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.

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

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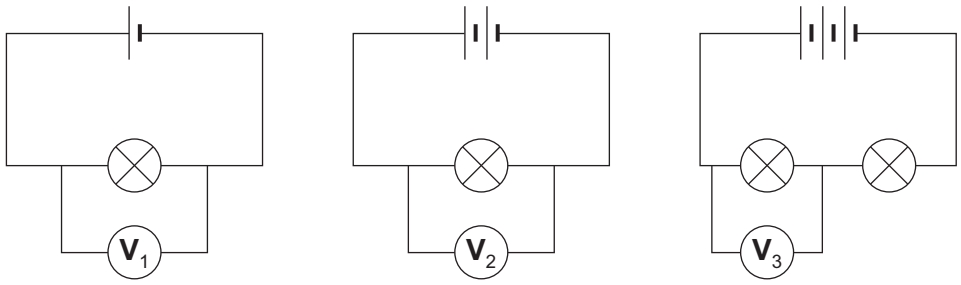
2 (a) The lamps in the circuits drawn below are all identical.
Each of the cells has a potential difference of 1.5 volts.



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.

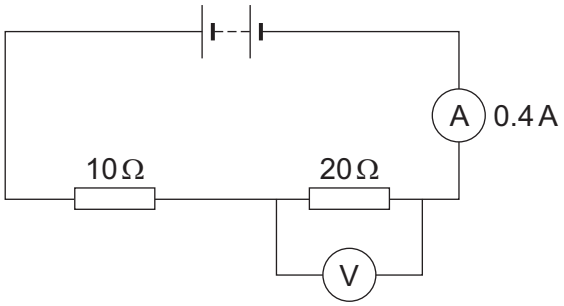
$\mathbf{V_1}$ $\mathbf{V_2}$ $\mathbf{V_3}$

(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

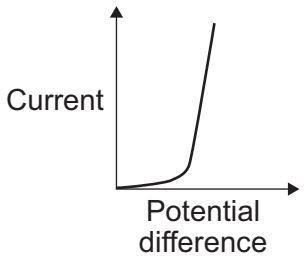
(2 marks)

Do not write outside the box

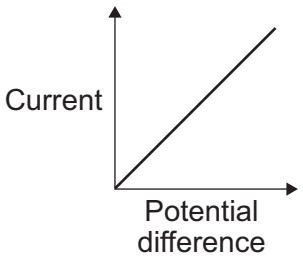
2 (b) (iii) The current through a resistor at constant temperature changes when the potential difference across the resistor changes.

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

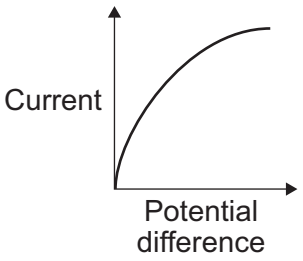
Write your answer, **X**, **Y** or **Z**, in the box.



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**

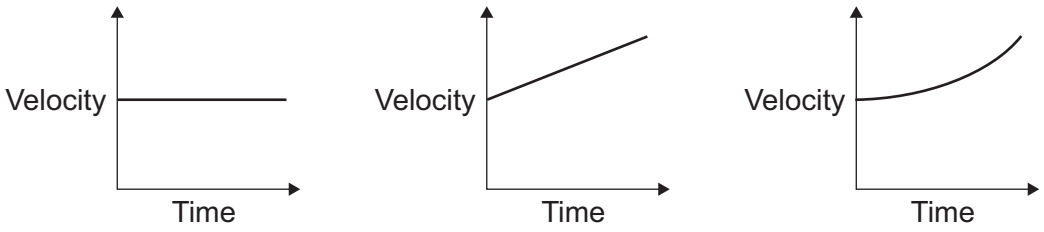
.....

.....

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

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ANSWER IN THE SPACES PROVIDED

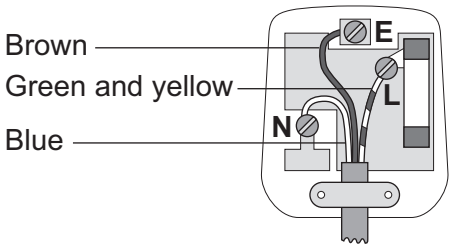
Do not write outside the box

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

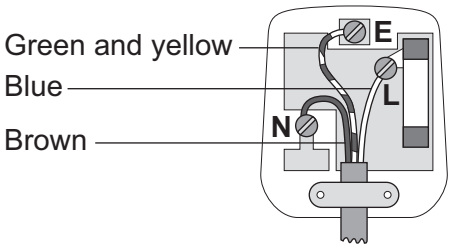
4 (a) (i) Which **one** of the plugs, **A**, **B**, **C** or **D**, is correctly wired?

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

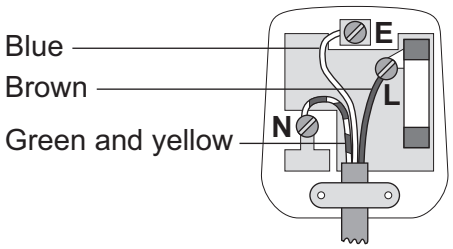
A



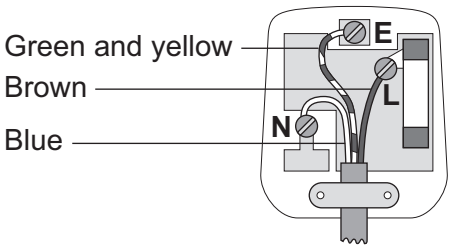
B



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.

.....

.....

.....

.....

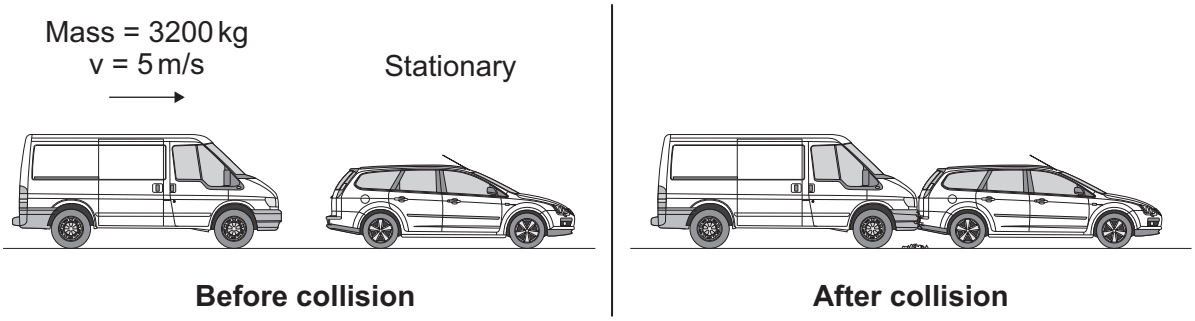
(2 marks)

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,

..... .

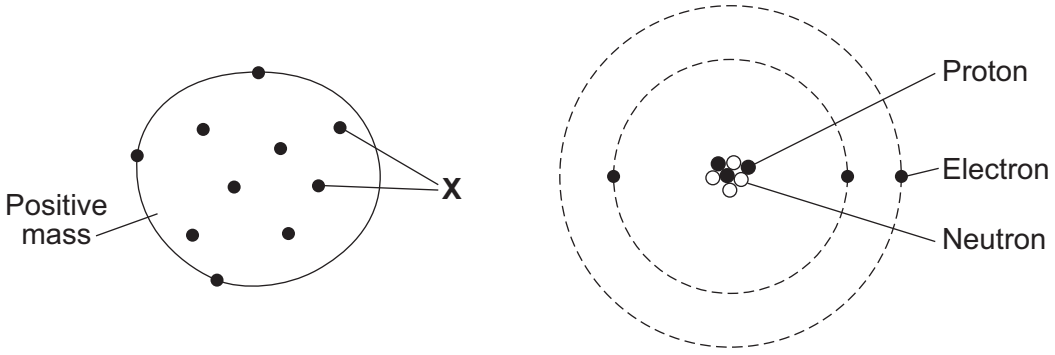
The force on the person's body ..... and so reduces the risk of injury.

(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

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ANSWER IN THE SPACES PROVIDED

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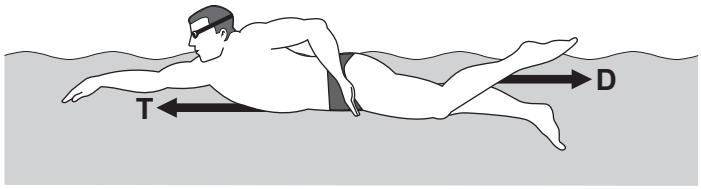
7 (a) The diagram shows the horizontal forces acting on a swimmer.



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.

.....

.....

.....

.....

.....

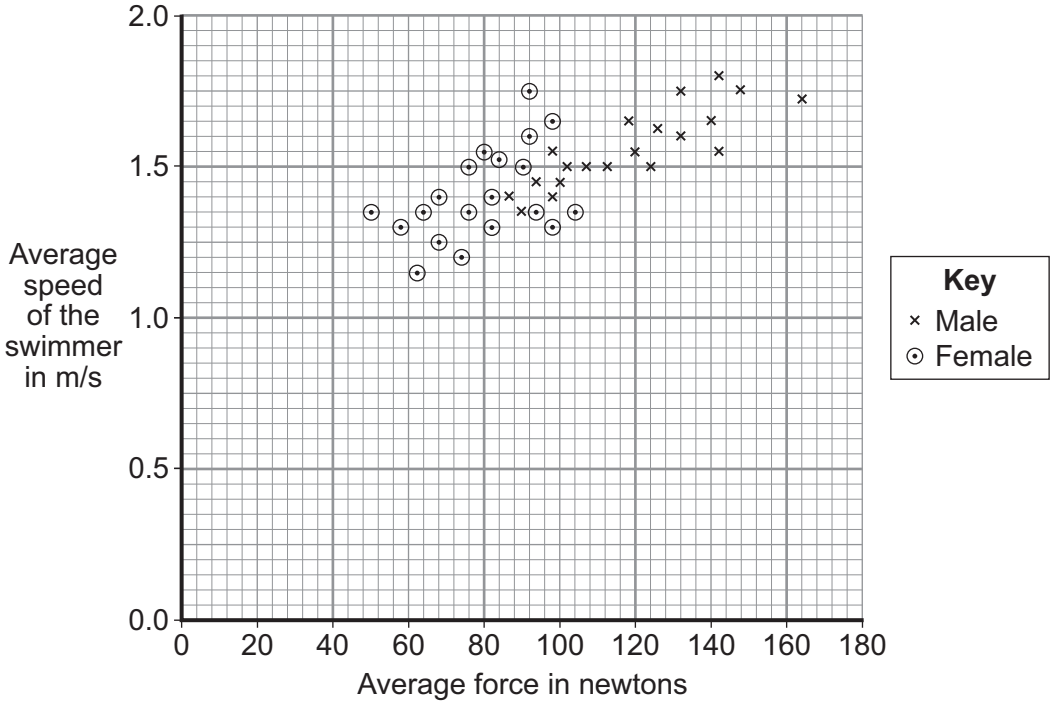
.....
(3 marks)

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?

.....

.....

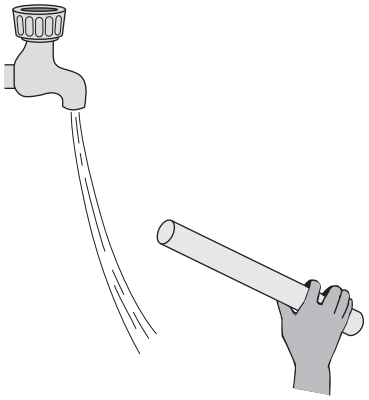
(1 mark)

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. ☐

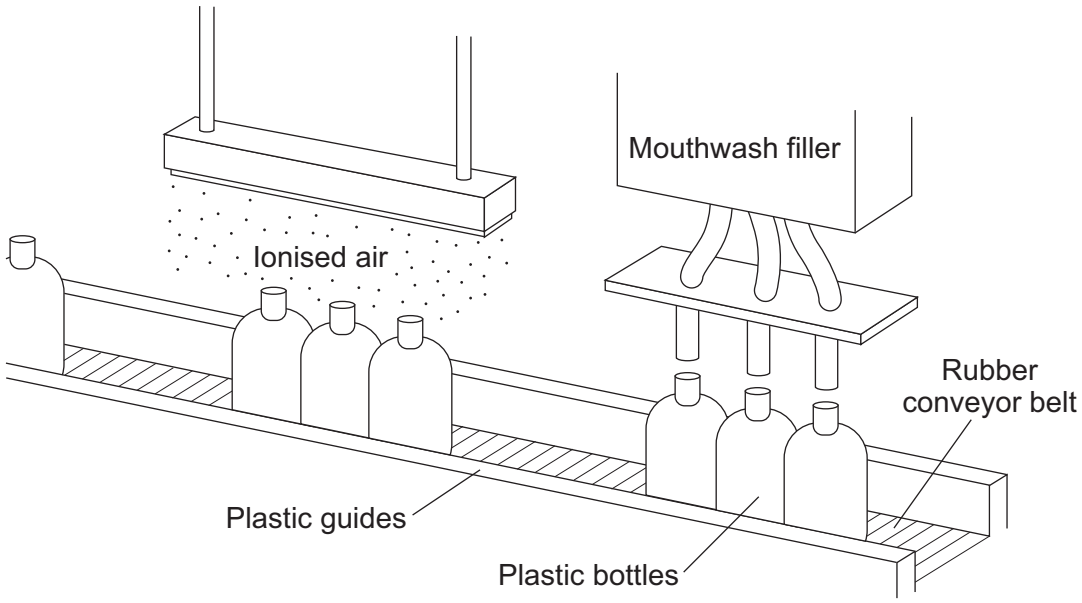
The negative charge in the water is attracted by the rod and the positive charge is repelled. ☐

(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

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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