| 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**

**PHY2H**

**H**

**PHYSICS**
**Unit Physics P2**

**Higher 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 | | 3 | |
| 2 | | 4 | |
| | | 5 | |
| | | 6 | |
| Total (Column 1) → | | | |
| Total (Column 2) → | | | |
| TOTAL | | | |
| Examiner's Initials | | | |

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

**1** 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 |

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

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

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*(2 marks)*

**1** (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.

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

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*(1 mark)*

**1** (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?

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*(1 mark)*

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

What name is given to this process?

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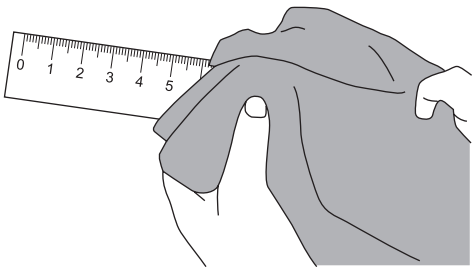
*(1 mark)*

7

**Turn over for the next question**

**2** (a) A plastic ruler is rubbed with a cloth.




The ruler becomes negatively charged.

**2** (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)*

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

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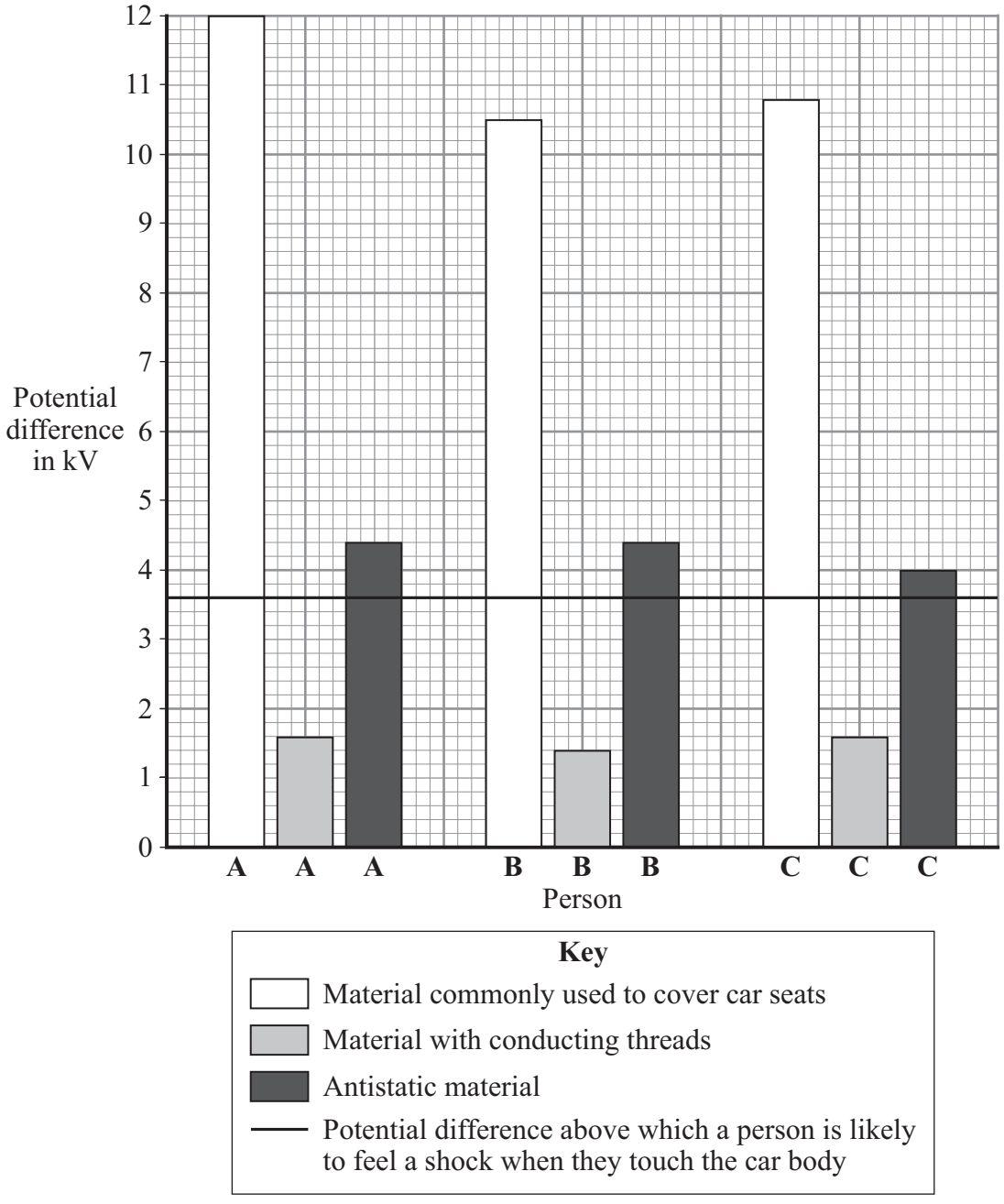
.....

*(1 mark)*

**2** (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.




**Question 2 continues on the next page**

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

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*(2 marks)*

**2** (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.

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*(1 mark)*

**2** (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.

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*(1 mark)*

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

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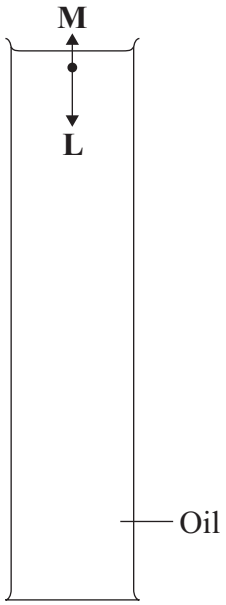
*(2 marks)*

**8**

**3** (a) The diagram shows a steel ball-bearing falling through a tube of oil.
The forces, **L** and **M**, act on the ball-bearing.




What causes force **L**?

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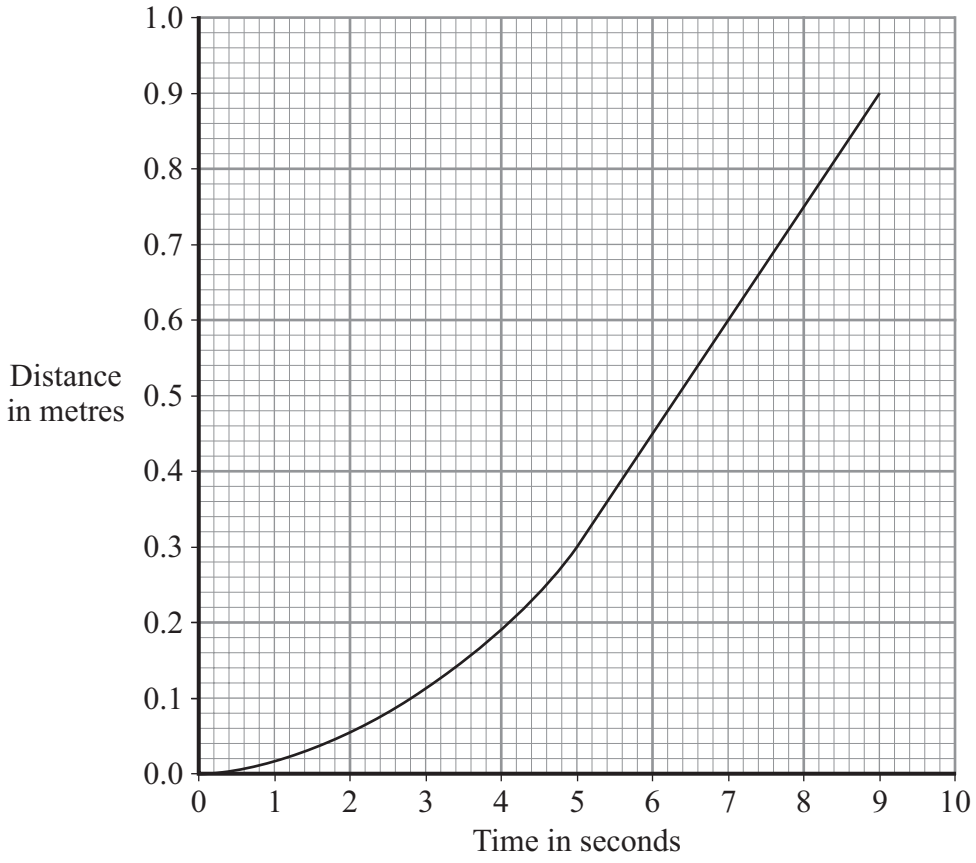
*(1 mark)*

**Question 3 continues on the next page**

**3** (b) The distance – time graph represents the motion of the ball-bearing as it falls through the oil.




**3** (b) (i) Explain, in terms of the forces, **L** and **M**, why the ball-bearing accelerates at first but then falls at constant speed.

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*(3 marks)*

**3** (b) (ii) What name is given to the constant speed reached by the falling ball-bearing?

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*(1 mark)*

**3** (b) (iii) Calculate the constant speed reached by the ball-bearing.

Show clearly how you use the graph to work out your answer.

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Speed = ..... m/s

*(2 marks)*

7

**Turn over for the next question**

**4** The diagram shows a child on a playground swing.
The playground has a rubber safety surface.


**4** (a) The child, with a mass of 35 kg, falls off the swing and hits the ground at a speed of 6 m/s.

**4** (a) (i) Use the equation in the box to calculate the momentum of the child as it hits the ground.

| momentum = mass × velocity |
|---|

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

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Momentum = .....

*(3 marks)*

**4** (a) (ii) After hitting the ground, the child slows down and stops in 0.25 s.
Use the equation in the box to calculate the force exerted by the ground on the child.

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken for the change}}$$

Show clearly how you work out your answer.

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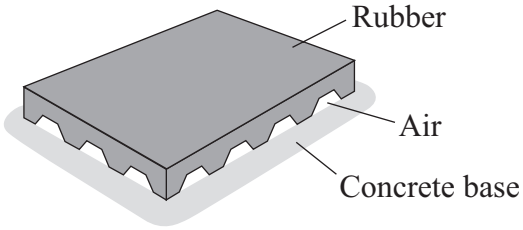
Force = ..... N

*(2 marks)*

**4** (b) The diagram shows the type of rubber tile used to cover the playground surface.




Explain how the rubber tiles reduce the risk of children being seriously injured when they fall off the playground equipment.

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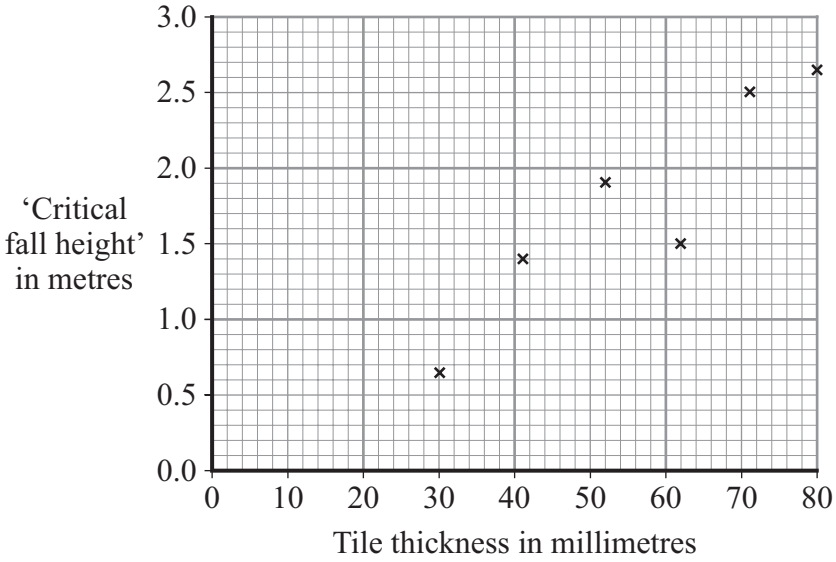
*(3 marks)*

**Question 4 continues on the next page**

**4** (c) The 'critical fall height' is the height that a child can fall and **not** be expected to sustain a life-threatening head injury.
A new type of tile, made in a range of different thicknesses, was tested in a laboratory using test dummies and the 'critical fall height' measured. Only one test was completed on each tile.

The results are shown in the graph.




The 'critical fall height' for playground equipment varies from 0.5 m to 3.0 m.

Suggest **two** reasons why more tests are needed before this new type of tile can be used in a playground.

1.....

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2.....

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*(2 marks)*

**4** (d) Developments in technology allow manufacturers to make rubber tiles from scrap car tyres.

Suggest why this process may benefit the environment.

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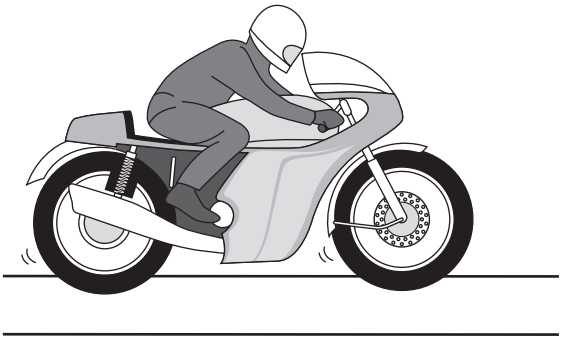
*(1 mark)*

**11**

**5** The diagram shows a motorbike of mass 300 kg being ridden along a straight road.



The rider sees a traffic queue ahead. He applies the brakes and reduces the speed of the motorbike from 18 m/s to 3 m/s.

**5** (a) Use the equation in the box to calculate the kinetic energy lost by the motorbike.

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

Show clearly how you work out your answer.

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Kinetic energy lost = ..... J

*(2 marks)*

**5** (b) (i) How much work is done on the motorbike by the braking force?

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*(1 mark)*

**5** (b) (ii) What happens to the kinetic energy lost by the motorbike?

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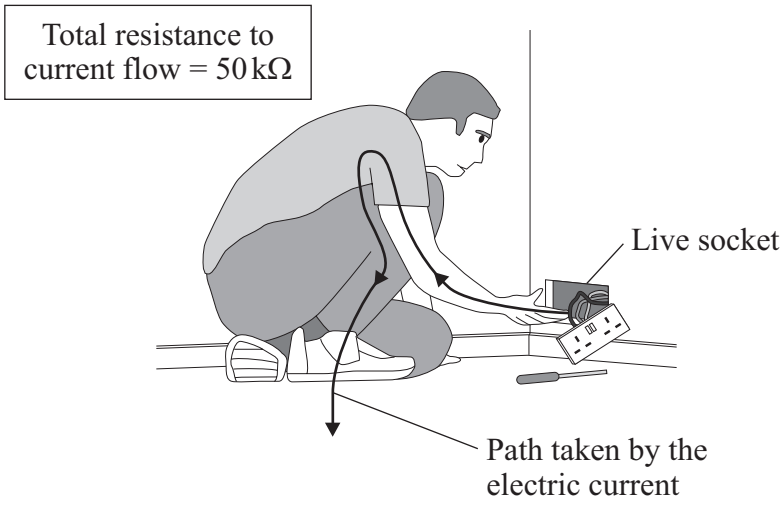
*(1 mark)*

**4**

**6** The diagram shows someone accidentally touching the live wire inside a dismantled 230 volt mains electricity socket.

A current flows through the person giving him an electric shock.




**6** (a) (i) Use the equation in the box to calculate the current that will flow through the person.

| potential difference | = | current | × | resistance |
|---|---|---|---|---|

Show clearly how you work out your answer.

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Current = ..... A

*(2 marks)*

**6** (a) (ii) Rubber is a good insulator.

Explain why it is a good idea for electricians to wear rubber soled boots when working.

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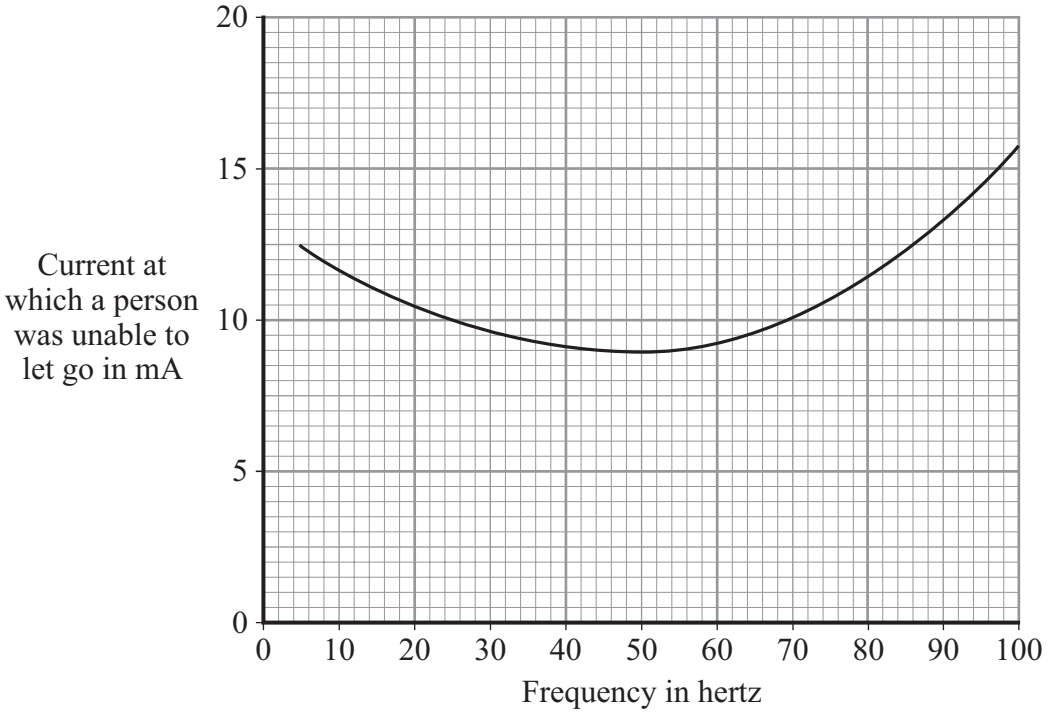
*(2 marks)*

**6** (b) If the current flowing through a person is too high, the person cannot let go of the electrical source.

Different people were tested to see whether the ability to let go of an electrical source depended on the frequency of the current.

The results of the test are shown in the graph.




**6** (b) (i) What is the frequency of the mains electricity supply in the UK?

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*(1 mark)*

**6** (b) (ii) From a safety point of view, is the frequency of the UK mains electricity supply suitable?

Give a reason for your answer.

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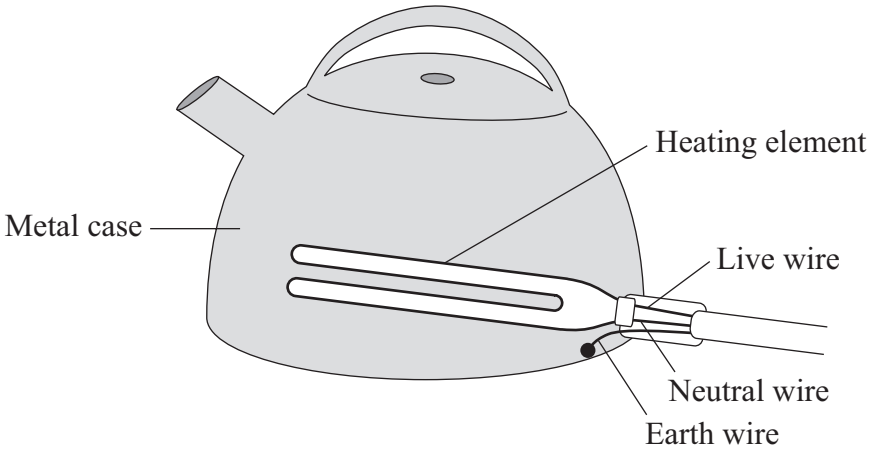
*(1 mark)*

**Question 6 continues on the next page**

**6** (c) The diagram shows how the electric supply cable is connected to an electric kettle. The earth wire is connected to the metal case of the kettle.




If a fault makes the metal case live, the earth wire and the fuse inside the plug protect anyone using the kettle from an electric shock.

Explain how.

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*(2 marks)*

8

**END OF QUESTIONS**