| Centre Number | | | | | | Candidate Number | | | | |
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| For Examiner's Use | |
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| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
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| 6 | |
| 7 | |
| TOTAL | |

General Certificate of Secondary Education
Higher Tier
June 2012

# Additional Science
**Unit Physics P2**

**PHY2H**

**H**

# 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.

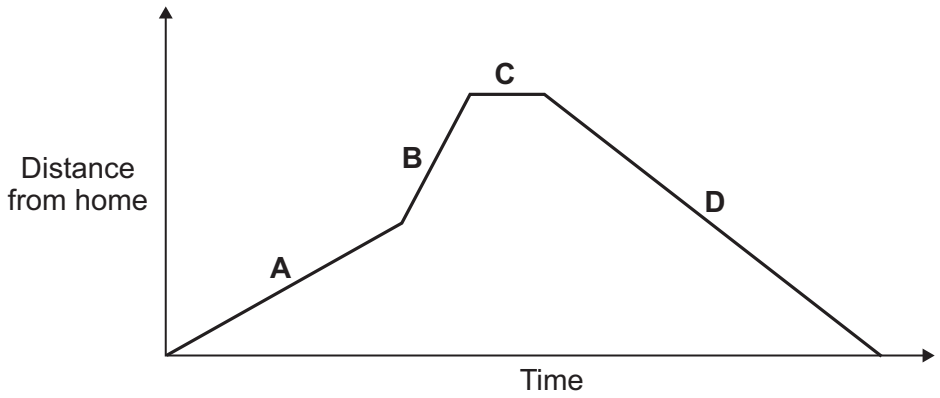
**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

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

**1 (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.

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*(2 marks)*

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

How is *velocity* different from *speed*?

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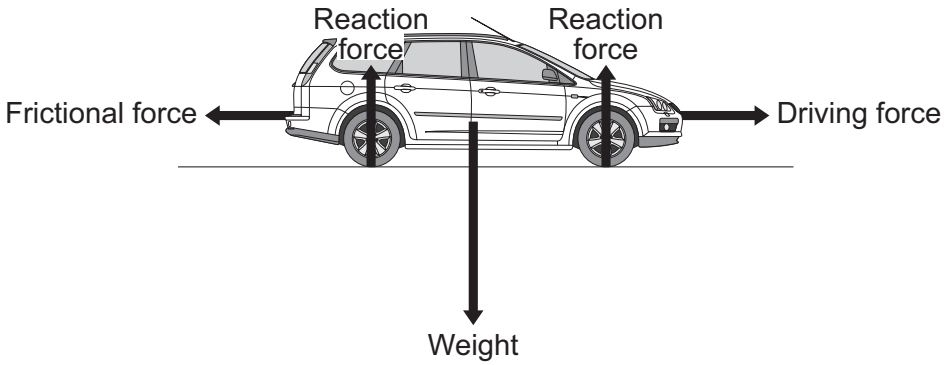
*(1 mark)*

3

**2** 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.




**2 (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.

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.....

Acceleration = .....

*(3 marks)*

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

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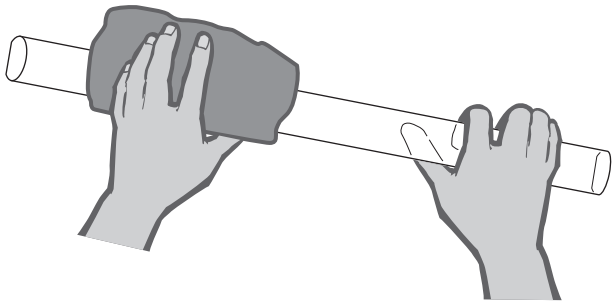
*(3 marks)*

**6**

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



The polythene rod becomes negatively charged.

Explain how this happens.

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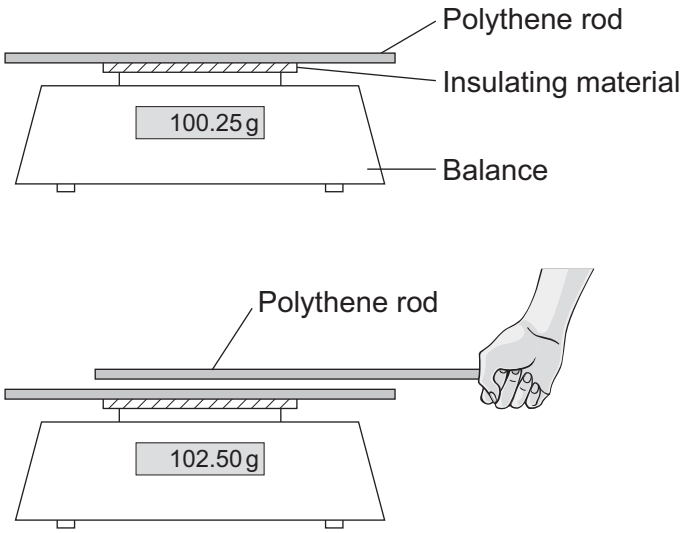
*(2 marks)*

**3 (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.



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

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*(2 marks)*

**3 (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?

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.....

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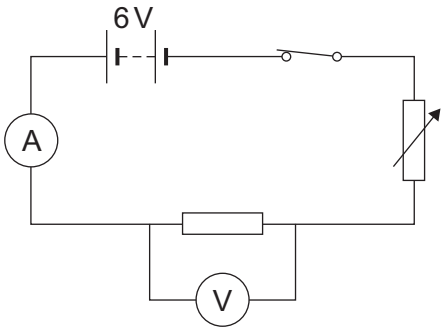
*(2 marks)*

**6**

**Turn over for the next question**

**4** The diagram shows the circuit set up by a student.




**4 (a)** The student uses the circuit to test the following hypothesis:

*'The current through a resistor is directly proportional to the potential difference across the resistor.'*

**4 (a) (i)** If the hypothesis is correct, what should the student predict will happen to the current through the resistor when the potential difference across the resistor is doubled?

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*(1 mark)*

**4 (a) (ii)** Name the component in the circuit used to change the potential difference across the resistor.

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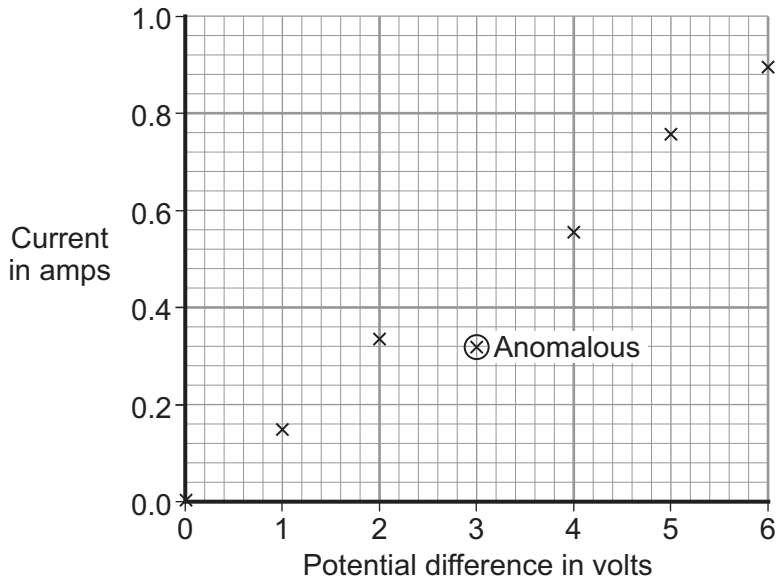
*(1 mark)*

**4 (b)** The student used the data obtained to plot the points for a graph of current against potential difference.




**4 (b) (i)** Why has the student plotted the points for a line graph and not drawn a bar chart?

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.....

*(1 mark)*

**4 (b) (ii)** One of the points has been identified by the student as being anomalous.

What is the most likely cause for this anomalous point?

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*(1 mark)*

**4 (b) (iii)** Draw a line of best fit for these points.

*(1 mark)*

**4 (b) (iv)** Does the data the student obtained support the hypothesis?

Give a reason for your answer.

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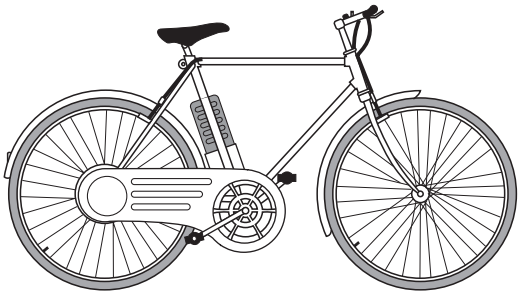
*(1 mark)*

6

**5** The picture shows an electric bicycle. The bicycle is usually powered using a combination of the rider pedalling and an electric motor.



**5 (a)** A 36 volt battery powers the electric motor. The battery is made using individual 1.2 volt cells.

**5 (a) (i)** Explain how a 36 volt battery can be produced using individual 1.2 volt cells.

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

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*(2 marks)*

**5 (a) (ii)** The battery supplies a direct current (d.c.).

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

.....

.....

*(1 mark)*

**5 (a) (iii)** When fully charged, the battery can deliver a current of 5 A for 2 hours. The battery is then fully discharged.

Use the equation in the box to calculate the maximum charge that the battery stores.

charge = current × time

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

.....

.....

Charge stored = .....

*(3 marks)*

**5 (b)** When powered only by the electric motor, the bicycle can carry a 90 kg rider at a maximum speed of 6 m/s. Under these conditions, the maximum distance that the bicycle can cover before the battery needs recharging is 32 km.

The bicycle has a mass of 30 kg.

**5 (b) (i)** Use the equation in the box to calculate the maximum kinetic energy of the bicycle **and** rider when the rider is not pedalling.

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

Show clearly how you work out your answer.

.....

.....

Kinetic energy = ..... J

*(2 marks)*

**5 (b) (ii)** The bicycle can be fitted with panniers (bags) to carry a small amount of luggage.

What effect would fitting panniers and carrying luggage have on the distance the bicycle can cover before the battery needs recharging?

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Give a reason for your answer.

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*(2 marks)*

10

**Turn over for the next question**

**6 (a)** The picture shows two teenagers riding identical skateboards.
The skateboards are moving at the same speed and the teenagers have the same mass.

Why do the teenagers **not** have the same momentum?

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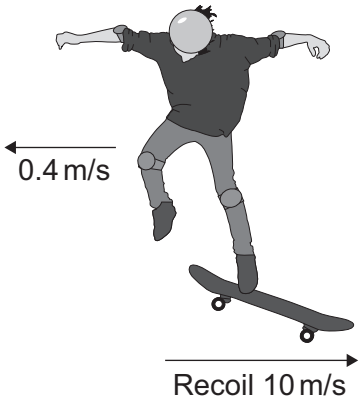
*(1 mark)*

**6 (b)** One of the skateboards slows down and stops. The teenager then jumps off the skateboard, causing it to recoil and move in the opposite direction.




The momentum of the teenager and skateboard is conserved.

**6 (b) (i)** What is meant by 'momentum being conserved'?

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.....

*(1 mark)*

**6 (b) (ii)** The teenager, of mass 55 kg, jumps off the skateboard at 0.4 m/s causing the skateboard to recoil at 10 m/s.

Use the equation in the box to calculate the mass of the skateboard.

momentum = mass × velocity

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Mass = ..... kg

*(3 marks)*

**6 (c)** Once the skateboard starts to recoil, it soon slows down and its kinetic energy decreases.

Explain why.

.....

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*(2 marks)*

7

**Turn over for the next question**

**7 (a)** Atoms of the isotope bismuth-212 decay by emitting either an alpha particle or a beta particle.
The equation represents what happens when an atom of bismuth-212 decays by beta emission into an atom of polonium-212.

$$^{212}_{83}\text{Bi} \longrightarrow {}^{212}_{84}\text{Po} + \text{beta particle}$$

**7 (a) (i)** The bismuth atom and the polonium atom have the same mass number (212).

What is the *mass number* of an atom?

.....

*(1 mark)*

**7 (a) (ii)** Beta decay does **not** cause the mass number of an atom to change.

Explain why not.

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.....

*(2 marks)*

**7 (b)** When an atom of bismuth-212 emits an alpha particle, the atom decays into an atom of thallium.

An alpha particle is the same as a helium nucleus.
The symbol below represents an alpha particle.

$$^{4}_{2}\text{He}$$

**7 (b) (i)** The equation below represents the alpha decay of bismuth-212.

Complete the equation by writing the correct number in each of the two boxes.

$$^{212}_{83}\text{Bi} \longrightarrow \square\ \text{Tl} + {}^{4}_{2}\text{He}$$

*(2 marks)*

**7 (b) (ii)** It is impossible for the alpha decay of bismuth-212 to produce the same element as the beta decay of bismuth-212.

Explain why.

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*(2 marks)*

7

**END OF QUESTIONS**

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