because B and C are d.c.	1
	or it changes direction/p.d.	accept voltage for p.d.	
		it goes up and down is insufficient	
		it is constantly changing is insufficient	
		an answer B and/or C with the reason because it is direct current /d.c scores 1 mark	
2(b) (E)	too much current (through socket)	accept electricity for current	1
		accept too much power	
		accept socket/circuit overloaded	
		do not accept voltage/p.d for current	
	wiring / socket gets hot		1
		accept melts for gets hot	
		accept risk of fire	
		risk of fire in appliances is insufficient	
		ignore reference to sparking	
		overloaded plugs and plugs getting hot or fuses melting is insufficient	
Total			**4**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)(i) (E)	bowl the ball faster	accept increase its speed accept a stated speed above 20 m/s increase momentum is insufficient bowl ball with greater power/force is insufficient bowl ball harder is insufficient do **not** accept increase mass of ball	1
3(a)(ii) (E)	3.2 kg m/s	allow **1** mark for correct substitution i.e. 0.16 × 20 provided no further steps shown accept any clear indication of correct answer	2 1
3(b)(i) (E)	work done by ball to move stumps	accept transformed into heat / sound accept transferred to surroundings accept transferred to the stumps do **not** accept absorbed by the stumps	1
3(b)(ii) (E)	the stumps gain momentum equal to momentum lost by ball	 accept momentum is <u>conserved</u>	1 1
Total			**7**

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PHY2F

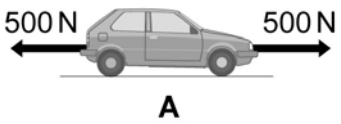
Question 4

question	answers	extra information	mark
4(a)(i) (E)	24	allow **1** mark for converting time to 600 seconds **or** showing method ie 14400/10 **or** $\frac{14400}{10 \times 60}$ provided no further steps shown	2
4(a)(ii) (E)	24 **or** their (a)(i)	ignore any unit	1
4(b)(i) (G)	20 45	**both** required – either order	1
4(b)(ii) (A)	the block transfers energy to the surroundings		1
Total			**5**

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PHY2F

Question 5

question	answers	extra information	mark
5(a) (G)	 A  B  C stationary constant speed slowing down accelerating forwards	3 lines drawn all correct allow **1** mark for each correct line if two or more lines are drawn from any diagram then all these lines are incorrect	3
5(b)(i) (G)	horizontal arrow to the right	judge by eye accept an arrow drawn outside the box if it is labelled correctly	1
5(b)(ii) (G)	horizontal arrow to the left	judge by eye accept an arrow drawn outside the box if it is labelled correctly	1

Question 5 continues on the next page . . .

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PHY2F

Question 5 continued . . .

question	answers	extra information	mark
5(b)(iii) (A)	equal to		1
5(b)(iv) (A)	to measure the forces exerted on the dummy during the impact		1
Total			**7**

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PHY2F

Question 6

question	answers	extra information	mark
6(a)(i) (E)	friction between the beads and pipe	accept beads rub against the pipe	1
	(cause) <u>electrons</u> to transfer	accept electrons are lost/gained do **not** accept negatively charged atoms for electrons	1
	from the pipe **or** to the beads	3rd mark point only scores if 2nd mark scores do **not** accept from the (negatively) charged pipe do **not** accept to the (positively) charged beads accept negative charge transfer to the beads for **1** mark provided 2nd or 3rd marking point not awarded mention of positive charge transfer negates last 2 marking points	1
6(a)(ii) (E)	<u>volume</u> of beads **or** <u>length</u> of pipe **or** speed the beads are poured **or** angle of pipe	accept (75)cm^3 accept use the same pipe poured the same way is insufficient	1
6(b)(i) (E)	the larger the beads the less charge	do **not** accept inversely proportional negative correlation is insufficient	1

Question 6 continues on the next page . . .

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PHY2F

Question 6 continued . . .

6(b)(ii) (E)	(total) charge decrease beads in contact with pipe (walls) for less time **or** smaller surface area (to rub against)	results would be lower/smaller would be insufficient accept less contact (between beads and pipe) accept beads in pipe for less time accept less pipe to rub against less friction is insufficient	1 1
6(c)(i) (E)	(pumping very) fine powders greater charge (build up) **or** higher pd/voltage **or** greater energy	reason only scores if (very)fine powders given accept more static (electricity) accept an answer that correctly relates back to the experimental data accept larger surface area to volume (ratio)	1
6(c)(ii) (E)	idea of earthing (the pipe)	accept use metal pipes do **not** accept use larger particles	1
6(d) (E)	to compare (the relative risks) **or** different conditions change the MIE value	fair test is insufficient you can only have one independent variable is insufficient accept different conditions change t results do **not** accept avoid bias	1
Total			**10**

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PHY2F

Question 7

question	answers	extra information	mark
7(a)(i) (E)	(nuclear) fission is the splitting of a (large atomic) nucleus (nuclear) fusion is the joining of (two atomic) nuclei (to form a larger one)	do **not** accept particle/atom for nucleus do not accept particles/atoms for nuclei	1 1
7(a)(ii) (E)	energy	accept heat/radiation/nuclear energy accept gamma (radiation) do not accept neutrons/neutrinos	1
7(b)(i) (E)	uranium (-235)	accept U (-235) ignore any numbers given with uranium accept thorium accept MOX (mixed oxide) do **not** accept hydrogen	1
7(b)(ii) (E)	(same) number of protons	accept (same) atomic number accept (same) positive charge ignore reference to number of electrons	1
Total			**5**

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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	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2011

Additional Science PHY2F
Unit Physics P2

F

Physics
Unit Physics P2

Written Paper

Friday 27 May 2011 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.

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Do not write outside the box

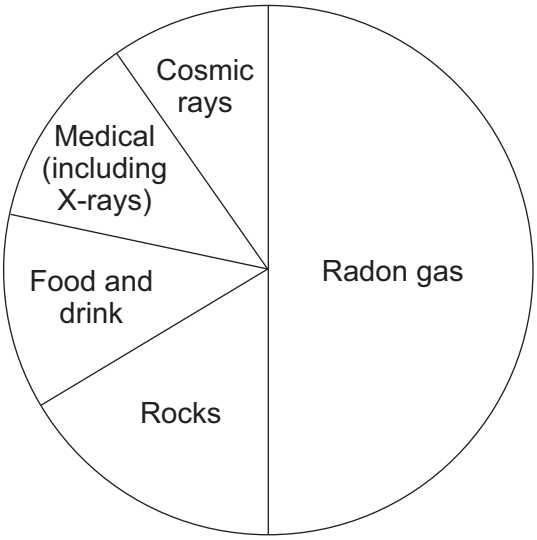
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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

1 The pie chart shows the average proportions of background radiation from various sources in the UK.



Three sources of background radiation are given in **List A**.
Statements about sources of background radiation are given in **List B**.

Draw **one** line to link each source of background radiation in **List A** to the statement about that source given in **List B**.

Draw only **three** lines.

List A	**List B**
	Are used to show broken bones.
X-rays	
	The radiation comes from outer space.
Cosmic rays	
	Comes from soil containing a radioactive isotope of potassium.
Radon gas	
	Gives about 50% of all background radiation.

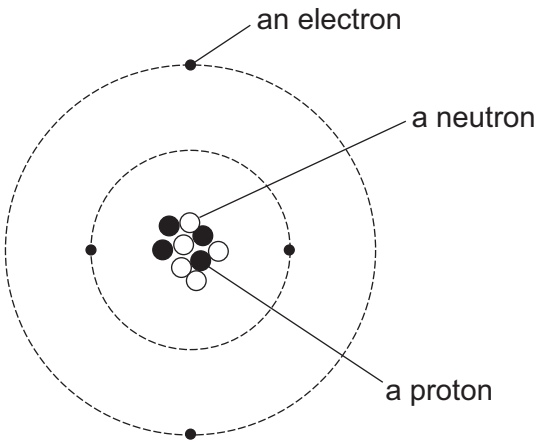
(3 marks)

3

Turn over ▶

Do not write outside the box

2 The diagram represents an atom of beryllium. The three types of particle that make up the atom have been labelled.



2 (a) Use the labels from the diagram to complete the following statements.

Each label should be used once.

The particle with a positive charge is ..... .

The particle with the smallest mass is ..... .

The particle with no charge is ..... .

(2 marks)

2 (b) What is the atomic number of a beryllium atom?

Draw a ring around your answer.

4	**5**	**9**	**13**

Give a reason for your answer.

.....

.....

(2 marks)

Do not write outside the box

2 (c) Which **one** of the following statements describes what can happen to an atom to change it into an ion?

Tick (✓) **one** box.

The atom loses a neutron. ☐

The atom loses an electron. ☐

The atom loses a proton. ☐

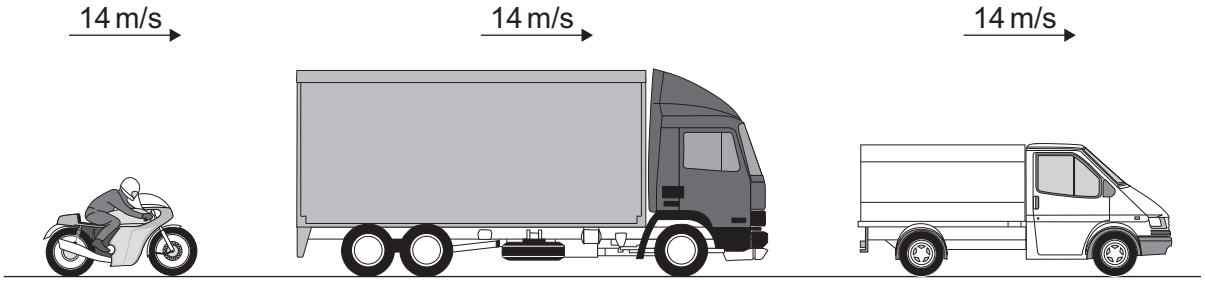
(1 mark)

5

Turn over for the next question

Do not write outside the box

3 (a) (i) The diagram shows three vehicles travelling along a straight road at 14 m/s.



Motorbike
Mass = 175 kg

Lorry
Mass = 10 000 kg

Van
Mass = 3000 kg

Which vehicle has the greatest momentum?

.....

Give the reason for your answer.

.....

.....

.....

(2 marks)

3 (a) (ii) Use the equation in the box to calculate the momentum of the motorbike when it travels at 14 m/s.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ...kg m/s

(2 marks)

Do not write outside the box

3 (b) The motorbike follows the lorry for a short time, and then accelerates to overtake both the lorry and van.

3 (b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

When the motorbike starts to overtake, the kinetic energy

of the motorbike

decreases.
stays the same.
increases.

(1 mark)

3 (b) (ii) Give a reason for your answer to part (b)(i).

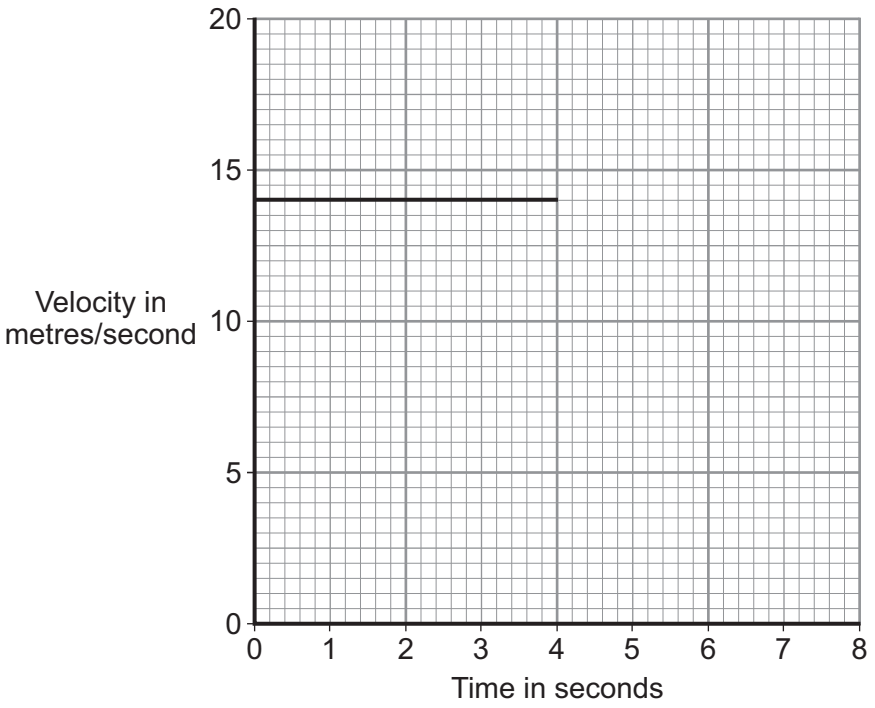
.....

.....

(1 mark)

3 (b) (iii) The graph shows the velocity of the motorbike up to the time when it starts to accelerate. The motorbike accelerates constantly, going from a speed of 14 m/s to a speed of 20 m/s in a time of 2 seconds. The motorbike then stays at 20 m/s.

Complete the graph to show the motion of the motorbike over the next 4 seconds.



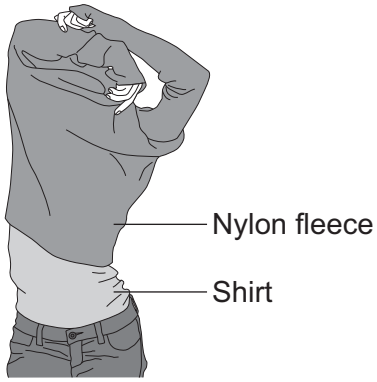
(3 marks)

9

Turn over ▶

Do not write outside the box

4 (a) A student takes off his nylon fleece and feels a small electric shock.
He realises that this happens because his fleece becomes charged.



Explain why the fleece becomes charged.

.....

.....

.....

.....

.....

(2 marks)

4 (b) Only **two** of the following statements are correct.

Put a tick (✓) in the boxes next to the **two** correct statements.

Positively charged objects repel negatively charged objects. ☐

Electrical charges move easily through metals. ☐

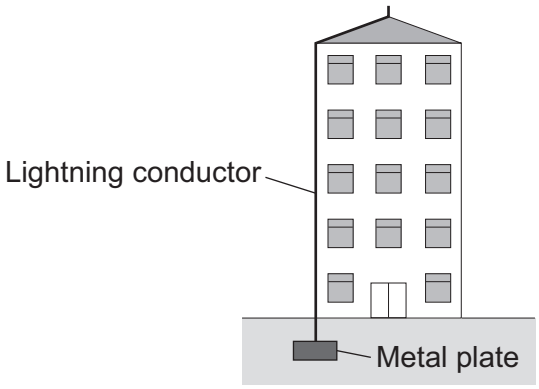
Static electricity is safe; it never causes any danger. ☐

An electric current is a flow of electrical charge. ☐

(2 marks)

Do not write outside the box

4 (c) The diagram shows a lightning conductor attached to the side of a tall building.



If the building is struck by lightning, charge flows to earth through the lightning conductor.

4 (c) (i) Which of the materials in the list is used to make the lightning conductor?

Draw a ring around your answer.

copper **glass** **plastic**

Give a reason for your answer.

.....

.....

.....

(2 marks)

4 (c) (ii) Complete the sentence by drawing a ring around the correct line in the box.

The resistance of the lightning conductor is

higher than
the same as
lower than

the resistance of the building.

(1 mark)

4 (c) (iii) It is almost impossible to test different designs of lightning conductor in controlled experiments during a lightning storm.

Suggest a reason why.

.....

.....

(1 mark)

8

Do not write outside the box

5 Motorway accidents have many causes.

5 (a) Which **one** of the following is most likely to increase the chance of a car being in an accident?

Tick (✓) the box next to your answer.

The car has just had new tyres fitted. ☐

The driver has been drinking alcohol. ☐

A road surface in dry conditions ☐

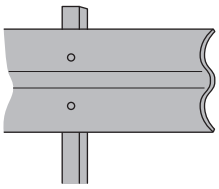
Give a reason for your answer.

.....

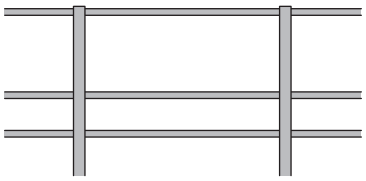
.....

(2 marks)

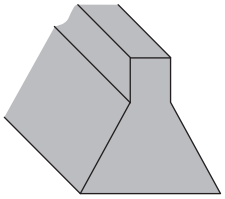
5 (b) The diagram shows three designs of motorway crash barriers.



Steel sheets



Steel 'ropes'



Solid concrete

Before a new design of barrier is used, it must be tested.
A car of mass 1500 kg is driven at 30 m/s to hit the barrier at an angle of 20 degrees.
This barrier must slow the car down and must not break.

Do not write outside the box

Explain why the mass of the car, the speed of the car and the angle at which the car hits the barrier must be the same in every test.

.....

.....

.....

.....

.....

(2 marks)

5 (c) A group of scientists has suggested that new designs of crash barriers should be first tested using computer simulations.

Which **two** statements give sensible reasons for testing new barrier designs using a computer simulation?

Put a tick (✓) in the box next to each of your answers.

The design of the barrier can be changed easily. ☐

Data for different conditions can be obtained quickly. ☐

Simulations are more realistic than using cars and barriers. ☐

(1 mark)

5

Turn over for the next question

Do not write outside the box

6 **Diagram 1** shows a hairdryer.
Diagram 2 shows how the heaters and fan of the hairdryer are connected to a 3-pin plug.
The hairdryer does not have an earth wire.

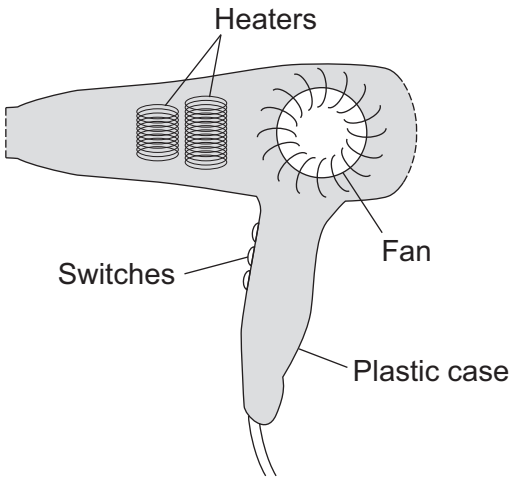


Diagram 1

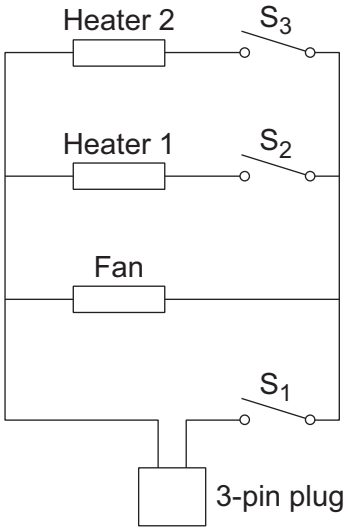


Diagram 2

6 (a) What colour is the insulation around the wire connected to the live pin inside the plug?

.....

(1 mark)

6 (b) Why does the hairdryer **not** need an earth wire?

.....

.....

(1 mark)

6 (c) All the switches are shown in the OFF position.

6 (c) (i) Which switch or switches have to be ON to make:

(1) only the fan work; .....

(2) heater 2 work? .....

(2 marks)

Do not write outside the box

6 (c) (ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

.....

.....

.....

.....

.....

(2 marks)

6 (d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Use the equation in the box to calculate the maximum power of the hairdryer.

power = current × potential difference

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

.....

.....

Maximum power = ...

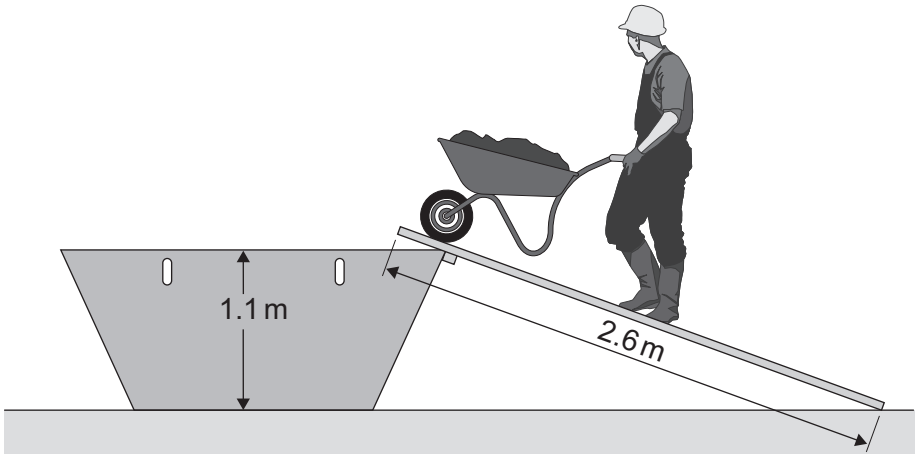
(3 marks)

9

Turn over for the next question

Do not write outside the box

7 (a) The diagram shows a builder using a plank to help load rubble into a skip.



The builder uses a force of 220 N to push the wheelbarrow up the plank.

Use information from the diagram and the equation in the box to calculate the work done to push the wheelbarrow up the plank to the skip.

work done = force applied × distance moved in the direction of force

Show clearly how you work out your answer.

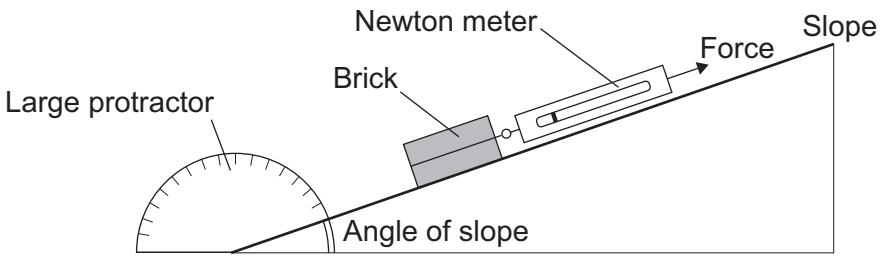
.....

.....

Work done = ... J

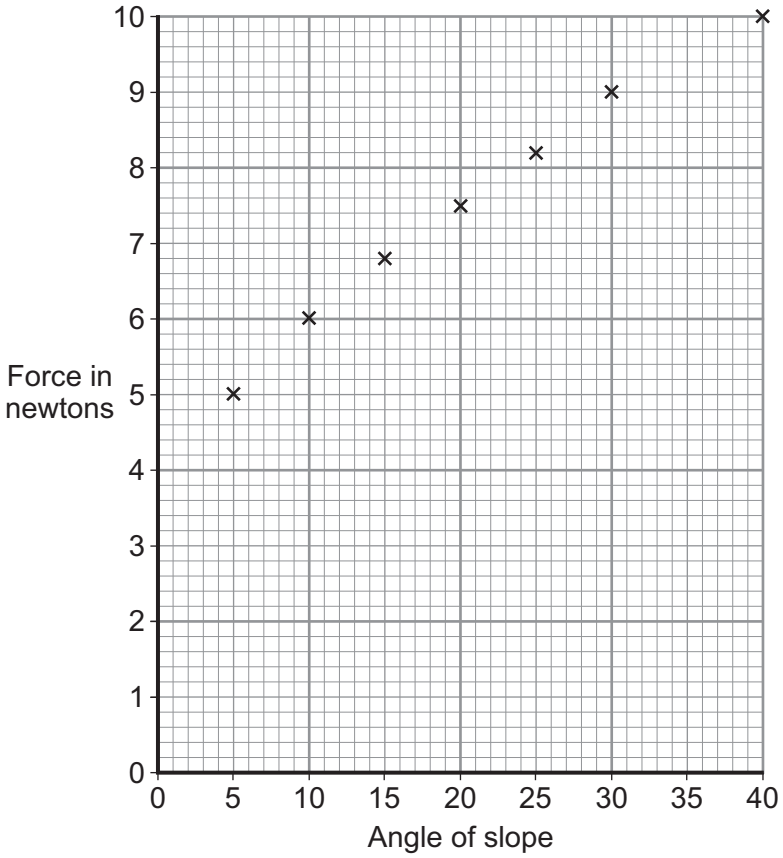
(2 marks)

7 (b) A student investigated how the force needed to pull a brick up a slope, at a steady speed, depends on the angle of the slope.
The apparatus used by the student is shown in the diagram.



The student used the results from the investigation to plot the points for a graph of force used against the angle of the slope.

Do not write outside the box



7 (b) (i) Draw a line of best fit for these points. *(1 mark)*

7 (b) (ii) How does the force used to pull the brick up the slope change as the angle of the slope increases?

.....

.....

(1 mark)

7 (b) (iii) Consider the results from this experiment.
Should the student recommend that the builder use a long plank or a short plank to help load the skip?

Draw a ring around your answer.

long plank **short plank**

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

END OF QUESTIONS

6

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There are no questions printed on this page

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Version1.0: 29/07/2011

General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2011 Examination – June Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

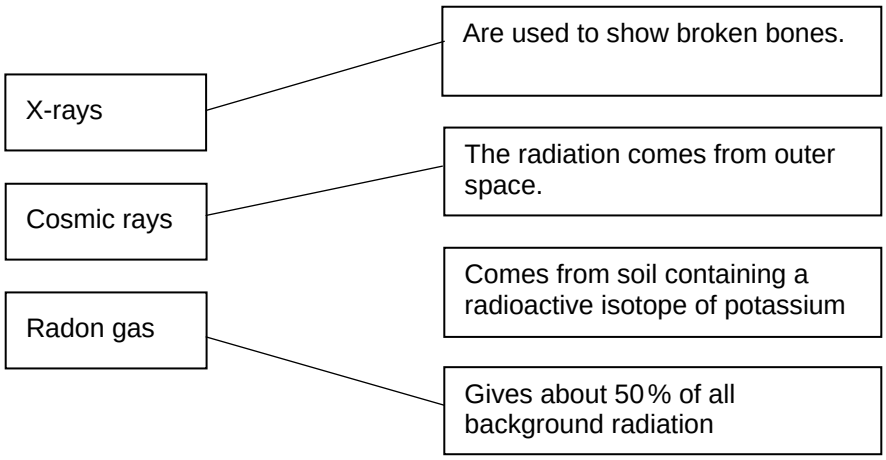
3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY2F

Question 1

question	answers	extra information	mark
1	**1** mark for each correct line  	If more than 1 line has been drawn from a box in **List A** then all those lines are marked incorrect.	3
Total			**3**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)	proton electron neutron	all 3 in correct order allow **1** mark for 1 correct do **not** accept letters p, e, n	2
2(b)	4 number of protons	reason only scores if 4 is chosen accept number of electrons accept there are 4 protons and 4 electrons do **not** accept there are 4 protons and electrons	1 1
2(c)	The atom loses an electron.		1
Total			**5**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)(i)	lorry greatest mass	reason only scores if lorry chosen accept weight for mass accept heaviest accept correct calculations for all 3 vehicles the biggest is insufficient	1 1
3(a)(ii)	2450	allow **1** mark for correct substitution ie 175 × 14	2
3(b)(i)	increases	accept any clear indication of the correct answer	1
3(b)(ii)	speed increases	accept velocity for speed accept gets faster do **not** accept it accelerates on its own moves more is insufficient	1
3(b)(iii)	straight line going to 6, 20 horizontal line from 6,20 to 8,20	allow **1** mark for a curve going to 6,20 **or** a straight line diagonally upwards but missing 6,20 allow a horizontal line from where their **diagonal** meets 20m/s to 8,20	2 1
Total			**9**

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PHY2F

Question 4

question	answers	extra information	mark
4(a)	fleece rubs against shirt **or** friction (between fleece and shirt)	it refers to the fleece	1
	(causing) <u>electrons</u> to transfer from one to the other	accept a specific direction of transfer do **not** accept charge for electrons positive electrons negates this mark movement of protons negates this mark	1
4(b)	Electrical charges move easily through metals.		1
	An electric current is a flow of electrical charge.		1
4(c)(i)	copper	reason only scores if copper chosen	1
	(good electrical) conductor	accept it is a metal any mention of heat conduction negates this mark	1
4(c)(ii)	lower than		1

Question 4 continues on the next page

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PHY2F

Question 4 continued

question	answers	extra information	mark
4(c)(iii)	accept any sensible suggestion, eg: • too many variables (to control) • lightning strikes / storms are random / unpredictable • do not know which building will be struck • do not know when a building will be struck • do not know when lightning will happen • (very) difficult to create same conditions in a laboratory • lightning storms are not the same	it is not safe is insufficient do **not** accept lightning does not strike the same place twice	1
Total			**8**

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PHY2F

Question 5

question	answers	extra information	mark
5(a)	The driver has been drinking alcohol.	reason only scores if this box is ticked	1
	drivers reaction time increases **or** thinking distance / stopping distance increases **or** driver less alert	accept slower reactions accept slower reaction time do not accept braking distance increases accept driver may fall asleep / be tired	1
5(b)	they are all variables that could affect outcome / results	accept specific effect of changing one of the variables accept to make the test valid ignore reliable	1
	so data / barriers can be compared	accept to see which is / works best / safest do **not** accept fair test on its own	1
5(c)	ticks in both the top and middle boxes		1
Total			**5**

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PHY2F

Question 6

question	answers	extra information	mark
6(a)	brown		1
6(b)	outside / case is plastic / an insulator	accept is double insulated accept non-conductor for plastic do **not** accept it / hairdryer is plastic	1
6(c)(i)	(1) S_1 (2) S_1 and S_3	and no other both required, either order	1 1
6(c)(ii)	S_1 must be ON (for either heater to work) S_1 switches the fan on	do **not** accept reference to 'fan' switch	1 1
6(d)	1495 watt(s) or W	 allow **1** mark for correct substitution ie, 6.5 × 230 an answer of 1.495 kW gains **3** marks although the unit is an independent mark for full credit the unit and numerical value must be consistent accept joules per second or J/s	2 1
Total			**9**

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PHY2F

Question 7

question	answers	extra information	mark
7(a)	572	allow **1** mark for correct substitution, ie 220 × 2.6 allow **1** mark for 220 x 260 = 57 200 **or** 220 x 2600 = 572 000 but to score this mark the entire calculation must be shown	2
7(b)(i)	smooth curve drawn	accept a line that is extrapolated back to 0 degrees, but not through the origin accept a straight line of best fit (point at 40 degrees can be treated as anomalous and line may stop at 30 degrees) do **not** accept straight lines drawn 'dot to dot' or directly from first to last point or a line going through the origin	1
7(b)(ii)	increases	accept a positive correlation do **not** accept proportional	1

Question 7 continues on the next page

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PHY2F

Question 7 continued

question	answers	extra information	mark
7(b)(iii)	long plank	no mark for this, the marks are for the explanation	
	makes the angle small(er) (than a short plank)	accept increases the distance accept small(er) slope	1
	a small(er) force is needed		1
	or		
	short plank	no mark for this, the marks are for the explanation	
	a large(r) force is used over a short(er) distance (1)		
	less work done (1)	accept less energy transfer	
Total			**6**

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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
Foundation Tier
January 2011

Additional Science PHY2F
Unit Physics P2

F

Physics
Unit Physics P2

Wednesday 19 January 2011 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.

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Do not write outside the box

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

1 The names of three different processes are given in **List A**.
Where these processes happen is given in **List B**.

Draw a line to link each process in **List A** to where the process happens in **List B**.

Draw only **three** lines.

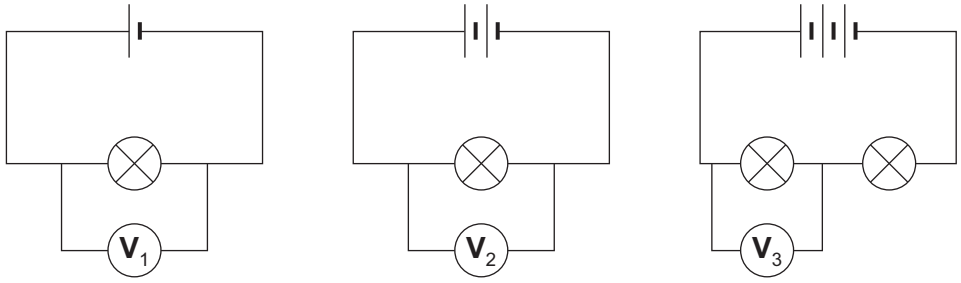
List A	**List B**
Process	**Where it happens**
fusion	in a star
chain reaction	in a nuclear reactor
alpha decay	in a smoke precipitator
	in the nucleus of an atom

(3 marks)

3

Do not write outside the box

2 (a) The lamps in the circuits drawn below are all identical.
Each of the cells has a potential difference of 1.5 volts.



2 (a) (i) What is the potential difference across the 3 cells that are joined in series?

.....

Potential difference = ... V
(1 mark)

2 (a) (ii) What will be the reading on the voltmeter labelled $\mathbf{V_3}$?

Voltmeter reading $\mathbf{V_3}$ = ... V
(1 mark)

2 (a) (iii) Which voltmeter, $\mathbf{V_1}$, $\mathbf{V_2}$ or $\mathbf{V_3}$, will give the highest reading?

Draw a ring around your answer.

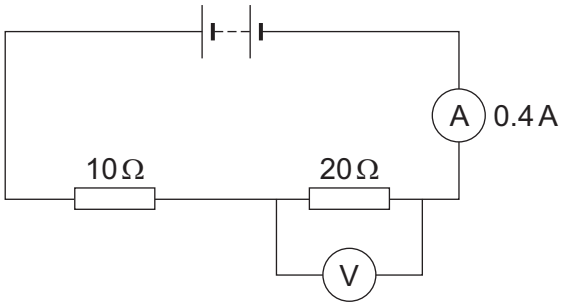
$\mathbf{V_1}$ $\mathbf{V_2}$ $\mathbf{V_3}$

(1 mark)

Question 2 continues on the next page

Do not write outside the box

2 (b) The diagram below shows a simple circuit.



2 (b) (i) Calculate the total resistance of the two resistors in the circuit.

.....

Total resistance = ... Ω

(1 mark)

2 (b) (ii) Use the equation in the box to calculate the reading on the voltmeter.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

.....

Voltmeter reading = ... V

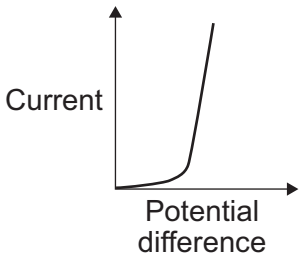
(2 marks)

Do not write outside the box

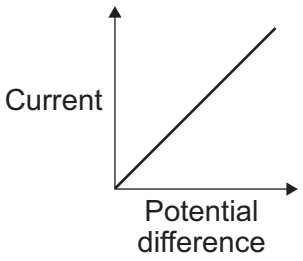
2 (b) (iii) The current through a resistor at constant temperature changes when the potential difference across the resistor changes.

Which **one** of the graphs, **X**, **Y** or **Z**, shows how the current changes?

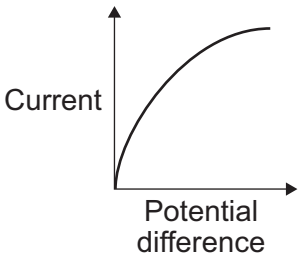
Write your answer, **X**, **Y** or **Z**, in the box.



X



Y



Z

Graph ☐

(1 mark)

7

Turn over for the next question

Do not write outside the box

3 A high-speed train accelerates at a constant rate in a straight line.
The velocity of the train increases from 30 m/s to 42 m/s in 60 seconds.

3 (a) (i) Calculate the change in the velocity of the train.

.....

Change in velocity = ... m/s
(1 mark)

3 (a) (ii) Use the equation in the box to calculate the acceleration of the train.

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

Show clearly how you work out your answer and give the unit.
Choose the unit from the list below.

m/s **m/s^2** **N/kg** **Nm**

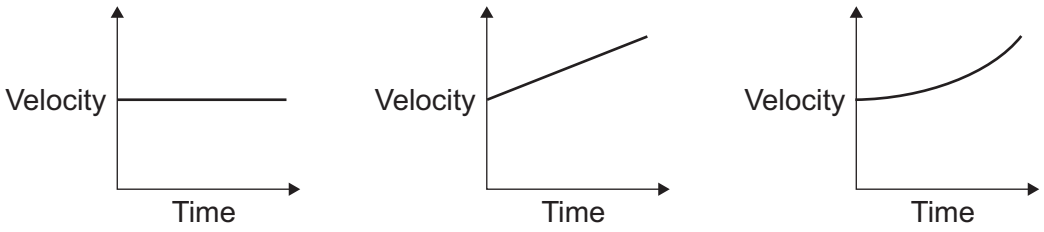
.....

.....

Acceleration = ...
(2 marks)

3 (b) Which **one** of the graphs, **A**, **B** or **C**, shows how the velocity of the train changes as it accelerates?

Write your answer, **A**, **B** or **C**, in the box.



A **B** **C**

Graph ☐

(1 mark)

4

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

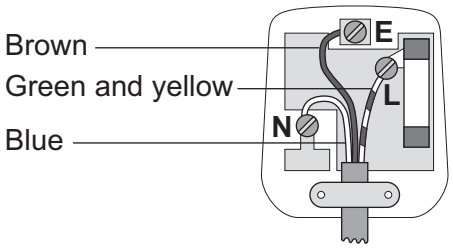
Do not write outside the box

4 The diagrams show the inside of a 13 amp plug.

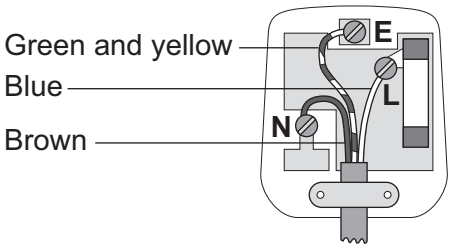
4 (a) (i) Which **one** of the plugs, **A**, **B**, **C** or **D**, is correctly wired?

Write your answer, **A**, **B**, **C** or **D**, in the box.

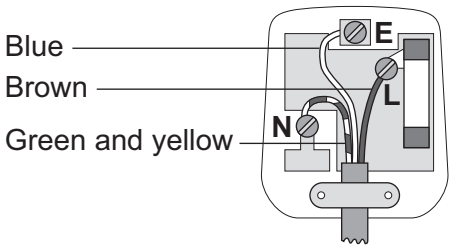
A



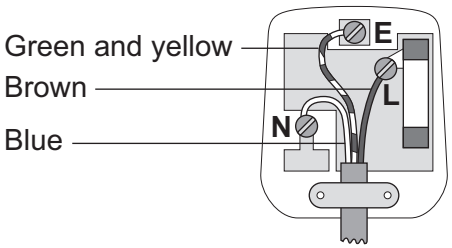
B



C



D



The plug that is correctly wired is ☐ .

(1 mark)

4 (a) (ii) What material is the outside casing of a plug made from?

.....

(1 mark)

4 (b) An electric drill draws a current of 2 amps from the 230 volt mains electricity supply.

Use the equation in the box to calculate the power of the drill.

power = current × potential difference

Show clearly how you work out your answer.

.....

.....

Power ..... watts

(2 marks)

Do not write outside the box

4 (c) A householder needs to replace a damaged plug. Most replacement plugs are sold with a 13 amp fuse fitted inside. The householder thinks it would be better for shops to sell the plugs without a fuse. He could then buy either a 3 A, 5 A or 13 A fuse to fit inside the plug.

Explain an advantage of selling plugs without a fuse, rather than with a 13 amp fuse fitted.

.....

.....

.....

.....

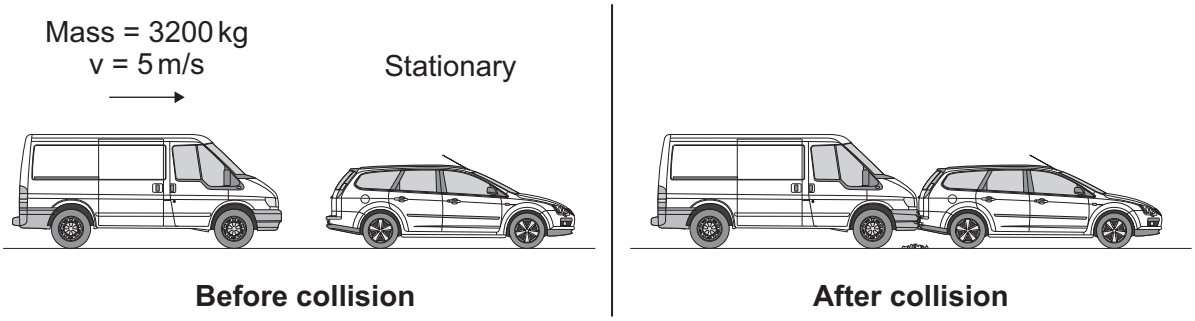
(2 marks)

6

Turn over for the next question

Do not write outside the box

5 (a) A van has a mass of 3200 kg. The diagram shows the van just before and just after it collides with the back of a car.



Just before the collision, the van was moving at 5 m/s and the car was stationary.

5 (a) (i) Use the equation in the box to calculate the momentum of the van just before the collision.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ... kg m/s
(2 marks)

5 (a) (ii) The collision makes the van and car join together.

What is the total momentum of the van and the car just after the collision?

Momentum = ... kg m/s
(1 mark)

Do not write outside the box

5 (a) (iii) Complete the following sentence by drawing a ring around the correct line in the box.

The momentum of the car before the collision is

more than
the same as
less than

the momentum of the car after the collision.

(1 mark)

5 (b) A seat belt is one of the safety features of a car.



In a collision, wearing a seat belt reduces the risk of injury.

Use words or phrases from the box to complete the following sentences.

decreases	stays the same	increases

In a collision, the seat belt stretches. The time it takes for the person held by the seat belt to lose momentum compared to a person not wearing a seat belt,

..... .

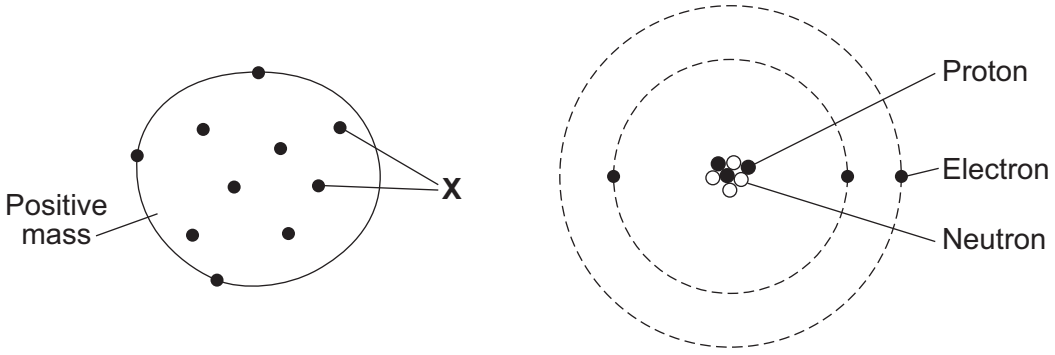
The force on the person's body ..... and so reduces the risk of injury.

(2 marks)

6

Do not write outside the box

6 The diagrams show two different models of an atom.



'Plum pudding' model **Model used today**

6 (a) The particles labelled '**X**' in the plum pudding model are also included in the model of the atom used today.

What are the particles labelled '**X**'?

.....

(1 mark)

6 (b) Scientists decided that the 'plum pudding' model was wrong and needed replacing.

Which **one** of the following statements gives a reason for deciding that a scientific model needs replacing?

Tick (✓) **one** box.

The model is too simple. ☐

The model has been used by scientists for a long time. ☐

The model cannot explain the results from a new experiment. ☐

(1 mark)

Do not write outside the box

6 (c) The table gives information about the three types of particle that are in the model of the atom used today.

Particle	Relative mass	Relative charge
	1	+1
	very small	–1
	1	0

Complete the table by adding the names of the particles.

(2 marks)

4

Turn over for the next question

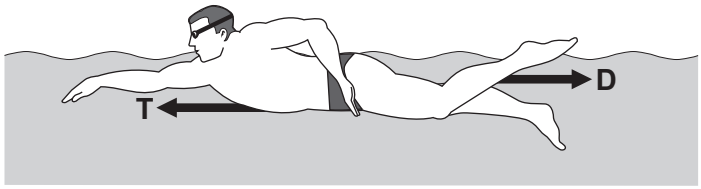
Do not write outside the box

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DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

7 (a) The diagram shows the horizontal forces acting on a swimmer.



7 (a) (i) The swimmer is moving at constant speed.
Force **T** is 120 N.

What is the size of force **D**?

..... N
(1 mark)

7 (a) (ii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

.....

.....

Initial resultant force = ... N
(1 mark)

7 (a) (iii) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

.....

.....

.....

.....

.....

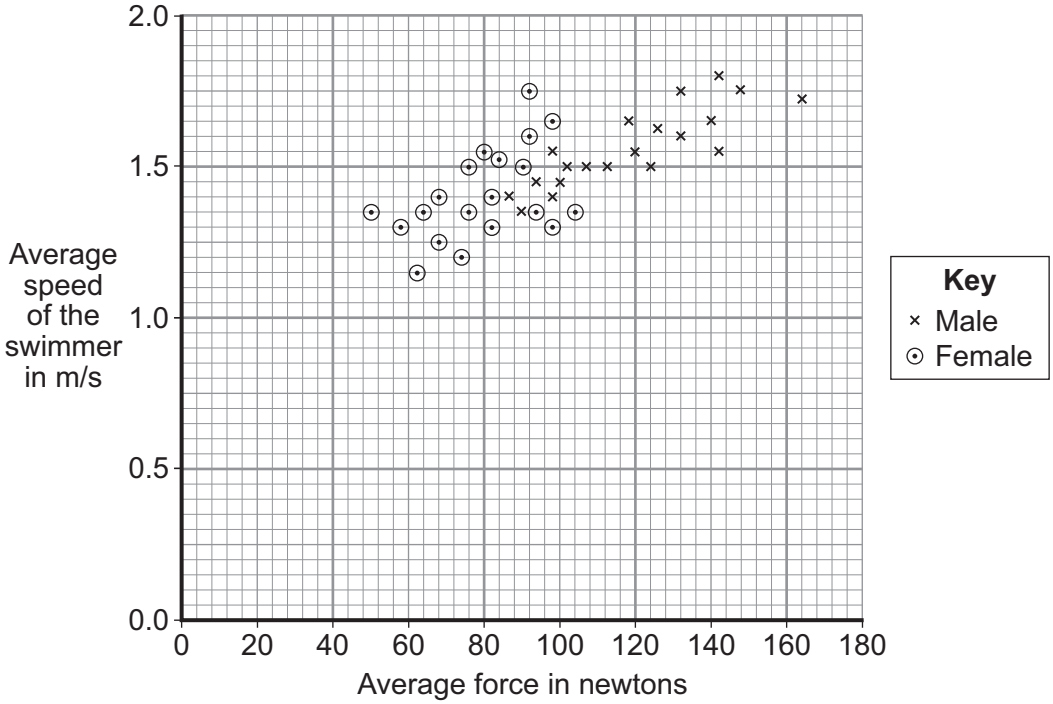
.....
(3 marks)

Question 7 continues on the next page

Do not write outside the box

7 (b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.
The investigation involved 20 males and 20 females swimming a fixed distance.
Sensors placed on each swimmer's hands measured the force 85 times every second over the last 10 metres of the swim.
The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



7 (b) (i) What was the dependent variable in this investigation?

.....

(1 mark)

7 (b) (ii) Explain **one** advantage of measuring the force 85 times every second rather than just once or twice every second.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

7 (b) (iii) Give **one** way in which the data for the male swimmers is different from the data for the female swimmers.

.....

.....

(1 mark)

7 (b) (iv) Considering only the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

.....

.....

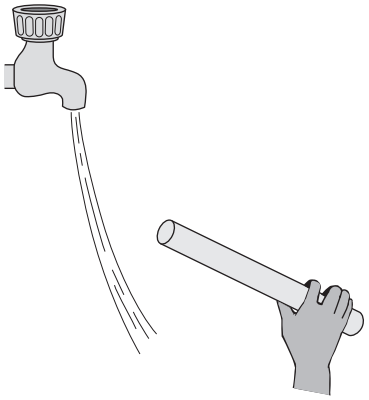
(1 mark)

10

Turn over for the next question

Do not write outside the box

8 (a) The diagram shows a negatively charged plastic rod held close 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. ☐

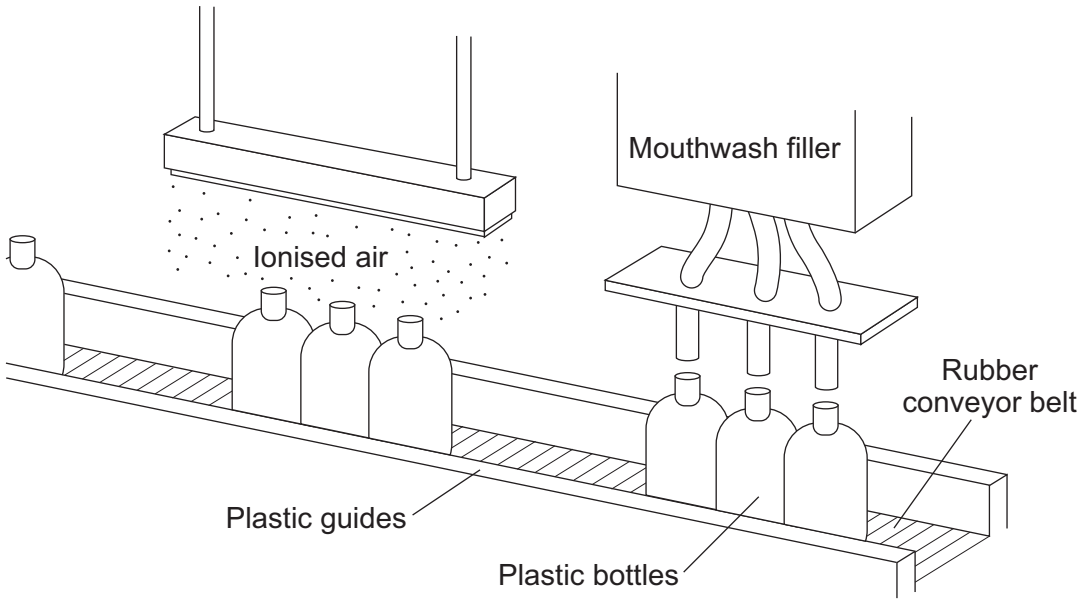
The negative charge in the water is attracted by the rod and the positive charge is repelled. ☐

(1 mark)

Do not write outside the box

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

As the bottles go towards the filler, they move around on the conveyer 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 a solution to the problem. Before the bottles reach the filler, they pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

8 (b) (i) Explain why the plastic bottles become charged.

.....

.....

.....

.....

(2 marks)

Question 8 continues on the next page

Turn over ▶

Do not write outside the box

8 (b) (ii) What is an ion?

.....

.....

(1 mark)

8 (b) (iii) Earthing the conveyor belt with a conducting wire would not have solved this problem.

Give a reason why.

.....

.....

(1 mark)

5

END OF QUESTIONS

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Version1.0: 24/02/2011

General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2011 Examination – January Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY2F

Question 1

question	answers	extra information	mark
1	**three** lines correct **List A** fusion chain reaction alpha decay **List B** in a star in a nuclear reactor in a smoke precipitator in the nucleus of an atom	allow **1** mark for each correct line if more than 1 line is drawn from a box in **List A**, mark each line incorrect	3
Total			**3**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)(i)	4.5		1
2(a)(ii)	2.25 or their (a)(i) ÷ 2 correctly calculated		1
2(a)(iii)	V_2		1
2(b)(i)	30		1
2(b)(ii)	8	allow **1** mark for correct substitution ie 0.4 × 20 allow **1** mark for answers of 4 or 12	2
2(b)(iii)	**Y**		1
Total			**7**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)(i)	12		1
3(a)(ii)	0.2 m/s^2	allow **1** mark for their (a)(i) ÷ 60 and correctly calculated accept correct unit circled in list accept ms^{-2} do **not** accept mps^2	1 1
3(b)	**B**		1
Total			**4**

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PHY2F

Question 4

question	answers	extra information	mark
4(a)(i)	**D**		1
4(a)(ii)	plastic or rubber	accept a specific type of plastic accept electrical insulator	1
4(b)	460	allow **1** mark for correct substitution ie 2 × 230	2
4(c)	any **two** from: • not all appliances need a 13 A fuse • can choose the most suitable fuse (for the appliance) • (in the event of a fault) 13 A fuse may allow too much current to flow through an appliance **or** fuse may not melt (before appliance is damaged) • may already have the fuse	 idea that 13 A is (much) bigger than required by many appliances do **not** accept some appliances require more than 13 A do **not** accept 13 A fuse will blow accept install correct fuse for the appliance idea of reusing a fuse do **not** accept cheaper unless explained correctly	2
Total			**6**

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PHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	16 000	allow **1** mark for correct substitution ie 3200 × 5	2
5(a)(ii)	16 000 or their (a)(i)		1
5(a)(iii)	less than		1
5(b)	increases decreases	 correct order only	1 1
Total			**6**

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PHY2F

Question 6

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>6(a)</td><td>electron(s)</td><td></td><td>1</td></tr>
<tr><td>6(b)</td><td>3rd box ticked

The model cannot explain the results from a new experiment</td><td></td><td>1</td></tr>
<tr><td>6(c)</td><td>all three correct

<table><tr><th>Particle</th></tr><tr><td>Proton</td></tr><tr><td>Electron</td></tr><tr><td>Neutron</td></tr></table></td><td>allow 1 mark for 1 correct</td><td>2</td></tr>
<tr><td>Total</td><td></td><td></td><td>4</td></tr>
</table>

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PHY2F

Question 7

question	answers	extra information	mark
7(a)(i)	120		1
7(a)(ii)	20	accept 140-their (a)(i) provided answer is not negative	1
7(a)(iii)	as speed increases drag force / water resistance / friction / **D** increases (until) **D** = 140 N or (until) **D** = **T**	 forces balance is insufficient	1 1 1
7(b)(i)	(average) speed (of swimmer)		1
7(b)(ii)	any **two** from: • more data • force may vary (a lot) / change • give more <u>reliable average</u>	 accept results for data do **not** accept more accurate data ignore references to anomalies ignore accurate / precise	2

Question 7 continues on the next page . . .

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PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(b)(iii)	examples of acceptable responses: • most / some females produce smaller forces • most / some males produce larger forces • some females swim as fast as males but use a smaller force • most of the faster swimmers are male • most of the slower swimmers are female • range of the (average) speed of males is smaller than the range of the (average) speed of females • range of the (average) force of the males is greater than the range of the (average) force of the females	do **not** accept <u>all</u> females produce smaller forces do **not** accept <u>all</u> males produce larger forces do **not** accept <u>all</u> males swim faster do **not** accept <u>all</u> females swim slower	1
7(b)(iv)	exert maximum (hand) force (throughout the swim / stroke)	accept (any method to) increase (hand) force practise more is insufficient	1
Total			**10**

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PHY2F

Question 8

question	answers	extra information	mark
8(a)	3rd box The negative charge in the water is repelled by the rod and the positive charge is attracted.		1
8(b)(i)	friction between bottles and conveyor belt / (plastic) guides charge transfers between bottles and conveyor belt / (plastic) guides	accept bottles rub against conveyor belt / (plastic) guides accept specific reference eg electrons move onto / off the bottles reference to positive electrons / protons negates this mark	1 1
8(b)(ii)	an atom that has lost / gained electron(s)	do **not** accept a charged particle	1
8(b)(iii)	charge will not (easily) flow off the conveyor belt	accept the conveyor belt / bottle is an insulator / not a conductor accept conveyor belt is rubber	1
Total			**5**

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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	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2010

Additional Science PHY2F
Unit Physics P2

F

Physics
Unit Physics P2

Friday 28 May 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. 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.

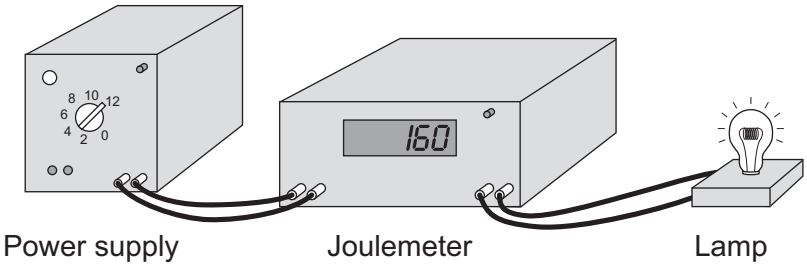
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.
After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

1 (a) In the space below, draw the circuit symbol used to represent a lamp.

(1 mark)

1 (b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

.....

.....

Power = ...

(2 marks)

Do not write outside the box

1 (b) (ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1 mark)

1 (c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed would be ..... the amount of energy transformed in 2 minutes.

(1 mark)

5

Turn over for the next question

Do not write outside the box

2 Complete each of the following sentences, **A**, **B**, **C**, **D** and **E**, by choosing the correct ending from **K**, **L**, **M**, **N** or **O**.

The first one has been done for you.

A The current through a resistor depends ..... **O**

B A direct current ..... ☐

C In a series circuit, the potential difference ..... ☐

D An alternating current ..... ☐

E In a parallel circuit, the potential difference ..... ☐

K ..... across each component is the same.

L ..... is supplied by a cell or battery.

M ..... is constantly changing direction.

N ..... of the power supply is shared by the components.

O ..... on the potential difference across the resistor.

(3 marks)

3

Do not write outside the box

3 (a) The total stopping distance of a car has two parts. One part is the distance the car travels during the driver's reaction time. This distance is often called the 'thinking distance'.

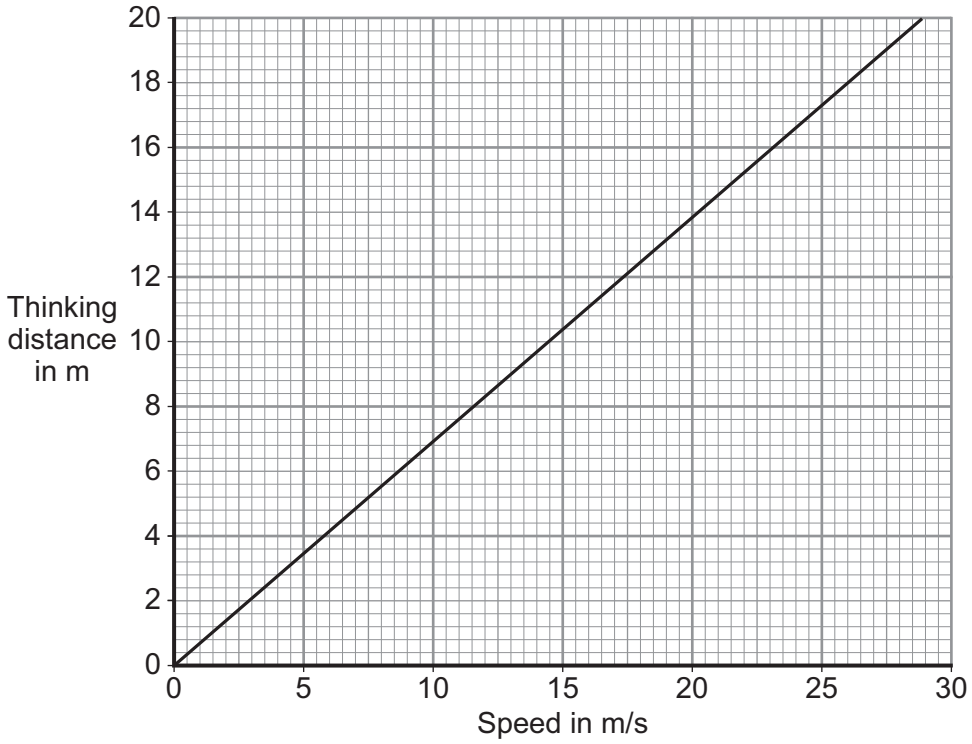
What distance is added to the 'thinking distance' to give the total stopping distance?

.....

.....

(1 mark)

3 (b) The graph shows the relationship between the speed of a car and the thinking distance.



Describe the relationship between speed and thinking distance.

.....

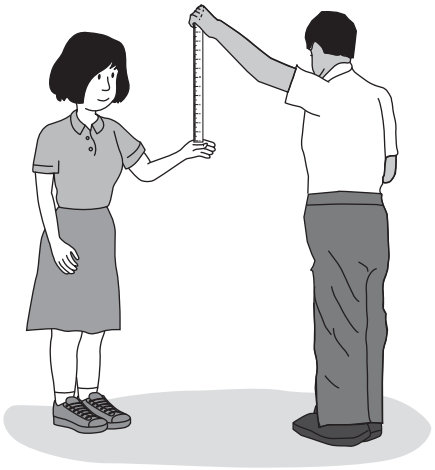
.....

(2 marks)

Question 3 continues on the next page

Do not write outside the box

3 (c) The diagram shows two students investigating reaction time.



One student holds a 30 cm ruler, then lets go. As soon as the second student sees the ruler fall, she closes her hand, stopping the ruler. The further the ruler falls before being stopped, the slower her reaction time.

3 (c) (i) One student always holds the ruler the same distance above the other student's hand. In this experiment, what type of variable is this?

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

independent variable ☐

dependent variable ☐

control variable ☐

(1 mark)

3 (c) (ii) Describe how this experiment could be used to find out whether listening to music affects reaction time.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

3 (d) The following information is written on the label of some cough medicine.

WARNING: Causes drowsiness.
Do not drive or operate machinery.

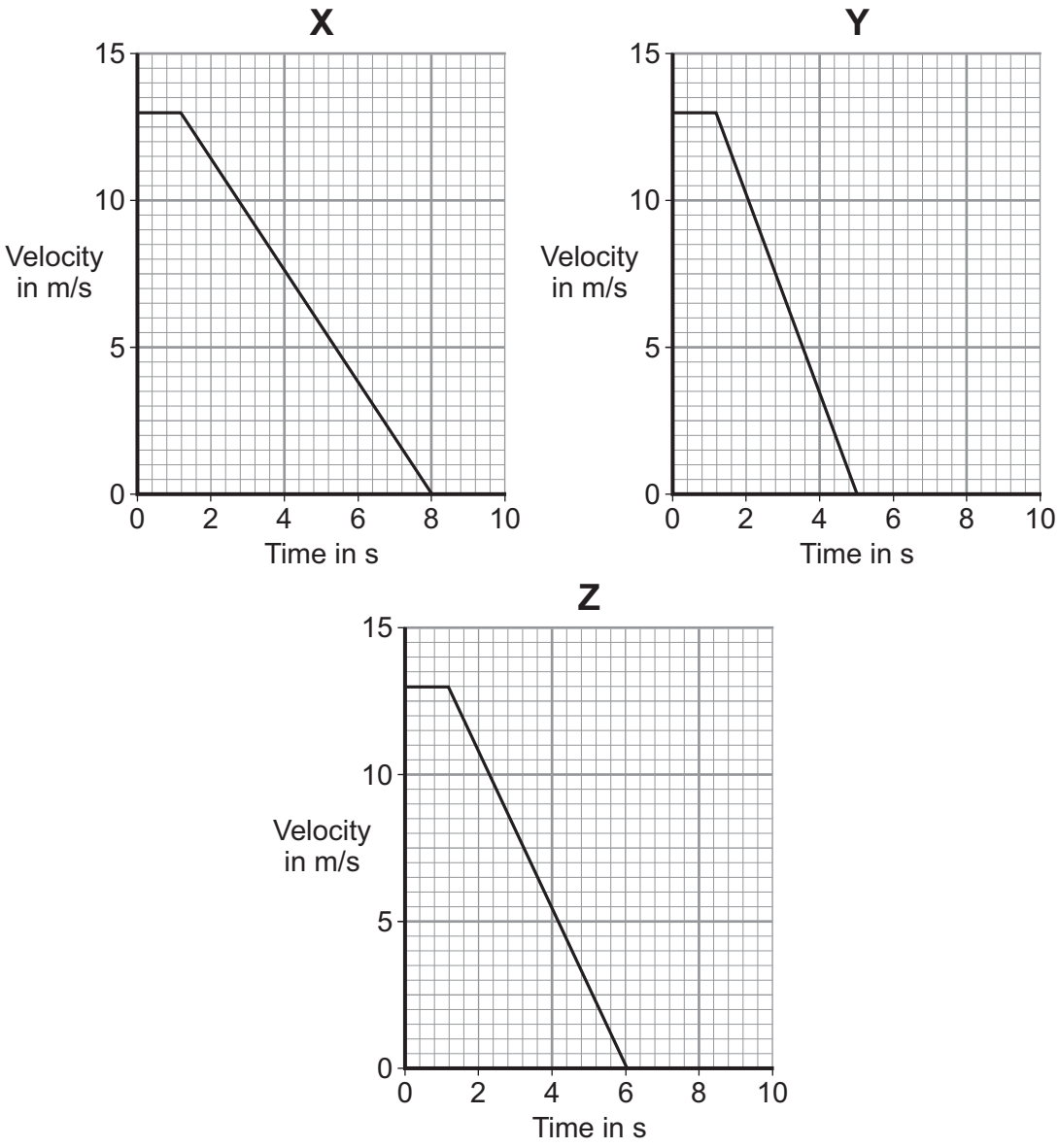
How is feeling drowsy (sleepy) likely to affect a driver's reaction time?

.....

.....

(1 mark)

3 (e) Three cars, **X**, **Y** and **Z**, are being driven along a straight road towards a set of traffic lights. The graphs show how the velocity of each car changes once the driver sees that the traffic light has turned to red.



Which one of the cars, **X**, **Y** or **Z**, stops in the shortest distance?

.....

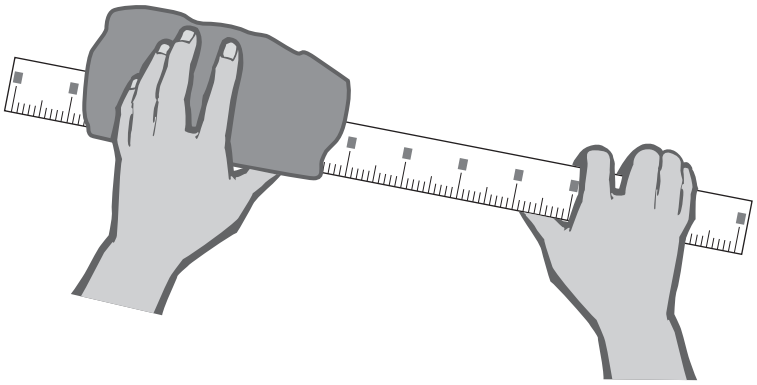
(1 mark)

8

Turn over ▶

Do not write outside the box

4 (a) A plastic ruler is rubbed with a cloth.



Some electrons move from the cloth onto the ruler.

4 (a) (i) What type of charge does the ruler gain?

.....

(1 mark)

4 (a) (ii) What type of charge is left on the cloth?

.....

(1 mark)

4 (b) The following statement is **false**.

Objects carrying the same type of charge attract each other.

Change **one** word in this statement to make it **true**.

Write down your new statement.

.....

.....

(1 mark)

Do not write outside the box

4 (c) Many devices use electrostatic charge to work.
The following sentences describe how a photocopier uses electrostatic charge to produce a photocopy.

Use words from the box to complete the sentences.

attracts	charge	insulating	light	photoconducting	repels

1 A roller coated with ..... material is given a charge.

2 A strong light is used to form an image of the page to be copied onto the roller.

3 Where light hits the roller, the ..... flows to earth.

4 The charge left on the roller ..... particles of black toner powder.

5 The toner powder sticks to a sheet of paper, producing the photocopy.

(3 marks)

4 (d) Give **one** other use for electrostatic charge.

.....

.....

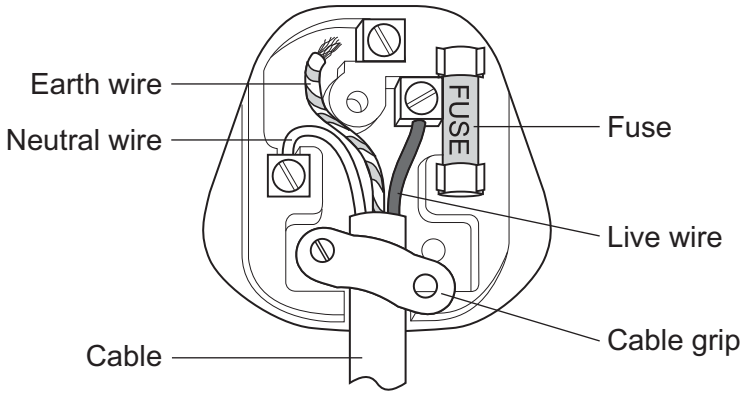
(1 mark)

7

Turn over for the next question

Do not write outside the box

5 (a) The diagram shows the inside of an incorrectly wired three-pin plug.



5 (a) (i) What **two** changes need to be made so that the plug is wired correctly?

1 .....

.....

2 .....

.....

(2 marks)

5 (a) (ii) Which one of the wires inside a plug is there to make an appliance with a metal case safer to use?

.....

(1 mark)

5 (a) (iii) The fuse inside a plug is a safety device.

Explain what happens when too much current passes through a fuse.

.....

.....

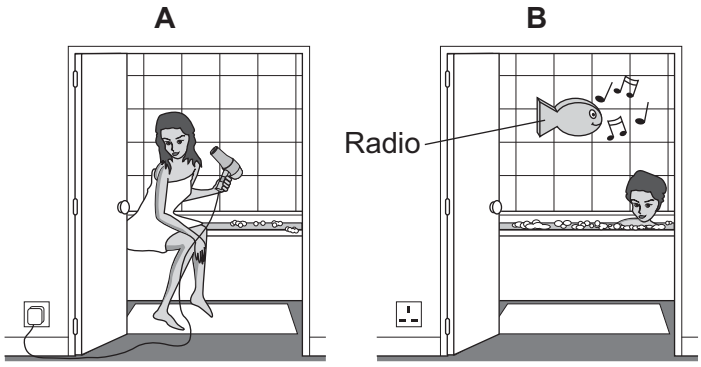
.....

.....

(2 marks)

Do not write outside the box

5 (b) Each of these pictures shows an electrical appliance being used in a bathroom.



Using the hairdryer in picture **A** is dangerous. However, it is safe to use the battery-operated radio in picture **B**.

Explain why.

.....

.....

.....

.....

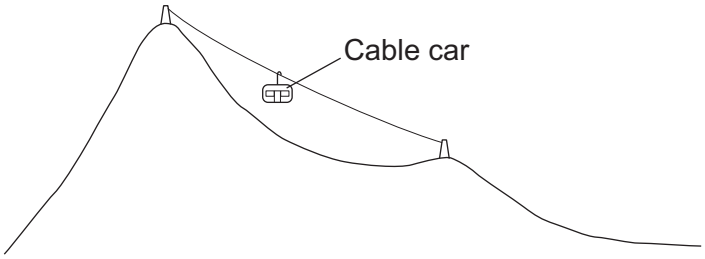
(2 marks)

7

Turn over for the next question

Do not write outside the box

6 (a) The diagram shows a cable car used to take skiers to the top of a mountain.



6 (a) (i) The total mass of the cable car and skiers is 7500 kg.

Use the equation in the box to calculate the weight of the cable car and skiers.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

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

.....

.....

Weight = ...

(3 marks)

Do not write outside the box

6 (a) (ii) The cable car moves at a constant speed. It lifts skiers through a vertical height of 800 metres in 7 minutes.

Use the following equation to calculate the work done to lift the cable car and skiers.

work done = force applied × distance moved in the direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ... J

(2 marks)

6 (b) The diagram shows a skier who is accelerating down a steep ski slope.



6 (b) (i) Draw an arrow on the diagram to show the direction of the resultant force acting on the skier.

(1 mark)

6 (b) (ii) How and why does the kinetic energy of the skier change?

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

Do not write outside the box

6 (c) Last year, 18 000 skiers suffered a head injury. It is thought that nearly 8000 of these injuries could have been avoided if the skier had been wearing a helmet.
However, at present, there are no laws to make skiers wear helmets.

Suggest why skiers should be made aware of the benefits of wearing a helmet.

.....

.....

(1 mark)

9

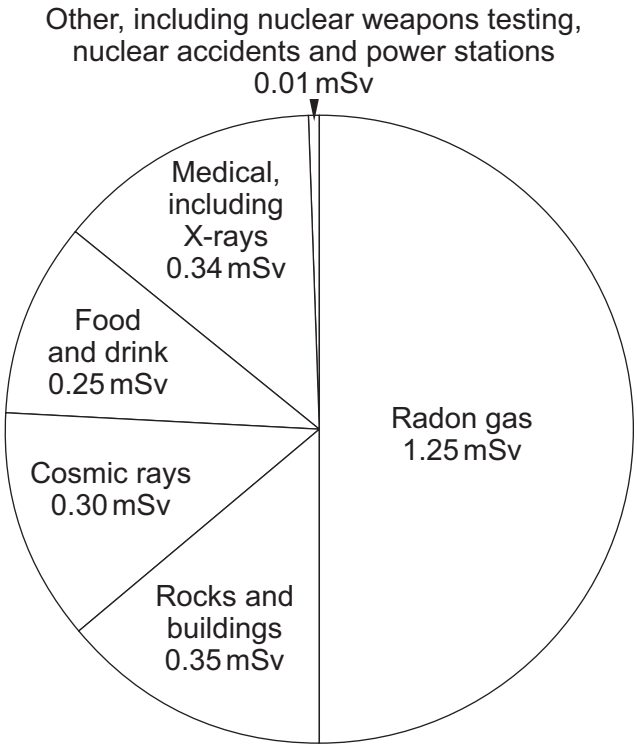
Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

7 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).



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

.....

.....

Total radiation dose = ... mSv
(1 mark)

Do not write outside the box

7 (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)

Question 7 continues on the next page

Do not write outside the box

7 (b) The concentration of radon gas inside a home can vary from day to day. In some homes, the level can build up to produce a significant health risk. It is estimated that each year 1000 to 2000 people die because of the effects of radiation from radon gas.

7 (b) (i) It is not possible to give an exact figure for the number of deaths caused by the effects of radiation from radon gas. Why?

.....

.....

(1 mark)

The table gives data for the radiation levels measured in homes in 4 different parts of the UK. The radiation levels were 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 level in Bq/m^3	Maximum radiation level 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

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

.....

.....

(1 mark)

7 (b) (iii) 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**.

.....

.....

.....

(2 marks)

6

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Version : 29/07/2010

General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F Unit Physics 2

Final Mark Scheme

2010 Examination – June Series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct

substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

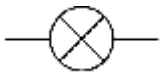
(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use the **?** area in the CMI+ software to forward such answers to a Senior Examiner.

PHY2F

Question 1

question	answers	extra information	mark
1(a)		accept 'the humpback bridge' symbol accept circle with cross but no lines if more than one symbol drawn, no mark unless lamp is labelled	1
1(b)(i)	24	allow **1** mark for correct substitution ie $\frac{2880}{120}$ allow **1** mark for an answer 1440 ignore any unit	2
1(b)(ii)	watt		1
1(c)	larger than	accept correct indication inside the box accept an answer meaning larger than ie greater than	1
Total			**5**

PHY2F

Question 2

question	answers	extra information	mark
2	**L** **N** **M** **K**	all four in the correct order **2** marks for 2 correct **1** mark for 1 correct	3
Total			**3**

PHY2F

Question 3

question	answers	extra information	mark
3(a)	distance travelled under the braking force	accept braking (distance)	1
3(b)	(directly) proportional **or** increase in the same ratio	accept a correct description using figures eg if speed doubles then thinking <u>distance</u> doubles accept for **1** mark positive correlation accept for **1** mark as speed increases so does thinking <u>distance</u> accept as one increases the other increases accept as thinking <u>distance</u> increases speed increases	2
3(c)(i)	control variable		1
3(c)(ii)	experiment done, student listens to music / ipod (etc) experiment (repeated), student not listening to music	 for both marks to be awarded there must be a comparison	1 1
3(d)	increase it	accept an answer which implies reactions are slower do **not** accept answers in terms of thinking distance only	1
3(e)	**Y**		1
Total			**8**

PHY2F

Question 4

question	answers	extra information	mark
4(a)(i)	negative	accept minus **or** – (ve) do **not** accept electron/s	1
4(a)(ii)	positive	accept plus **or** + (ve) allow this mark if (a)(i) and (a)(ii) are given the wrong way around	1
4(b)	Objects carrying the same type of charge **repel**. **or** Objects carrying the **opposite** type of charge attract.	do **not** accept unattract for repel accept **different** for opposite allow credit if candidates change more than one word but final statement is equivalent to one of these two.	1
4(c)	1 photoconducting 3 charge 4 attracts		1 1 1
4(d)	accept anything feasible eg paint spraying / crop spraying / (electrostatic) precipitator / making sandpaper / a printer	accept a reasonable description of a process do **not** accept scanner on its own do **not** accept paint car / paint bicycle on its own must be use, **not** demonstration of charge ie rubbing a balloon and sticking to a wall is incorrect	1
Total			**7**

PHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	connect the earth wire (to pin) screw cable grip (across cable)	answers must be in terms of correcting the faults accept tighten the cable grip	1 1
5(a)(ii)	earth (wire)	accept the green and yellow (wire)	1
5(a)(iii)	any **two** from: • fuse gets (very) hot • fuse melts • circuit breaks/ switches off	 accept blows for melts do **not** accept break / snap fuse / blow up accept stops current flowing	2
5(b)	any **two** from: • hairdryer is plugged into mains (electricity socket) **or** hairdryer is using 230 V • water conducts electricity • radio is low power / current / pd / voltage • (the current in / p.d. across) hairdryer more likely to give a (fatal) electric shock	it refers to hairdryer hairdryer works from the mains accept 240 for 230 do **not** accept water and electricity don't mix accept radio not connected to the mains do **not** accept radio is waterproof accept the idea of electrocution if hairdryer is wet accept the idea of radio not causing electrocution if wet	2
Total			**7**

PHY2F

Question 6

question	answers	extra information	mark
6(a)(i)	75 000 newtons / N	accept correct substitution for **1** mark ie 7500 × 10 do **not** accept n full credit for using g = 9.8 **or** 9.81	2 1
6(a)(ii)	60 000 000	accept for both marks their (a)(i) × 800 correctly calculated accept correct substitution for **1** mark ie their (a)(i) × 800	2
6(b)(i)	arrow drawn parallel (to) **and** down (the) slope	accept arrow drawn anywhere on the diagram	1
6(b)(ii)	increases GPE transformed to KE **or** speed increasing	 accept is accelerating however 'speed increasing' only scores if correctly linked to increasing kinetic energy	1 1
6(c)	so more likely to wear one **or** they know wearing a helmet is likely to / will reduce (risk) head injury **or** so can make an (informed) choice (about wearing one)		1
Total			**9**

PHY2F

Question 7

question	answers	extra information	mark
7(a)(i)	2.5		1
7(a)(ii)	The radiation dose from natural sources is much greater than from artificial sources.		1
7(b)(i)	other factors may be involved	accept a specific suggestion eg they may be exposed to other types of radiation accept cannot be sure (in many cases) that the cause of death is radon (poisoning)	1
7(b)(ii)	any **one** from: • different concentrations in different rooms • to average out daily fluctuations	 accept to find an average accept to make the result (more) reliable / valid do **not** accept to make more accurate on its own	1
7(b)(iii)	average level (much) higher (in **C** and **D**) some homes have very high level (in **C** and **D**) **or** maximum level in some homes (in **C** and **D**) is very high	accept converse accept maximum level in **A** and **B** is low accept higher radiation levels (in **C** and **D**) for **1** mark	1 1
Total			**6**

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	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
January 2010

Additional Science PHY2F
Unit Physics P2

F

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.

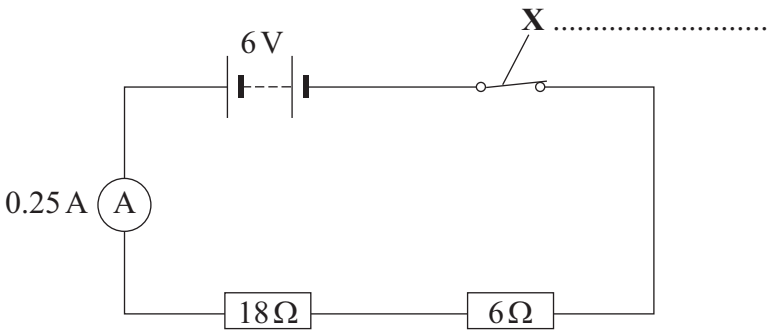
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

Areas outside the box will not be scanned for marking

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

1 A circuit diagram is shown below.



1 (a) Use a word from the box to label component **X**.

fuse	**switch**	**thermistor**

(1 mark)

1 (b) Calculate the total resistance of the two resistors in the circuit.

.....

Total resistance = ... Ω

(1 mark)

1 (c) The reading on the ammeter is 0.25 A.

The current through the 6 Ω resistor will be:

bigger than 0.25 A **equal to 0.25 A** **smaller than 0.25 A**

Draw a ring around your answer.

(1 mark)

1 (d) The 6 V battery is made by correctly joining several 1.5 V cells in series.

Calculate the number of cells needed to make the battery.

.....

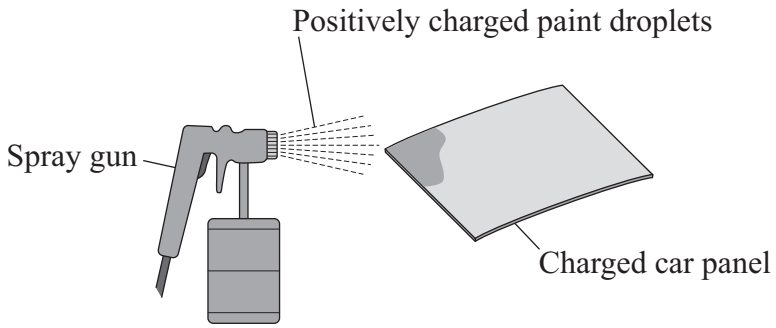
Number of cells = ...

(1 mark)

4

Areas outside the box will not be scanned for marking

2 (a) The diagram shows how static electricity is used to paint a metal car panel.



Use words from the box to complete the following sentences.

attract	**opposite**	**repel**	**same**

All the paint droplets have the same type of charge. This makes the paint droplets ..... each other and spread out.

The car panel and the paint droplets have the ..... type of charge. This causes the car panel to ..... the paint droplets.

The car panel is covered by an even layer of paint.

(3 marks)

2 (b) In which **one** of the following situations is static electricity dangerous and not useful?

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

using a photocopier ☐

refuelling an aircraft ☐

a smoke precipitator ☐

Give a reason for your answer.

.....

.....

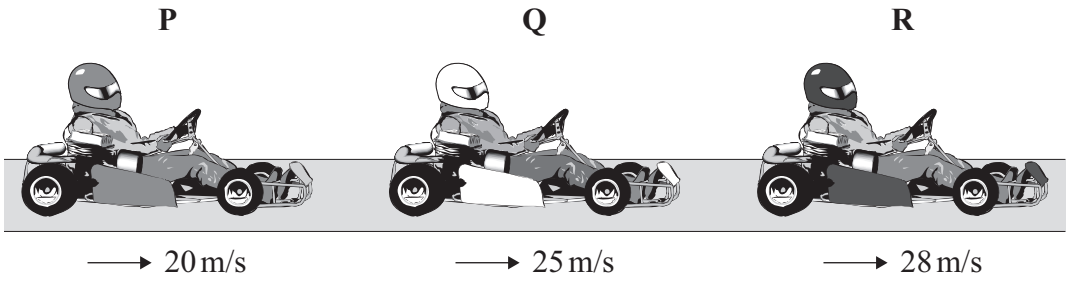
(2 marks)

5

Turn over ▶

Areas outside the box will not be scanned for marking

3 (a) The diagram shows three identical go-karts, **P**, **Q** and **R**, travelling at different speeds along the straight part of an outdoor racetrack.



Which **go-kart**, **P**, **Q** or **R**, has the greatest momentum?

.....

Give the reason for your answer.

.....

.....

(2 marks)

3 (b) The total mass of go-kart **Q** and the driver is 130 kg.

3 (b) (i) Use the equation in the box to calculate the total momentum of go-kart **Q** and the driver.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ...

(2 marks)

3 (b) (ii) Which of the following is the unit of momentum?

Draw a ring around your answer.

J/s **kg m/s** **Nm**

(1 mark)

Areas outside the box will not be scanned for marking

3 (c) To race safely at high speed, a go-kart driver must have fast reaction times and the outdoor racetrack should be dry.

3 (c) (i) How would being tired affect a driver's reaction time?

.....

(1 mark)

3 (c) (ii) How would a wet track affect the braking distance of a go-kart?

.....

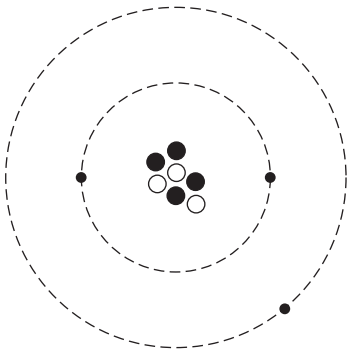
(1 mark)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

4 The diagram represents an atom of lithium.



4 (a) (i) Complete the following table of information for an atom of lithium.

Number of protons	
Number of electrons	
Number of neutrons	

(2 marks)

4 (a) (ii) What is the mass number of a lithium atom?

Draw a ring around your answer.

3	**4**	**7**	**10**

Give a reason for your answer.

.....

.....

(2 marks)

4 (b) Complete the following sentence by drawing a ring around the correct line in the box.

An atom that has lost an electron is called

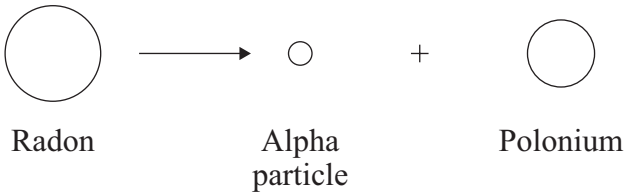
an ion
an isotope
a positive atom

.

(1 mark)

Areas outside the box will not be scanned for marking

4 (c) When an alpha particle is emitted from the nucleus of a radon atom, the radon changes into polonium.



Not to scale

An alpha particle consists of 2 protons and 2 neutrons.

4 (c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

The mass of a polonium atom is

greater than
the same as
smaller than

the mass of a radon atom.

(1 mark)

4 (c) (ii) Give a reason for your answer to part (c)(i).

.....

.....

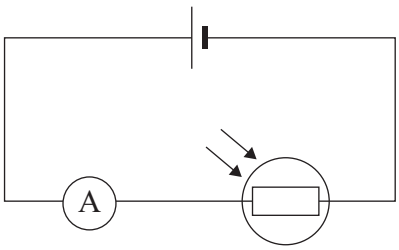
(1 mark)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

5 The diagram shows a simple circuit.



5 (a) The circuit includes an LDR.

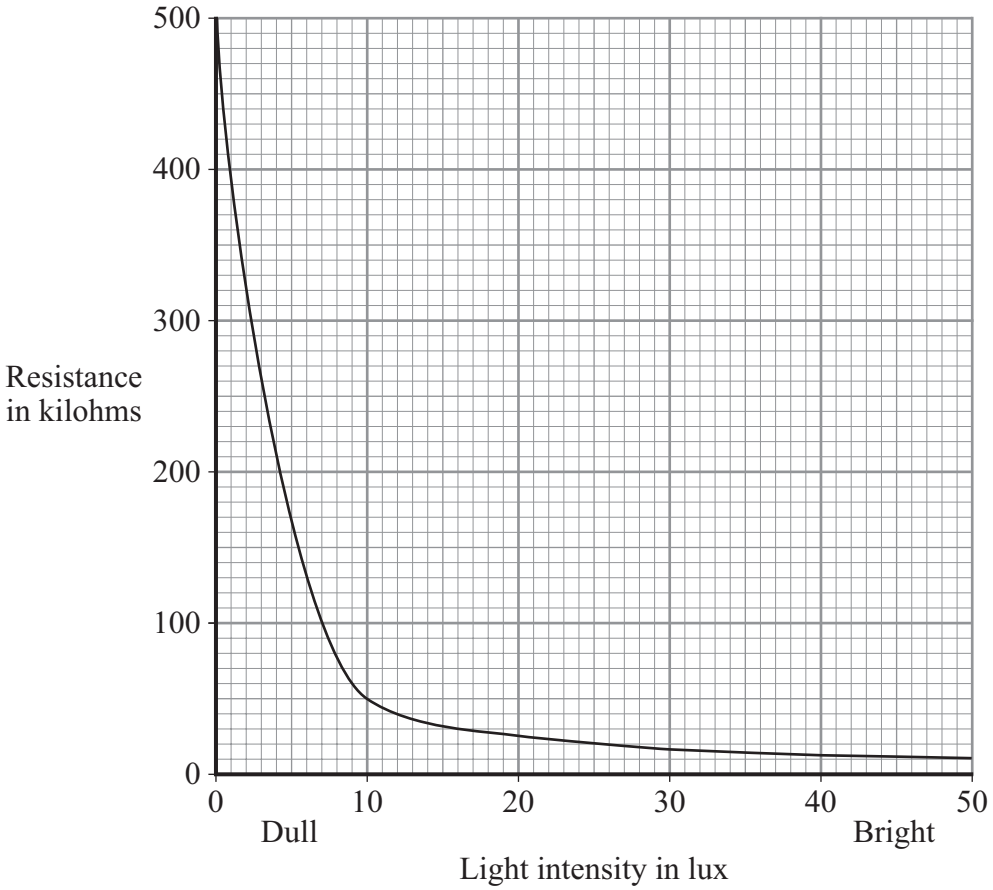
What do the letters LDR stand for?

Draw a ring around your answer.

Light-dependable resistor **light-dependent resistor** **light-direct resistor**

(1 mark)

5 (b) The graph shows how the resistance of an LDR changes with light intensity.



Areas outside the box will not be scanned for marking

Describe in detail how the resistance of the LDR changes as the light intensity increases from 0 to 50 lux.

.....

.....

.....

.....

.....

.....

(3 marks)

5 (c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

A decrease in the light intensity of light on the LDR will | decrease / not change / increase | the reading on the ammeter.

(1 mark)

5 (c) (ii) Give a reason for your answer to part (c)(i).

.....

.....

(1 mark)

5 (d) An LDR can be used to switch a circuit on and off automatically.

In which **one** of the following would an LDR be used?

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

a circuit to switch on central heating when it gets cold ☐

a circuit to switch on security lighting when it gets dark ☐

a circuit to switch on a water sprinkler when the soil in a greenhouse is dry ☐

(1 mark)

7

Areas outside the box will not be scanned for marking

6 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.

6 (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.

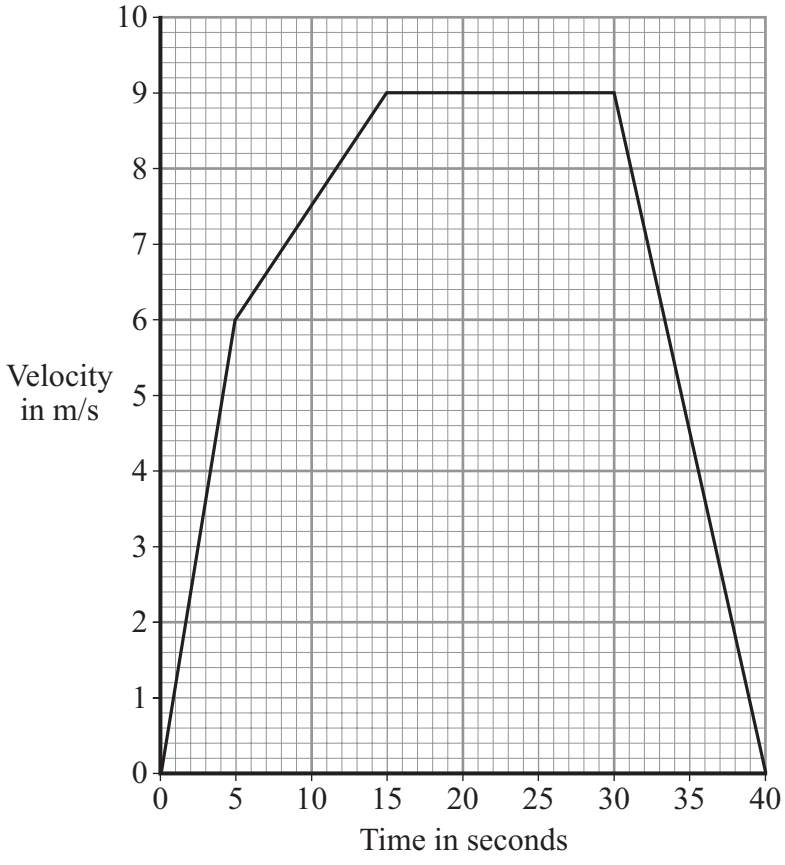
.....

.....

Resultant force = ...

(3 marks)

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



Areas outside the box will not be scanned for marking

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

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

(1 mark)

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

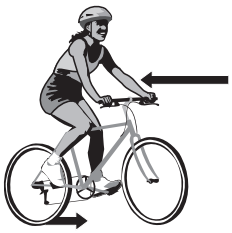
.....

.....

(1 mark)

6 (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.

A



B



C



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.

.....

.....

.....

.....

.....

.....

(3 marks)

8

Turn over ▶

Areas outside the box will not be scanned for marking

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

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

.....

.....

.....

.....

(2 marks)

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

.....

(1 mark)

7 (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.

7 (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)

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

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (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.

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

.....

.....

(1 mark)

7 (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.

.....

.....

.....

(1 mark)

7

END OF QUESTIONS

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There are no questions printed on this page

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Version : 24/02/2010

General Certificate of Secondary Education

Additional Science 4463/ Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2010 examination - January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY2F

Question 1

question	answers	extra information	mark
1(a)	switch	allow answer circled in box	1
1(b)	24		1
1(c)	equal to 0.25 A		1
1(d)	4		1
Total			**4**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)	repel	correct order only	1
	opposite		1
	attract		1
2(b)	refuelling an aircraft	reason cannot score if refuelling aircraft is not chosen	1
	a spark may cause an explosion / fire / ignite the fuel	accept the static for a spark accept named fuel there must be a consequence of having a spark do **not** accept answers in terms of people getting a shock or electrocuted	1
Total			**5**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)	**R** has the greatest speed / velocity	reason cannot score if **R** is not chosen accept it is going at 28 m/s answer should be comparative	1 1
3(b)(i)	3250	allow **1** mark for correct substitution of 130 and 25 ie 130 × 25 accept 2600 or 3640 for **1** mark	2
3(b)(ii)	kg m/s	accept answer given in (b)(i) if no answer given here	1
3(c)(i)	increase it	accept make it slower accept slow it down accept make it longer accept (reactions) would be slower do **not** accept if the answer clearly refers to distance comparative answers expected	1
3(c)(ii)	increase it	accept make it longer do **not** accept if the answer clearly refers to time comparative answers expected	1
Total			**7**

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PHY2F

Question 4

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>4(a)(i)</td><td>all correct
<table><tr><td>Number of protons</td><td>3</td></tr><tr><td>Number of electrons</td><td>3</td></tr><tr><td>Number of neutrons</td><td>4</td></tr></table></td><td>accept presented as a tally chart

allow 1 mark for 1 correct</td><td>2</td></tr>
<tr><td>4(a)(ii)</td><td>7

number of protons and neutrons</td><td>reason may score even if 7 not chosen

accept number of particles in the nucleus
accept number of nucleons

do not accept number of electrons and neutrons</td><td>1

1</td></tr>
<tr><td>4(b)</td><td>an ion</td><td></td><td>1</td></tr>
<tr><td>4(c)(i)</td><td>smaller than</td><td></td><td>1</td></tr>
<tr><td>4(c)(ii)</td><td>radon loses an alpha (particle)
or
radon loses an (alpha) particle
or
(mass of) polonium plus an alpha = (mass) radon
or
radon loses 2 protons and 2 neutrons (to become polonium)</td><td>accept radon has less protons and neutrons</td><td>1</td></tr>
<tr><td>Total</td><td></td><td></td><td>7</td></tr>
</table>

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PHY2F

Question 5

question	answers	extra information	mark
5(a)	a light-dependent resistor		1
5(b)	any **three** from: • resistance starts at 500 (kilohms) • (resistance) falls rapidly as intensity increases from 0 • (resistance) halves between 10 and 20 lux • (resistance) falls slightly between 20 and 50 lux **or** • (resistance) almost constant / levels out between 20 and 50 lux • at 50 lux, resistance = 10 (kilohms)	for full credit the word resistance must be used correctly at least once accept resistance falls accept brightness for intensity an answer resistance falls as intensity increases gains **2** marks - this may be combined with one of the bullet point marks for full credit	3
5(c)(i)	decrease		1
5(c)(ii)	resistance increases	this can score without (c)(i)	1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(d)	A circuit to switch on security lighting when it gets dark.		1
Total			**7**

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PHY2F

Question 6

question	answers	extra information	mark
6(a)	96	allow **1** mark for correct substitution ie 80 × 1.2	2
	newton or N	allow Newton do **not** allow n	1
6(b)(i)	direction		1
6(b)(ii)	velocity <u>and</u> time are continuous (variables)	answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric	1
6(b)(iii)	**C**		1
	velocity is not changing	the **2** marks for reason may be scored even if **A** or **B** are chosen accept speed for velocity accept speed is constant (9 m/s) accept **not** decelerating accept **not** accelerating accept reached terminal velocity	1
	forces must be balanced **or** resultant force is zero	accept forces are equal accept arrows are the same length / size do **not** accept the arrows are equal	1
Total			**8**

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PHY2F

Question 7

question	answers	extra information	mark
7(a)(i)	(two) nuclei (of light elements) join forming a larger / heavier nucleus / one	accept hydrogen atoms for nuclei accept comparative term equivalent to larger accept forms a helium (nucleus / atom) this mark only scores if fusion is in terms of hydrogen atoms	1 1
7(a)(ii)	stars	accept a named star e.g. the Sun accept nebula mention of planets negates answer	1
7(b)(i)	any **one** from: • (currently) only experimental • reaction does not last long enough • use more energy than they produce	 allow difficult to control do **not** allow inefficient on its own	1
7(b)(ii)	any **one** from: • will give another source of energy • unlimited fuel supplies / energy • would not produce any radioactive waste • want to show that it can be done	do **not** accept answers only in terms of fossil fuels or carbon dioxide accept unlimited hydrogen accept less radioactive waste accept nuclear for radioactive do **not** accept toxic waste accept any sensible suggestion	1

Question 7 continues on the next page . . .

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PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(c)(i)	any **one** from: • repeating did not produce the same results / data • experiments were not / may not be reproducible • data / experiments were not valid	accept could not be repeated accept has not been repeated do **not** accept answers in terms of scientists being biased	1
7(c)(ii)	any **one** from: • cannot trust journalists • newspaper journalist may not have a science background • newspaper may publish what people want to read • newspaper may simplify ideas • people believe / trust the scientists writing the journal • people have heard of the scientists writing in the journal • scientists writing in the journal are famous • journal only publishes the work of respected / famous scientists • data is checked by other scientists before published in the journal	bias is insufficient on its own accept any sensible suggestion, these are examples they do not constitute a full list	1
Total			**7**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
June 2009

ADDITIONAL SCIENCE
Unit Physics P2

PHY2F

F

PHYSICS
Unit Physics P2

Foundation Tier

Wednesday 10 June 2009 1.30 pm to 2.15 pm

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		7	
2		8	
3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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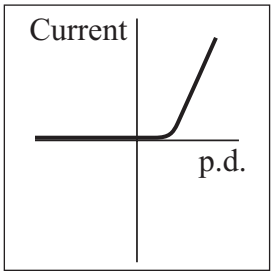
Answer **all** questions in the spaces provided.

1 (a) The graphs, **A**, **B** and **C**, show how the current through a component varies with the potential difference (p.d.) across the component.

Draw a line to link each graph to the correct component.
Draw only **three** lines.

Component

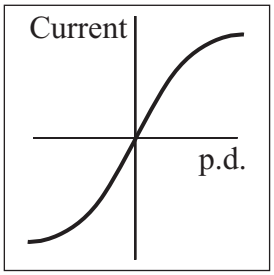
A



A resistor at constant temperature



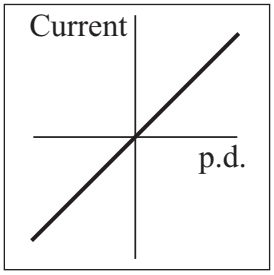
B



A filament lamp



C



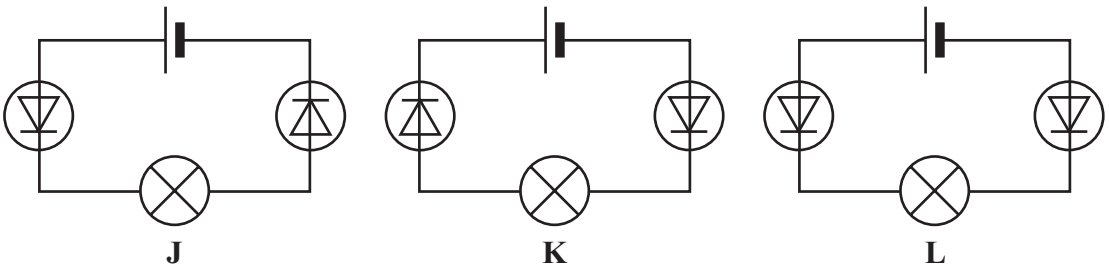
A diode



(2 marks)

Areas outside the box will not be scanned for marking

1 (b) Each of the circuits, **J**, **K** and **L**, include two diodes.



J **K** **L**

In which **one** of the circuits, **J**, **K** or **L**, would the filament lamp be on?

.....

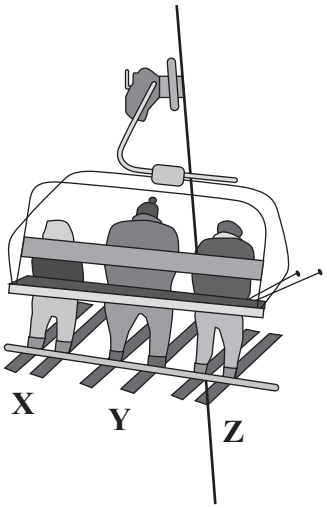
(1 mark)

3

Turn over for the next question

Areas outside the box will not be scanned for marking

2 (a) The diagram shows three skiers, **X**, **Y** and **Z**, on a moving chairlift.
The mass of each skier is given in the table.



Skier	Mass in kg
X	65
Y	90
Z	80

Which **one** of the skiers, **X**, **Y** or **Z**, has the most momentum?

.....

Give the reason for your answer.

.....

.....

(2 marks)

2 (b) At one point in the journey, the chairlift accelerates to a higher speed.

What happens to the momentum of the three skiers as the chairlift accelerates?

.....

(1 mark)

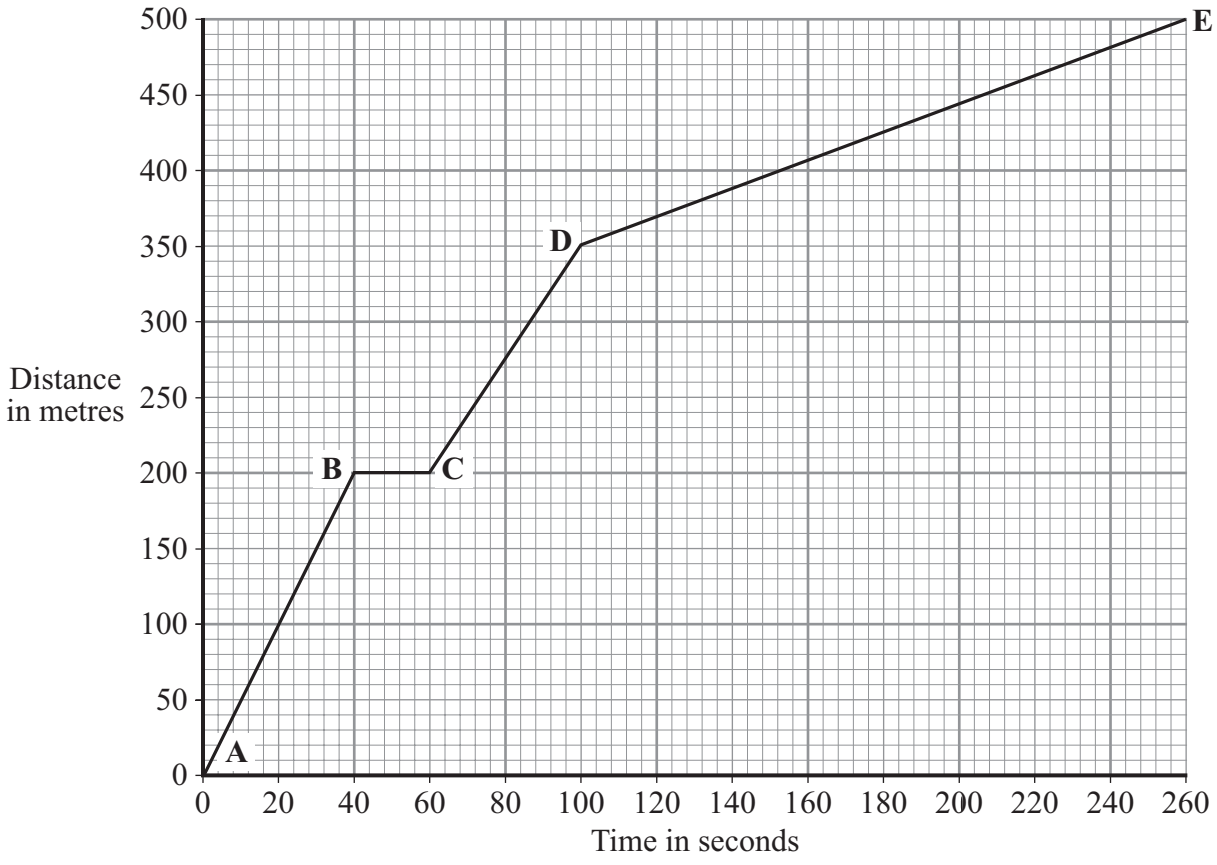
3

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

3 Part of a bus route is along a high street.
The distance–time graph shows how far the bus travelled along the high street and how long it took.



3 (a) The bus travels the **slowest** between points **D** and **E**.

How can you tell this from the graph?

.....

.....

(1 mark)

3 (b) Between which two points was the bus travelling the **fastest**?

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

Points	
A–B	
B–C	
C–D	

(1 mark)

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3 (c) There is a bus stop in the high street.
This is marked as point **B** on the graph.

3 (c) (i) What is the distance between point **A** on the graph and the bus stop?

Distance ..... metres
(1 mark)

3 (c) (ii) How long did the bus stop at the bus stop?
Show clearly how you work out your answer.

.....

Time = ... seconds
(2 marks)

3 (d) A cyclist made the same journey along the high street.
The cyclist started at the same time as the bus and completed the journey in 200 seconds. The cyclist travelled the whole distance at a constant speed.

3 (d) (i) Draw a line on the graph to show the cyclist's journey. *(2 marks)*

3 (d) (ii) After how many seconds did the cyclist overtake the bus?

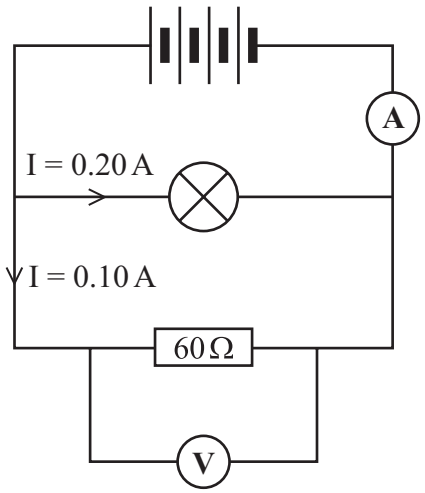
The cyclist overtook the bus after ..... seconds.
(1 mark)

8

Turn over for the next question

Areas outside the box will not be scanned for marking

4 A circuit was set up as shown in the diagram.



4 (a) Each cell provides a potential difference of 1.5 volts.

4 (a) (i) What is the total potential difference provided by the four cells in the circuit?

.....

Total potential difference = ... volts

(1 mark)

4 (a) (ii) What will be the reading on the voltmeter?

.....

(1 mark)

4 (b) The current through the lamp is 0.20 amps.
The current through the resistor is 0.10 amps.

What is the reading on the ammeter?

.....

Reading on ammeter = ... amps

(1 mark)

Areas outside the box will not be scanned for marking

4 (c) Use a phrase from the box to complete the following sentence.

greater than	**equal to**	**smaller than**

The resistance of the lamp is ..... 60 Ω.

Give a reason for your answer.

.....

.....

(2 marks)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

5 The diagram shows an adult and a child pushing a loaded shopping trolley.



5 (a) (i) What is the *total force* on the trolley due to the adult and child?

.....

(1 mark)

5 (a) (ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force	**mean force**	**resultant force**

(1 mark)

5 (a) (iii) The trolley is pushed at a constant speed for 80 metres.

Use the equation in the box to calculate the work done to push the trolley 80 metres.

work done = force applied × distance moved in direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ...

(2 marks)

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5 (b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

5 (b) (i) The unit of work done is the

joule
newton
watt

.

(1 mark)

5 (b) (ii) Most of the work done to push the trolley is transformed into

heat
light
sound

.

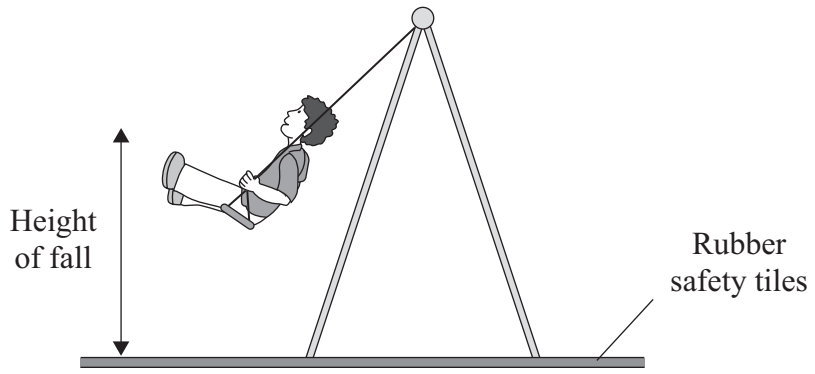
(1 mark)

6

Turn over for the next question

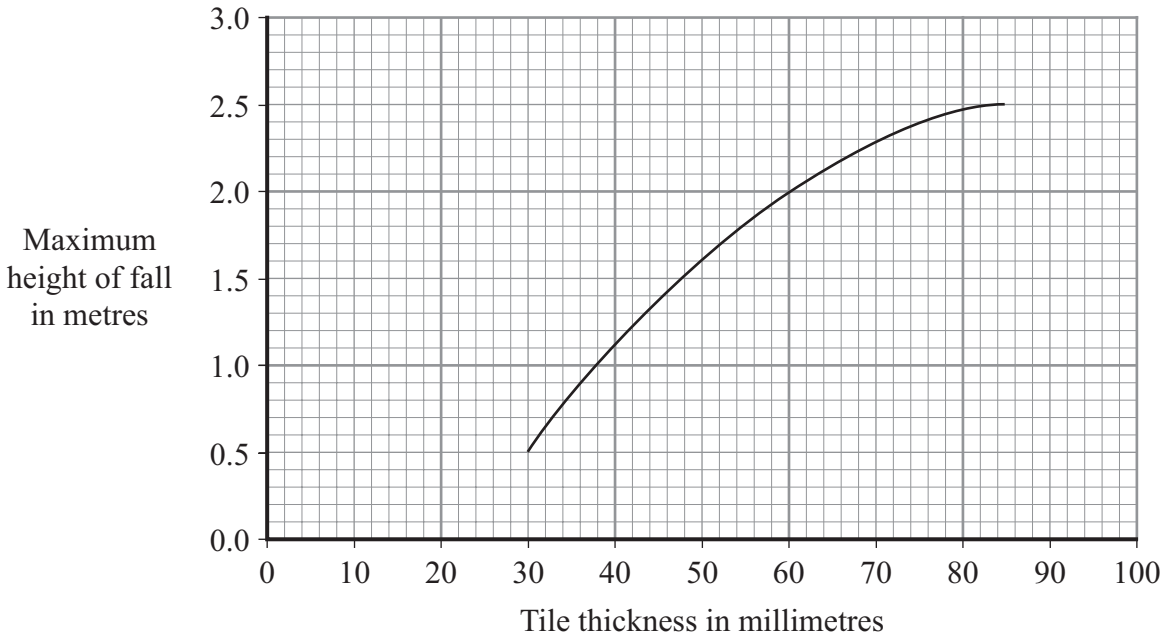
Areas outside the box will not be scanned for marking

6 The diagram shows a child on a playground swing.



6 (a) The playground surface is covered in rubber safety tiles. The tiles reduce the risk of serious injury to children who fall off the swing.

The graph gives the maximum height that a child can fall onto rubber safety tiles of different thicknesses and be unlikely to get a serious head injury.



6 (a) (i) Describe how the maximum height of fall relates to the thickness of the rubber safety tile.

.....

.....

(1 mark)

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6 (a) (ii) The maximum height of any of the playground rides is 2 metres.

What tile thickness should be used in the playground?

.....

Give a reason for your answer.

.....

.....

(2 marks)

6 (b) Use phrases from the box to complete the following sentences.

the force on	**the work done to stop**	**the time taken to stop**

6 (b) (i) Falling onto a rubber surface compared to a hard surface increases

..... the child.

(1 mark)

6 (b) (ii) Momentum is lost more slowly falling onto a rubber surface than on a hard surface.

This reduces ..... the child.

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

7 The table gives information about the three types of particle that make up an atom.

Particle	Relative mass	Relative charge
Proton		+1
Neutron	1	
Electron	very small	–1

7 (a) Complete the table by adding the **two** missing values. *(2 marks)*

7 (b) Use the information in the table to explain why an atom has no overall electrical charge.

.....

.....

.....

.....

(2 marks)

7 (c) Uranium has two natural isotopes, uranium-235 and uranium-238.
Uranium-235 is used as a fuel inside a nuclear reactor.
Inside the reactor, atoms of uranium-235 are split and energy is released.

7 (c) (i) How is the structure of an atom of uranium-235 different from the structure of an atom of uranium-238?

.....

.....

(1 mark)

7 (c) (ii) The nucleus of a uranium-235 atom must absorb a particle before the atom is able to split.

What type of particle is absorbed?

.....

(1 mark)

7 (c) (iii) The nucleus of an atom splits into smaller parts in a reactor.

What name is given to this process?

.....

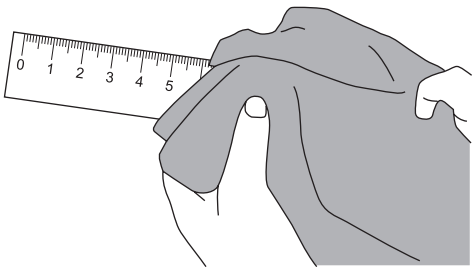
(1 mark)

7

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8 (a) A plastic ruler is rubbed with a cloth.



The ruler becomes negatively charged.

8 (a) (i) Complete the following sentence by drawing a ring around the correct line in the box.

The ruler becomes negatively charged because it has

gained electrons
lost neutrons
lost protons

.

(1 mark)

8 (a) (ii) How could you show that the ruler is charged?

.....

.....

(1 mark)

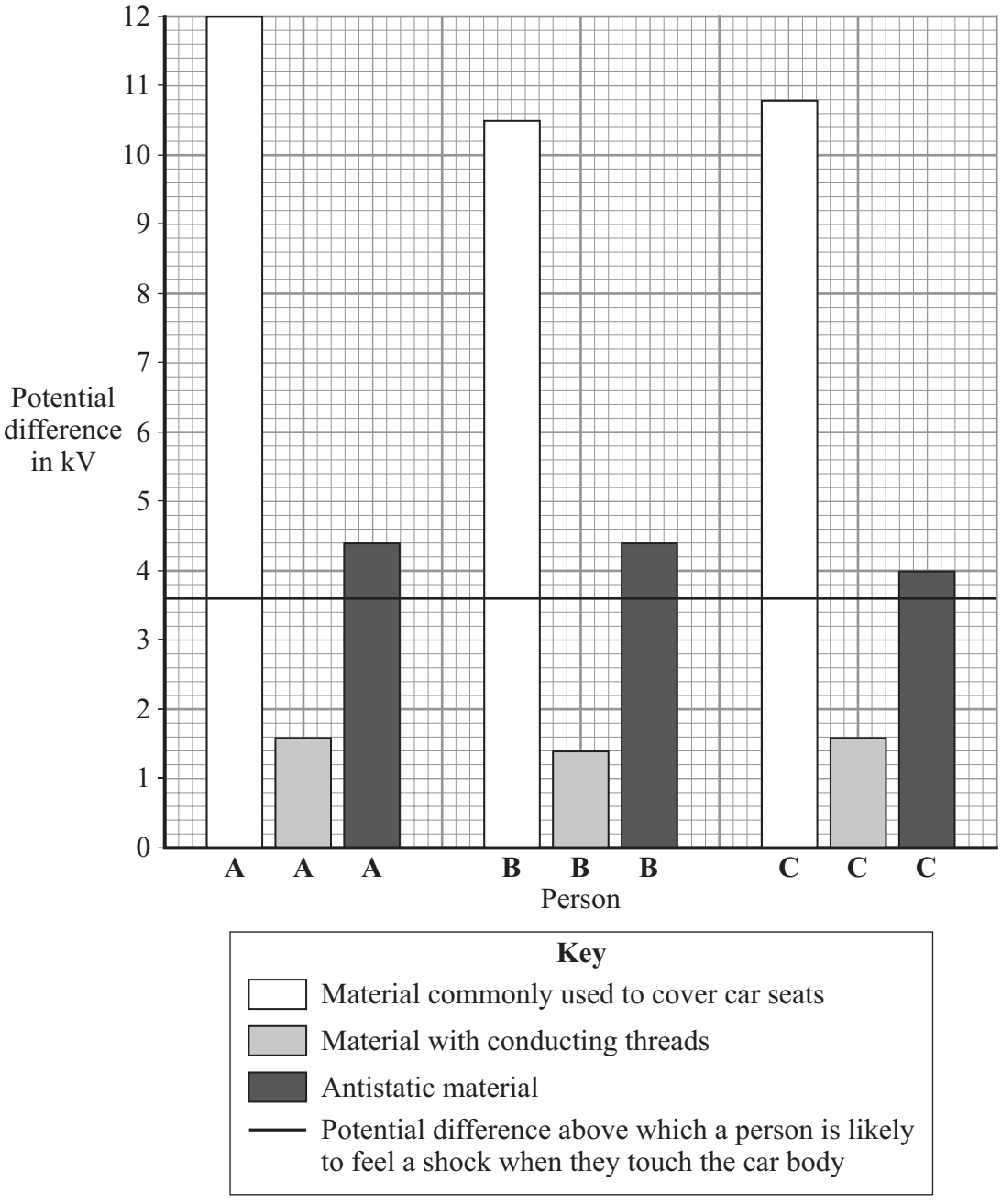
Question 8 continues on the next page

Areas outside the box will not be scanned for marking

8 (b) People often become electrostatically charged as they get out of a car.
This happens because their clothing rubs against the car seat.

A scientist was asked to find out whether the amount of charge on a person depended on the type of material which covered the car seat.
Three people, **A**, **B** and **C**, were used to test three different types of seat covering.

In each test, the person got out of the car and stood on a thick sheet of plastic.
The scientist then measured the potential difference between the person and the car body.
The results of the investigation are displayed in the bar chart.



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8 (b) (i) Explain why the measurement was made with the person standing on a thick sheet of plastic.

.....

.....

.....

.....

(2 marks)

8 (b) (ii) To make this a fair test, the three people, **A**, **B** and **C**, each wore the same type of clothing.

Suggest a reason why this was important.

.....

.....

(1 mark)

8 (b) (iii) The smallest scale division on the voltmeter was 0.1 kV.

Suggest why, from the data, it was **not** necessary to increase the precision of the potential difference measurements.

.....

.....

(1 mark)

8 (b) (iv) Explain why this investigation may cause a manufacturer to change the material used to cover car seats.

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS

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Version 1.0 21/07/2009

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463/ Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2009 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

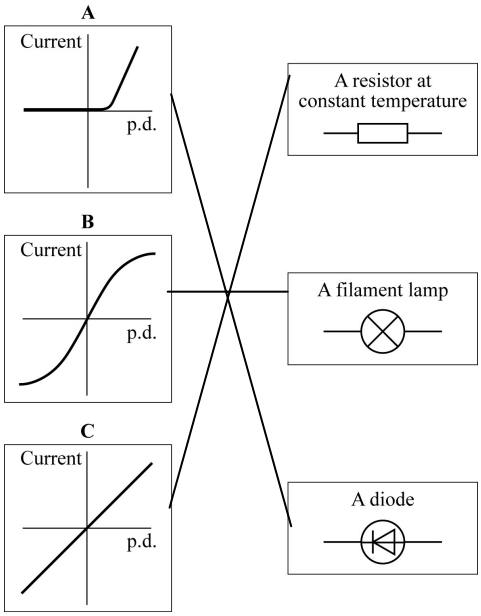
3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY2F

Question 1

question	answers	extra information	mark
1(a)	**three** lines drawn correctly  	allow **1** mark for 1 correct line if more than one line goes from a graph, both are incorrect	2
1(b)	**J**		1
Total			**3**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)	**Y**	accept the one in the middle accept 90	1
	has the biggest mass	reason does not score if X or Z is chosen accept weight for mass accept weighs the most accept they are the heaviest accept has a larger mass do **not** accept weighs 90kg's on its own biggest/larger on its own is not sufficient	1
2(b)	increases		1
Total			**3**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)	shallowest slope/ gradient	accept smallest distance in biggest time accept longest time to travel the same distance accept the line is not as steep accept it is a less steep line do **not** accept the line is not steep	1
3(b)	**A – B**	If 2or 3 boxes are ticked no mark	1
3(c)(i)	200 m		1
3(c)(ii)	20 s	allow **1** mark for correctly identifying 60 s or 40 s from the graph	2
3(d)(i)	straight line starting at origin passing through t = 200 and d = 500	accept within one small square of the origin	1 1
3(d)(ii)	166	accept any value between 162 and 168 accept where their line intersects given graph line correctly read ± 3 s	1
Total			**8**

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PHY2F

Question 4

question	answers	extra information	mark
4(a)(i)	6		1
4(a)(ii)	6 (volts)	accept their (a)(i) ignore any units	1
4(b)	0.30	accept 0.3	1
4(c)	smaller(than)	accept correct alternatives to smaller than e.g. less than	1
	a bigger current flows through the lamp	only accept if 'smaller than' is given accept converse accept a correct calculation accept resistance is half of 60 accept resistance = 30 (Ω) do **not** accept answers in terms of p.d	1
Total			**5**

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PHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	50 (N)	ignore any units	1
5(a)(ii)	resultant force		1
5(a)(iii)	4000	accept their (a)(i) × 80 correctly calculated for **2** marks allow **1** mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80 ignore any units	2
5(b)(i)	joule		1
5(b)(ii)	heat		1
Total			**6**

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PHY2F

Question 6

question	answers	extra information	mark
6(a)(i)	the thicker the tile, the greater the(fall) height	accept the higher(the fall) the thicker the tile accept there is a positive correlation do **not** accept they are proportional	1
6(a)(ii)	60(mm) (minimum thickness) needed to reduce risk of injury	accept any number or range between 60 and 85 inclusive if units are given must match range reason must match thickness choice do **not** accept to keep child safe accept an answer in terms of – the thicker the tile, the less chance there is of a serious injury if the answer given is greater than 60 accept answers in terms of use of graph e.g. the graph shows that for a 2m fall a thickness of 60mm is needed minimum level answer' the graph shows that's what's needed' accept only if 60 is the answer	1 1
6(b)(i)	the time taken (to stop)		1
6(b)(ii)	(the) force (on)		1
Total			**5**

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PHY2F

Question 7

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>7(a)</td><td>
<table>
<tr><td>Particle</td><td>Relative Mass</td><td>Relative charge</td></tr>
<tr><td>Proton</td><td>1</td><td></td></tr>
<tr><td>Neutron</td><td></td><td>0</td></tr>
</table>
</td><td>accept one, accept +1
do not accept -1
accept zero
do not accept no charge/ nothing/ neutral unless given with 0</td><td>1

1</td></tr>
<tr><td>7(b)</td><td>equal numbers/amounts of protons and electrons

protons and electrons have equal but opposite charge</td><td>

accept protons charge +1 and electron charge -1

accept (charge) on proton cancels/balances (charge) on electron
accept positive (charges) cancel out the negative(charges)
neutrons have no charge is neutral
do not accept total charge of protons, electrons (and neutrons) is 0 unless qualified</td><td>1

1</td></tr>
</table>

Question 7 continues on the next page . . .

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PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(c)(i)	(3) fewer neutrons	accept lower/ smaller mass number do **not** accept different numbers of neutrons any mention of fewer/more protons/ electrons negates mark accept answers in terms of U-238 providing U-238 is specifically stated i.e. U-238 has (3) more neutrons	1
7(c)(ii)	neutron		1
7(c)(iii)	(nuclear) fission	accept fision do **not** accept any spelling that may be taken as fusion	1
Total			**7**

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PHY2F

Question 8

question	answers	extra information	mark
8(a)(i)	gained electrons		1
8(a)(ii)	see if it exerts a force on another (charged) object **or** see if it will pick up (small) pieces of paper	accept repels another negative(ly charged)object accept attracts a positive(ly charged) object accept attracts or repels a charged object accept any correct way of showing an electrostatic effect i.e. bend a (slow moving) stream of water (from a tap) do **not** accept see if you get an electric shock on its own	1
8(b)(i)	plastic is an insulator stop them discharging **or** stop them being earthed	accept plastic is a poor conductor any mention of heat negates this mark accept keeps the charge on the person accept stop them being grounded accept electricity cannot go to earth do **not** accept so don't get an electric shock	1 1
8(b)(ii)	type of clothing could affect (build up of) charge/data	accept it is a variable/ factor (that needs to be controlled) do **not** accept fair test on its own	1
8(b)(iii)	there is a clear pattern **or** enough precision to tell difference (between the materials) **or** accept none of the results are within 0.1kV of the shock line or each other	accept there is a wide range of results	1

Question 8 continues on the next page . . .

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PHY2F

Question 8 continued . . .

question	answers	extra information	mark
8(b)(iv)	any **two** from: • the material normally used has a value above the p.d likely to cause a shock • use a material that reduces pd (below 3.6 kV) • so people are less likely to be shocked • can put 'non-shock' seating in adverts • may sell more seats/ cars	accept use a material that reduces charge (on the person) accept so people will not feel a shock owtte	2
Total			**8**

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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

PHY2F

F

PHYSICS
Unit Physics P2

Foundation 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		7	
2		8	
3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 Four different processes are described in **List A**. The names of these processes are given in **List B**.

Draw a line to link each description in **List A** to its correct name in **List B**.
Draw only **four** lines.

List A	List B
the nuclei of two atoms joining together	gamma emission
the nucleus of an atom splitting into several pieces	electric current
an atom losing an electron	ionisation
an electric charge moving through a metal	nuclear fission
	nuclear fusion

(4 marks)

4

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2 (a) Use numbers given in the box to complete the following sentences.

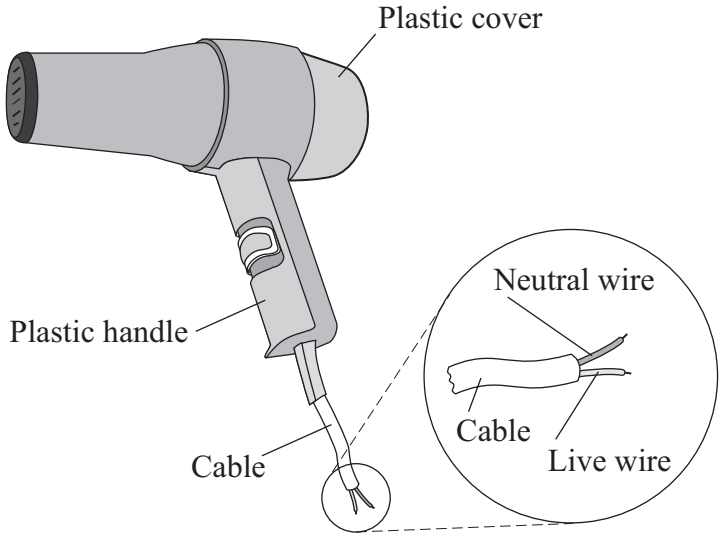
12	**50**	**110**	**230**

In the UK, the mains electricity supply is ..... volts.

The frequency of the UK mains electricity supply is ..... hertz.

(2 marks)

2 (b) The diagram shows a hairdryer designed to be used with the UK mains supply.
The cable connecting the hairdryer to the plug does not have an earth wire.



2 (b) (i) Why does the hairdryer **not** need a cable with an earth wire?

.....

.....

(1 mark)

2 (b) (ii) Which **one** of the following materials are the two wires inside the cable made from?

Draw a ring around your answer.

aluminium **copper** **steel**

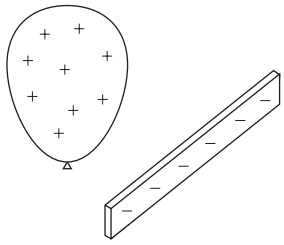
(1 mark)

4

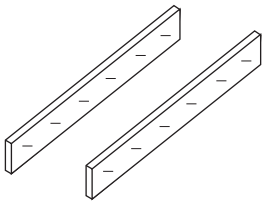
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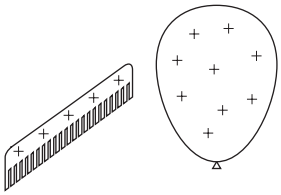
3 (a) The diagrams **X**, **Y** and **Z** show three pairs of charged objects. Each object is either positively charged or negatively charged.



X



Y



Z

3 (a) (i) In which diagram or diagrams do the objects repel each other?

.....

(1 mark)

3 (a) (ii) In which diagram or diagrams do the objects attract each other?

.....

(1 mark)

Areas outside the box will not be scanned for marking

3 (b) The diagram shows a fuel tanker refuelling an aircraft. A static charge can build up as the fuel flows through the pipe to the aircraft. This can be dangerous.



Fuel tanker

3 (b) (i) Static charge could be dangerous in this situation.
Explain why.

.....

.....

.....

.....

(2 marks)

3 (b) (ii) Before refuelling, the aircraft and fuel tanker are joined to earth by a metal wire.

Which **one** of the following statements is the reason why this procedure reduces the danger?

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

The charge will stay in the wire. ☐

The charge will flow to earth. ☐

The charge will move onto the aircraft. ☐

The charge will move onto the fuel tanker. ☐

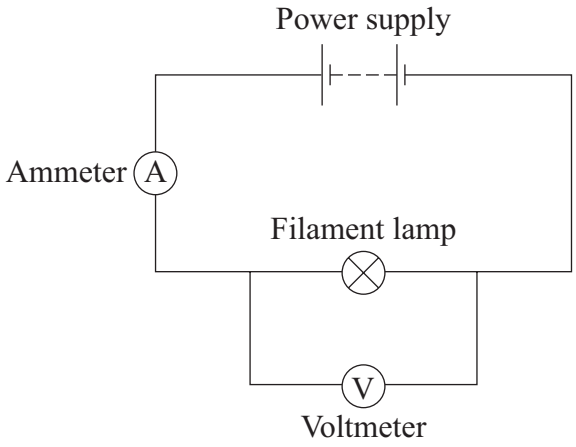
(1 mark)

5

Turn over ▶

Areas outside the box will not be scanned for marking

4 (a) The diagram shows the circuit used by a student to measure the power of a filament lamp.



Name a component connected in parallel with the filament lamp.

.....

(1 mark)

4 (b) By adding another component to the circuit, the student is able to obtain a range of ammeter and voltmeter readings.

Ammeter reading in amps	**Voltmeter reading in volts**
0.10	1.0
0.15	2.0
0.20	4.0
0.25	7.0
0.30	11.0

Areas outside the box will not be scanned for marking

4 (b) (i) Which **one** of the following components did the student add to the circuit?

Draw a ring around your answer.

fuse **switch** **variable resistor**

(1 mark)

4 (b) (ii) What is the range of ammeter readings taken by the student?

from ..... amps to ..... amps

(1 mark)

4 (b) (iii) Use the data in the table and the equation in the box to calculate the **maximum** power of the filament lamp.

power (watt, W)	=	current (ampere, A)	×	potential difference (volt, V)

Show clearly how you work out your answer.

.....

.....

Power = ... W

(3 marks)

4 (c) Complete the following sentence by drawing a ring around the correct line in the box.

As the temperature of a filament lamp increases, its resistance

increases
remains constant
decreases

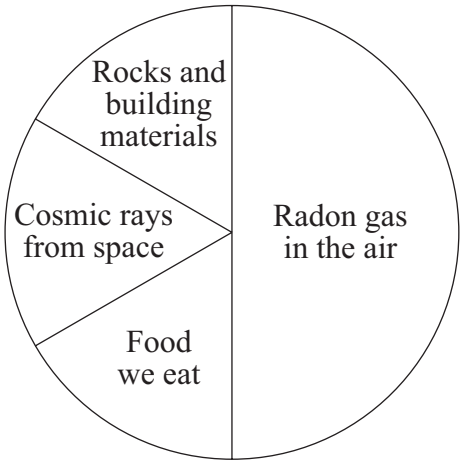
.

(1 mark)

7

Areas outside the box will not be scanned for marking

5 (a) The pie chart shows the average proportions of natural background radiation from various sources in one part of the UK.



5 (a) (i) What proportion of the background radiation comes from radon gas?

.....

(1 mark)

5 (a) (ii) Suggest why our bodies are slightly radioactive.

.....

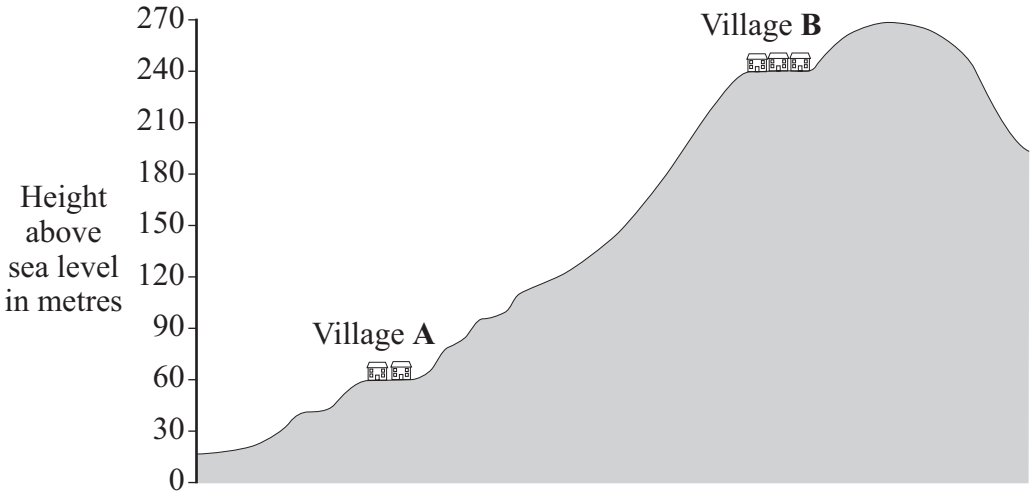
.....

(1 mark)

Areas outside the box will not be scanned for marking

5 (b) The level of background radiation from cosmic rays is not the same everywhere. For every 30 metres above sea level, the amount of background radiation increases by one unit.

The diagram shows the position of two villages, **A** and **B**, built on a hill.



How is the amount of background radiation from cosmic rays different in village **A** compared to village **B**?

To obtain full marks you must include a calculation in your answer.

.....

.....

.....

.....

.....

.....

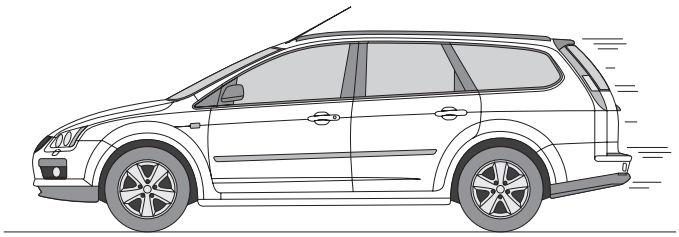
(3 marks)

5

Turn over ▶

Areas outside the box will not be scanned for marking

6 (a) The diagram shows a car travelling at a speed of 12 m/s along a straight road.



6 (a) (i) Use the equation in the box to calculate the momentum of the car.

momentum = mass × velocity

Mass of the car = 900 kg

Show clearly how you work out your answer.

.....

.....

.....

.....

Momentum = ... kg m/s

(2 marks)

6 (a) (ii) Momentum has direction.

Draw an arrow on the diagram to show the direction of the car's momentum.

(1 mark)

Areas outside the box will not be scanned for marking

6 (b) The car stops at a set of traffic lights.

How much momentum does the car have when it is stopped at the traffic lights?

.....

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

5

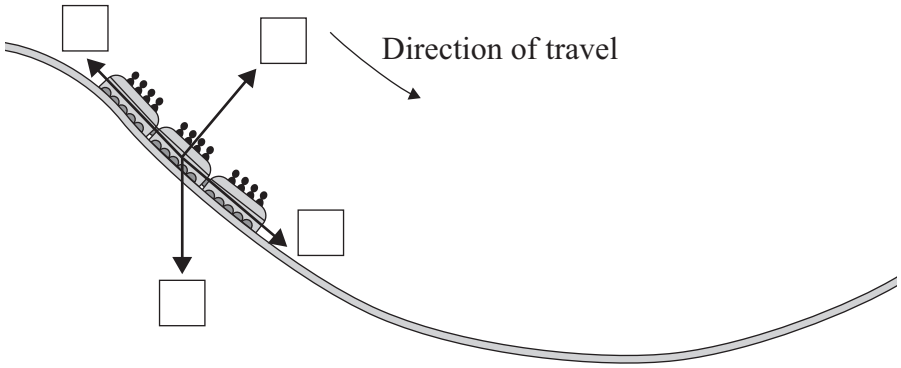
Turn over for the next question

Areas outside the box will not be scanned for marking

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

7 (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)

7 (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)

7 (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

7 (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)

Areas outside the box will not be scanned for marking

7 (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

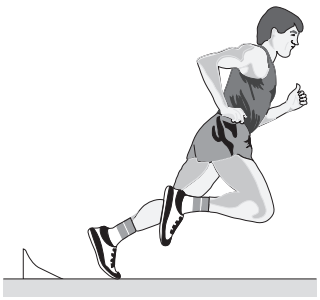
(2 marks)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

8 (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.

8 (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)

8 (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**

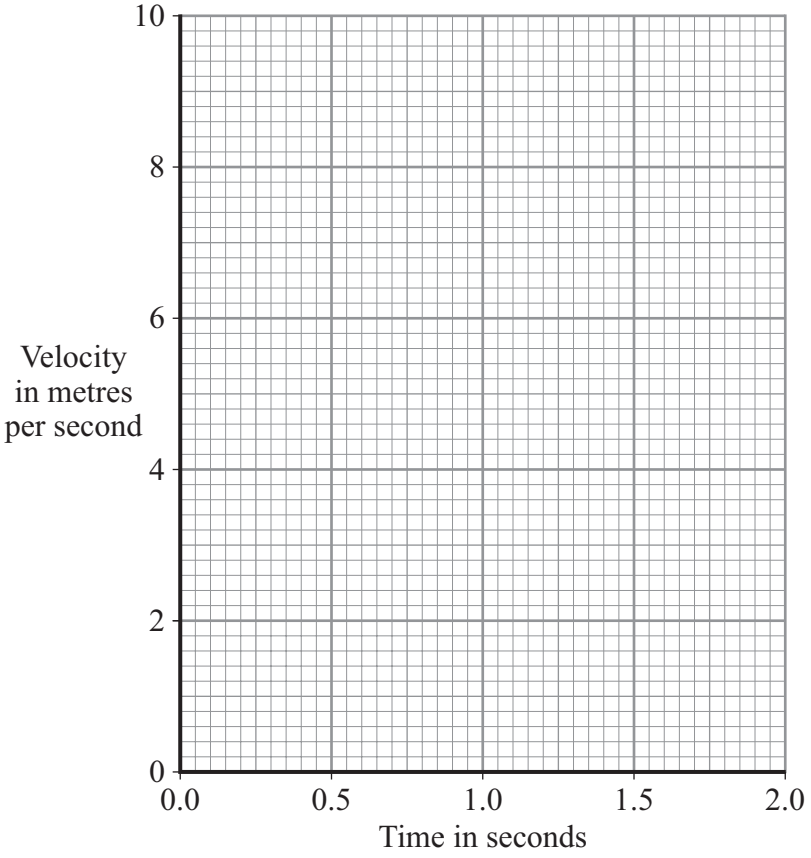
(1 mark)

Areas outside the box will not be scanned for marking

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

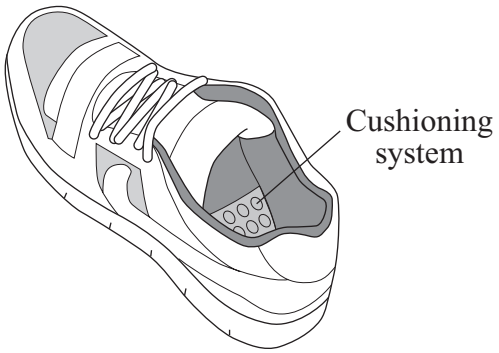
The velocity of the athlete is the ..... of the athlete in a given direction. *(1 mark)*

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



(2 marks)

8 (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.

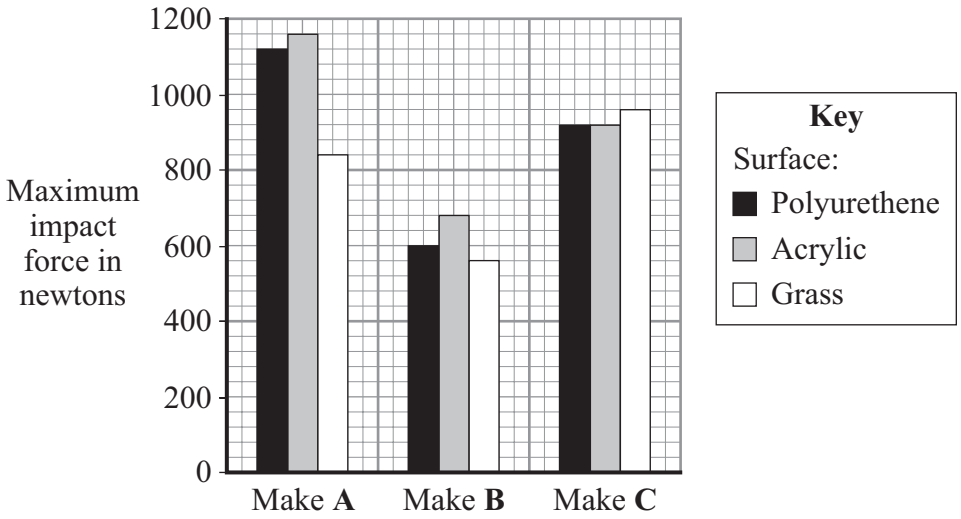


Question 8 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

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



8 (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.

.....

.....

.....

.....

(3 marks)

8 (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

END OF QUESTIONS

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Version : 1:0 09/02/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2009 examination – January series

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PHY2F

Question 1

question	answers	extra information	mark
1	**four** lines correct **List A** the nuclei of two atoms joining together the nucleus of an atom splitting into several pieces an atom losing an electron an electric charge moving through a metal **List B** gamma emission electric current ionisation nuclear fission nuclear fusion	allow **1** mark for each correct line if more than 1 line is drawn from a box in List A, mark each line incorrect	4
Total			**4**

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PHY2F

Question 2

question	answers	extra information	mark
2(a)	230 50		1 1
2(b)(i)	has a plastic case **or** does not have a metal case or plastic is an insulator	accept outside is plastic accept cover / handle/ hair dryer is plastic / non-conductor accept is double insulated	1
2(b)(ii)	copper		1
Total			**4**

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PHY2F

Question 3

question	answers	extra information	mark
3(a)(i)	**Y** and **Z**	both required, in either order	1
3(a)(ii)	**X**	and no other	1
3(b)(i)	cause a spark cause a fire / explosion	 accept blow up for explosion do **not** accept this mark if the reason given makes no sense e.g. if fuel reacts with the pipe it causes an explosion	1 1
3(b)(ii)	The charge will flow to earth		1
Total			**5**

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PHY2F

Question 4

question	answers	extra information	mark
4(a)	voltmeter	and no other do **not** accept voltage	1
4(b)(i)	variable resistor		1
4(b)(ii)	0.10 – 0.30	accept 0.1 – 0.3 accept 0.3 – 0.1 accept 0.30 – 0.10	1
4(b)(iii)	3.3 (W)	allow **1** mark for correct data choice allow ***2*** marks for substitution of correct data i.e. 0.30 × 11.0 the following answers gain **2** marks 0.10 / 0.30 / 0.80 / 1.75 allow **1** mark for substitution of incorrect of data incorrectly calculated e.g. 0.20 × 4.0 = 0.6 scores **1** mark	3
4(c)	increases		1
Total			**7**

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PHY2F

Question 5

question	answers	extra information	mark
5(a)(i)	half / ½ / 50%	accept 1 (part) in 2 (parts)	1
5(a)(ii)	(the) food (we eat) is radioactive	accept because of the food (we eat) accept we breathe in radon radon in the air is neutral	1
(b)	higher in village B by 6 units	 allow **1** mark for correctly obtaining a height difference of 180 (m)/ 4 times higher – this refers to height and not radiation levels accept for **3** marks in village A it is 2 units (extra) and in village be it is 8 units (extra) allow **1** mark for a correct radiation calculation based on incorrect height readings	1 2
Total			**5**

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PHY2F

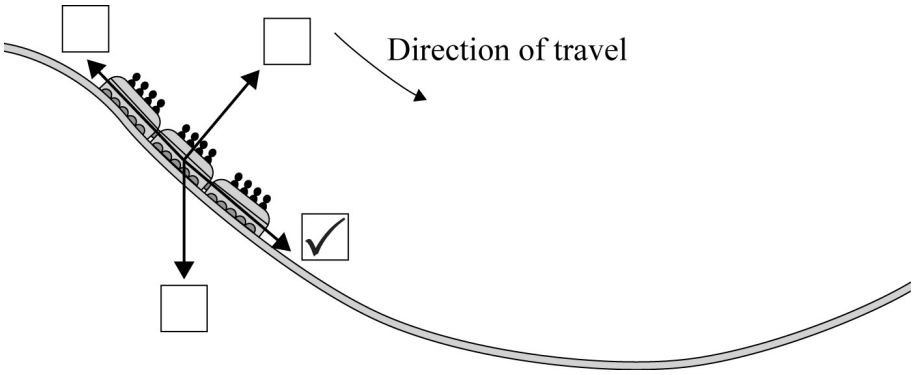
Question 6

question	answers	extra information	mark
6(a)(i)	10800	allow **1** mark for correct substitution i.e. 900 × 12	2
6(a)(ii)	arrow pointing towards the left	allow anywhere on the diagram or at bottom of the page	1
6(b)	zero velocity is zero	accept 0 / none / nothing accept speed for velocity accept stopped / not moving accept a calculation i.e. 900 × 0 = 0	1 1
Total			**5**

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PHY2F

Question 7

question	answers	extra information	mark
7(a)	correct box ticked  		1
7(b)	each passenger has a different mass	accept weight for mass ignore other irrelevant factors about the person e.g. mass and height do **not** accept a list with incorrect factors e.g. mass and position accept passengers started with different (gravitational) potential energy	1
7(c)(i)	30	ignore added units	1
7(c)(ii)	2400	accept their (c)(i) × 80 correctly calculated for both marks allow **1** mark for correct substitution of their (c)(i) and 80 an answer of 800 gains **1** mark only if answer to (c)(i) is not 10	2
Total			**5**

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PHY2F

Question 8

question	answers	extra information	mark
8(a)(i)	4.5	allow **1** mark for correct substitution i.e. 9 ÷ 2	2
8(a)(ii)	m/s^2	accept answer given in (a)(i) if not contradicted here	1
8(a)(iii)	speed		1
8(a)(iv)	straight line from the origin passing through (2s, 9 m/s)	allow **1** mark for straight line from the origin passing through to t = 2 seconds allow **1** mark for an attempt to draw a straight line from the origin passing through (2,9) allow **1** mark for a minimum of 3 points plotted with no line provided if joined up would give correct answer. Points must include(0,0) and (2,9)	2
8(b)(i)	**B** smallest (impact) force on all/ every/ any surfaces	if **A** or **C** given scores **0** marks in total these marks are awarded for comparative answers	1 1 1

Question 8 continues on the next page

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PHY2F

Question 8 continued

8(b)(ii)	(conditions) can be repeated **or** difficult to measure forces with human athletes	 accept answers in terms of variations in human athletes e.g. athletes may have different weights area / size of feet may be different difficult to measure forces athletes run at different speeds accept any answer that states or implies that with humans the conditions needed to repeat tests may not be constant e.g. athletes unable to maintain constant speed during tests (or during repeat tests) do **not** accept the robots are more accurate removes human error is insufficient fair test is insufficient	1
Total			**10**

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