| 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
## Unit Physics P2

PHY2F

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

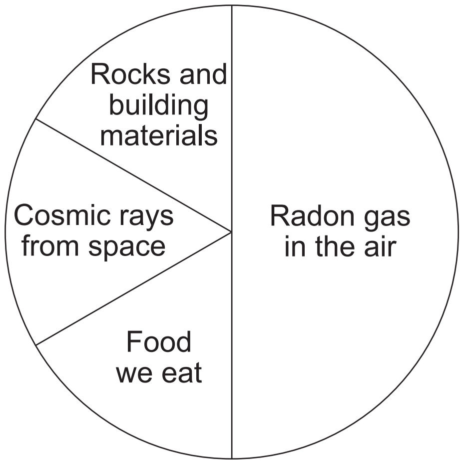
**Instructions**
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any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

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 |

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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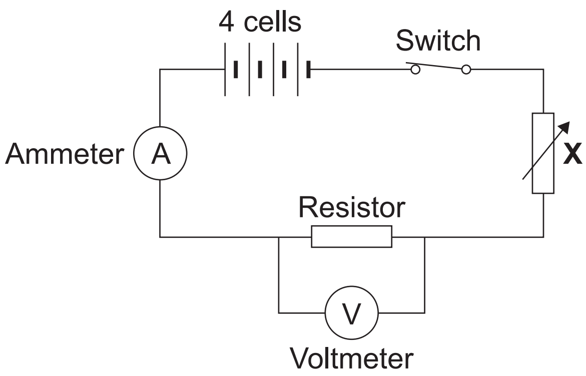
ANSWER IN THE SPACES PROVIDED

**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.

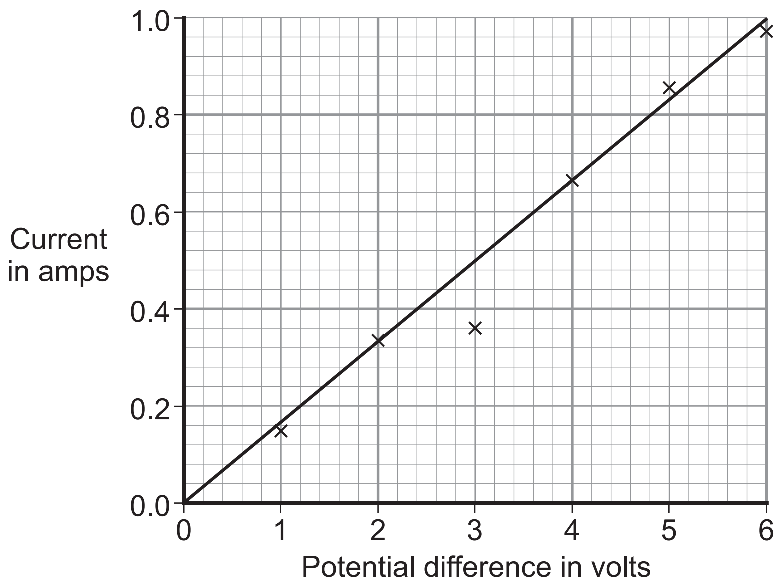
.......................................................................................................................................

*(1 mark)*

**Question 2 continues on the next page**

**Turn over ▶**

**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)*

**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**

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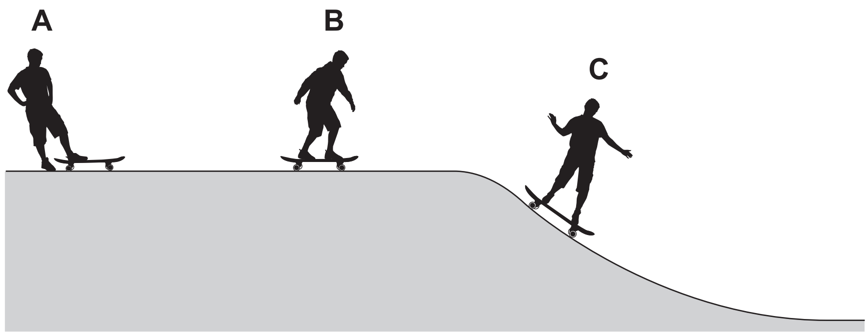
**3** The picture shows three skateboarders, **A**, **B** and **C**.




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

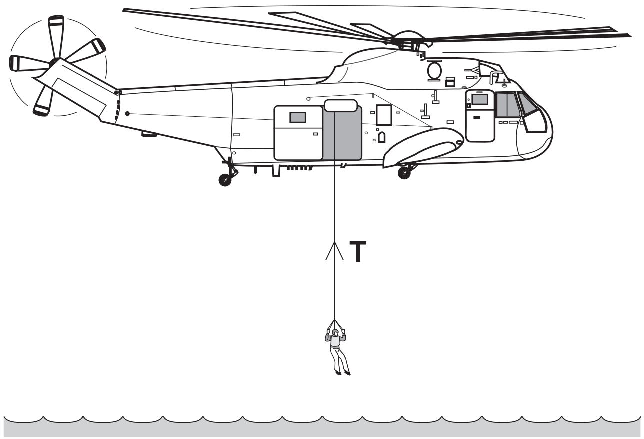
*(2 marks)*

5

**Turn over for the next question**

**Turn over ▶**

**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)*

**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)**

.............................................................................................................................

.............................................................................................................................

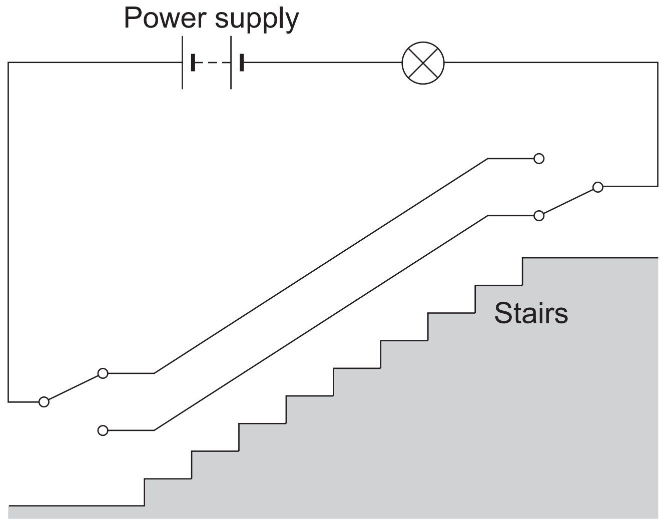
Power = ................................................

*(3 marks)*

7

**Turn over for the next question**

**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.

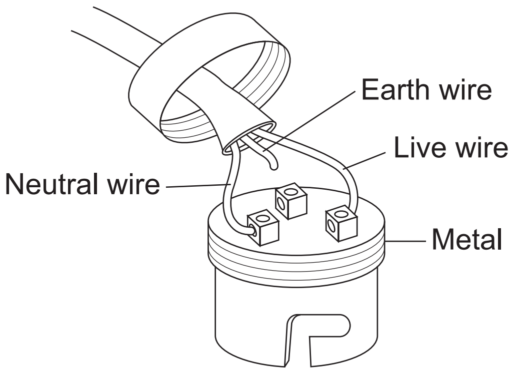
What is the advantage of using this circuit to switch a lamp on or off, rather than using a more simple circuit that has only one switch?

...........................................................................................................................

...........................................................................................................................

*(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?

...........................................................................................................................

...........................................................................................................................

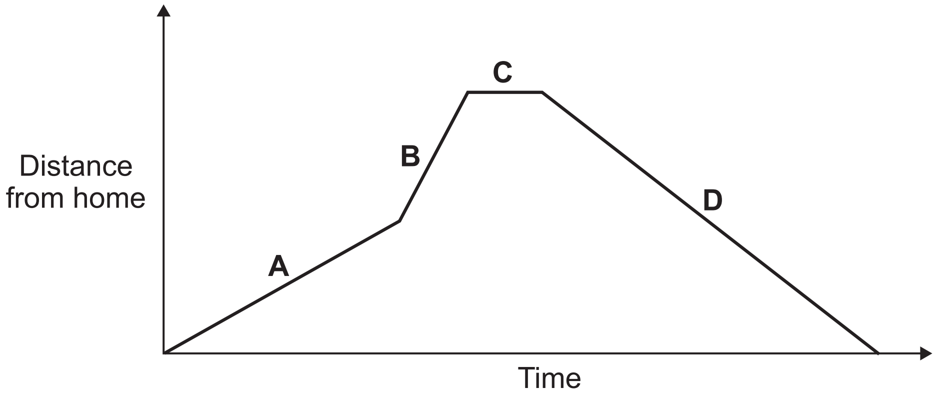
*(1 mark)*

7

**Turn over ▶**

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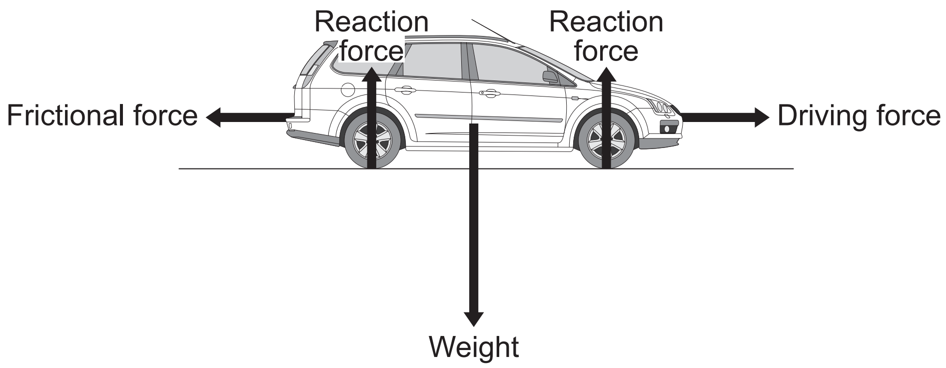
**7** The diagram shows the forces acting on a car. The car is being driven along a straight, level road at a constant speed of 12 m/s.




**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.

.....................................................................................................................................

.....................................................................................................................................

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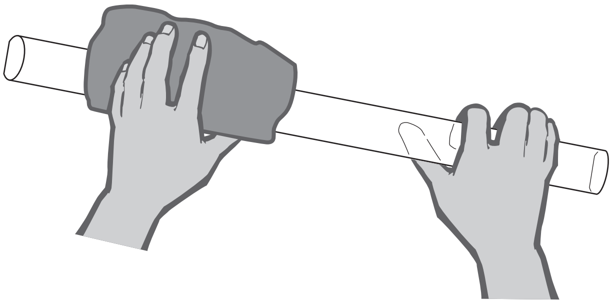
*(3 marks)*

6

**Turn over ▶**

**8 (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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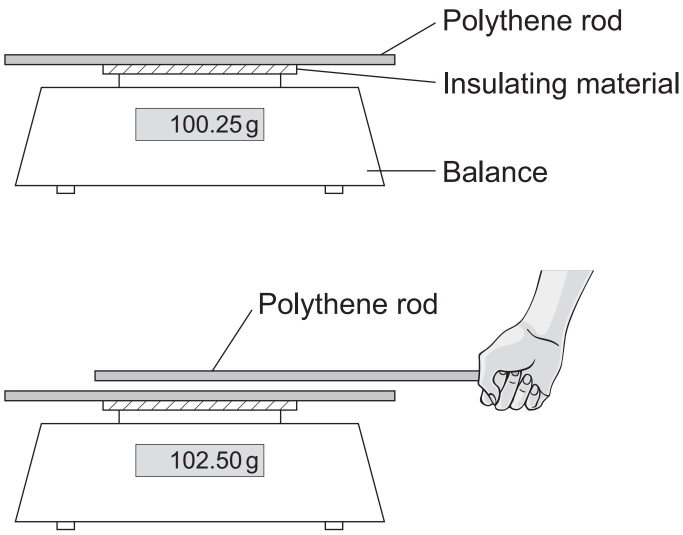
........................................................................................................................................

*(2 marks)*

**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.



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

..............................................................................................................................

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*(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?

..............................................................................................................................

..............................................................................................................................

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*(2 marks)*

6

**END OF QUESTIONS**

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