| Centre Number | | | | | | Candidate Number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
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| 6 | |
| 7 | |
| TOTAL | |

General Certificate of Secondary Education
Higher Tier
June 2012

# Additional Science PH2HP

**Unit Physics P2**

**H**

# Physics

**Unit Physics P2**

**Wednesday 30 May 2012 1.30 pm to 2.30 pm**

**For this paper you must have:**
- a ruler
- the Physics Equations Sheet (enclosed).

You may use a calculator.

**Time allowed**
- 1 hour

**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 60.
- You are expected to use a calculator where appropriate.
- Question 3 (b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

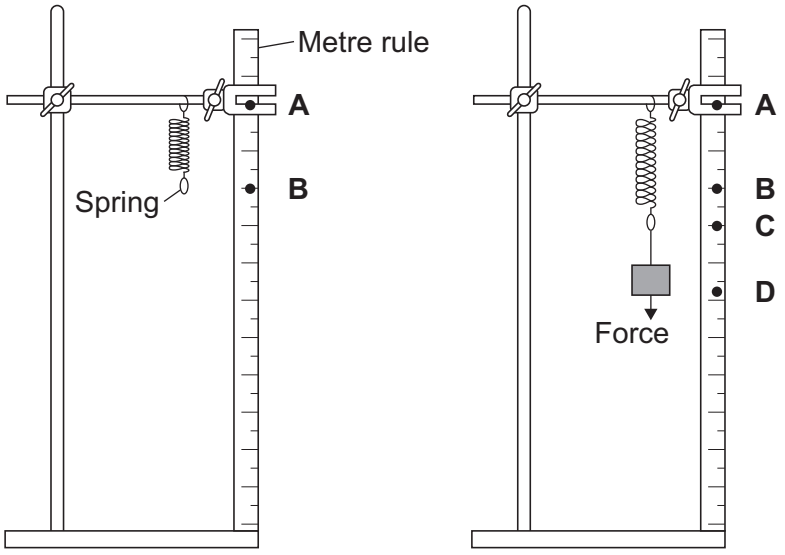
**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

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

**1** A student investigated how the extension of a spring depends on the force applied to the spring.

The diagram shows the spring before and after a force had been applied.




**1 (a) (i)** Complete the following sentence using letters, **A**, **B**, **C** or **D**, from the diagram.

The extension of the spring is the distance between the positions labelled .....

and ..... on the metre rule.

*(1 mark)*

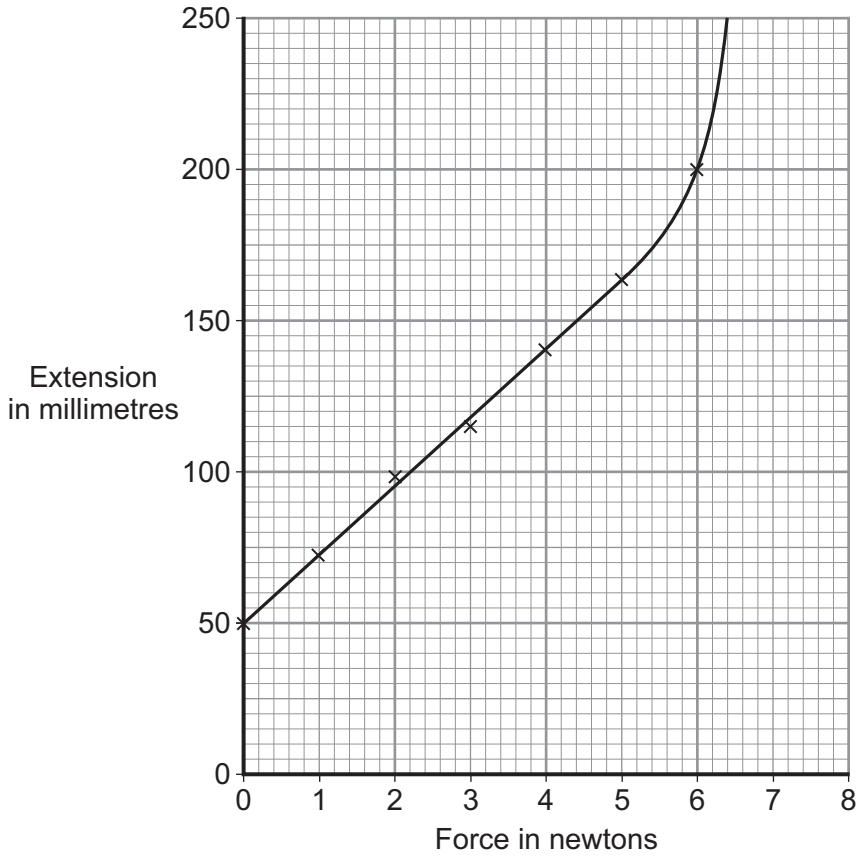
**1 (a) (ii)** What form of energy is stored in the stretched spring?

.....

*(1 mark)*

**Question 1 continues on the next page**

**1 (b)** The results from the investigation are plotted on the following graph.




**1 (b) (i)** The graph shows that the student has made an error throughout the investigation.

What error has the student made?

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.....

Give the reason for your answer.

.....

.....

*(2 marks)*

**1 (b) (ii)** The student has loaded the spring beyond its *limit of proportionality*.

Mark on the graph line the *limit of proportionality* of the spring. Label the point **P**.

Give the reason for choosing your point **P**.

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*(2 marks)*

**1 (c)** The student uses a different spring as a spring balance. When the student hangs a stone from this spring, its extension is 72 mm.

The spring does not go past the limit of proportionality.

Calculate the force exerted by the stone on the spring.

spring constant = 25 N/m

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Force = ..... N

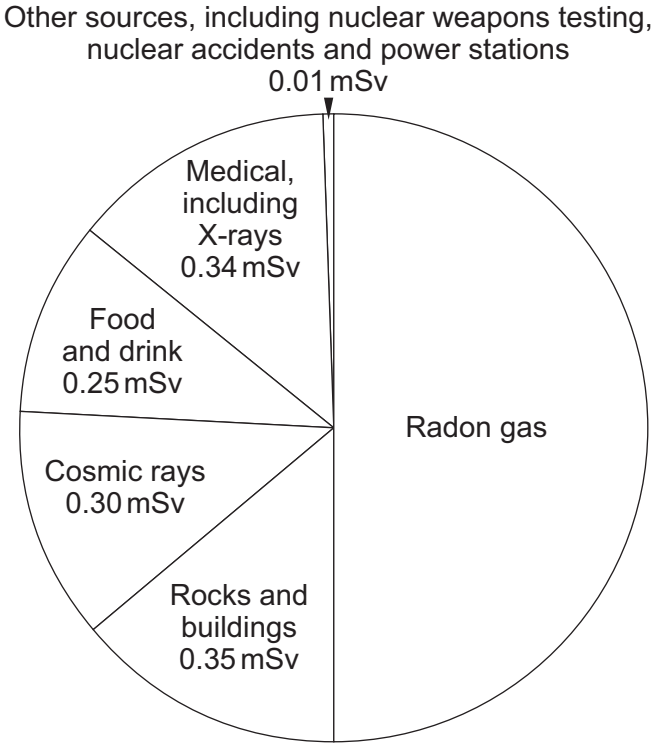
*(2 marks)*

8

**Turn over for the next question**

**2** 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).




**2 (a) (i)** What is the radiation dose that the average person in the UK receives from radon gas?

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Radiation dose from radon gas = ..... mSv

*(1 mark)*

**2 (a) (ii)** A person may receive a higher than average dose of radiation from background sources.

Suggest **two** reasons why.

1 .....

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2 .....

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*(2 marks)*

**2 (b)** Exposure to radon gas can cause lung cancer.
A recent study has compared the risk of getting lung cancer, by the age of 75 years, for cigarette smokers and non-smokers.
The people in the study had been exposed throughout their lives to different levels of radon gas.
A summary of the data produced from the study is given in the table.

| **Exposure to radon gas** | **Risk of lung cancer by age of 75** | |
|---|---|---|
| | **Non-smoker** | **Smoker** |
| No exposure | 0.4 % | 10 % |
| Moderate exposure | 1.0 % | 14 % |
| Very high exposure | 1.5 % | 32 % |

**2 (b) (i)** Why were people that have had **no exposure** to radon gas included in the study?

.....

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*(1 mark)*

**2 (b) (ii)** Using information from the table, what conclusions can be made about exposure to radon gas and the risk of getting lung cancer?

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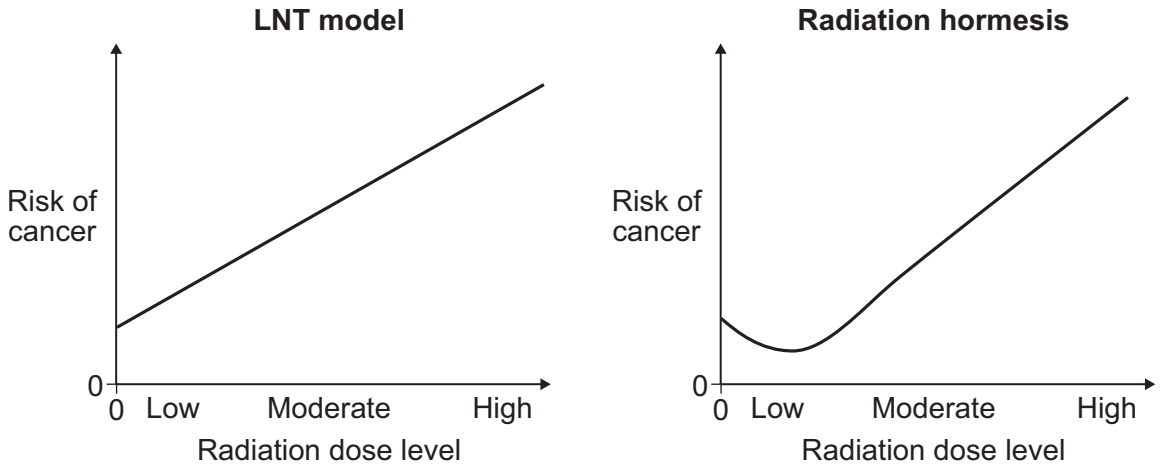
*(2 marks)*

**Question 2 continues on the next page**

**2 (c)** At the moment, the regulations designed to protect people from over-exposure to radiation are based on a model called the 'linear no-threshold' (LNT) model.
Some scientists believe that the LNT model is too simple. These scientists believe that at low radiation levels a process called 'radiation hormesis' happens.

The graphs show that each model suggests a link between the risk of developing a cancer and exposure to low levels of radiation.




The link between the risk of developing cancer and exposure to low levels of radiation suggested by each of the models is different.

Describe how.

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*(2 marks)*

**2 (d)** Scientists have conducted experiments in which mice have been exposed to different levels of radiation. The number of mice developing a cancer has then been measured.

Discuss whether it is ethical to use animals in scientific experiments.

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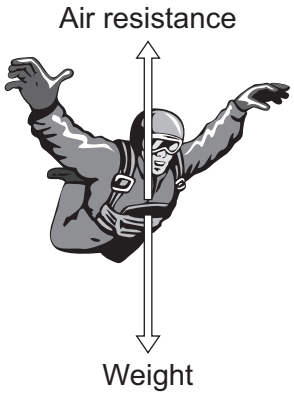
*(2 marks)*

10

**Turn over for the next question**

**3 (a)** The diagram shows the forces acting on a parachutist in free fall.




The parachutist has a mass of 75 kg.

Calculate the weight of the parachutist.

| gravitational field strength = 10 N/kg |
|---|

Use the correct equation from the Physics Equations Sheet.

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

.....

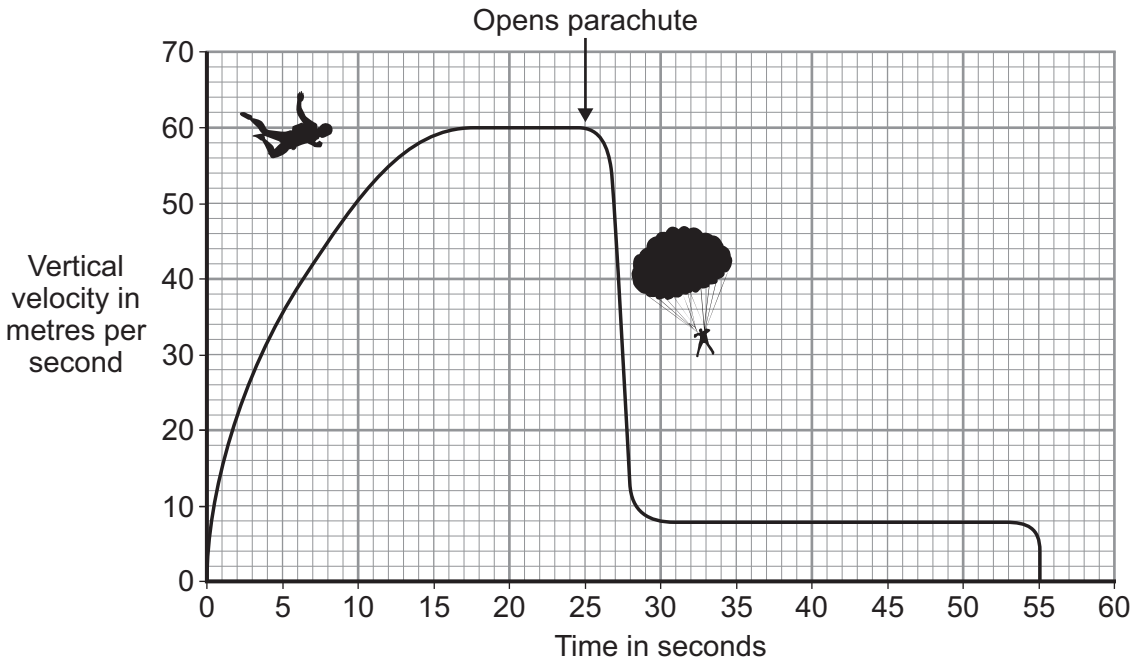
.....

Weight = .....

*(3 marks)*

**3 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The graph shows how the vertical velocity of a parachutist changes from the moment the parachutist jumps from the aircraft until landing on the ground.




Using the idea of forces, explain why the parachutist reaches a terminal velocity and why opening the parachute reduces the terminal velocity.

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*(6 marks)*

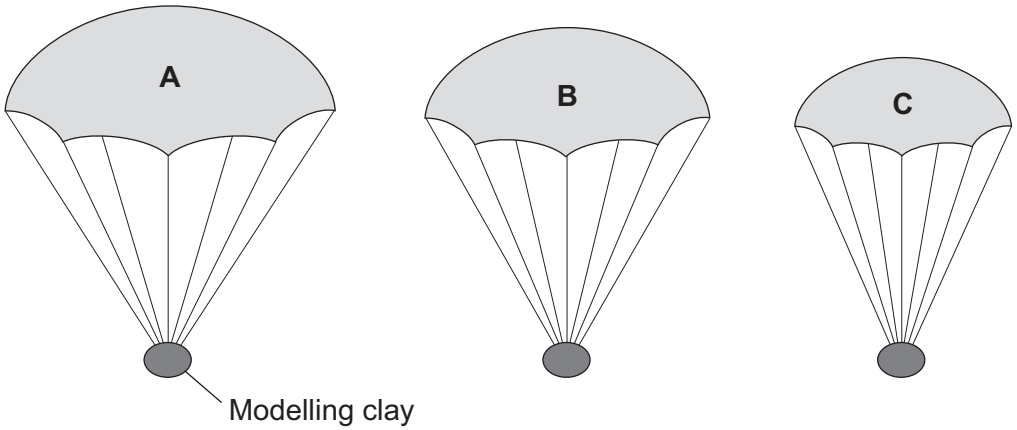
**Question 3 continues on the next page**

**Turn over ▶**

**3 (c)** A student wrote the following hypothesis.

*'The larger the area of a parachute, the slower a parachutist falls.'*

To test this hypothesis the student made three model parachutes, **A**, **B** and **C**, from one large plastic bag. The student dropped each parachute from the same height and timed how long each parachute took to fall to the ground.




**3 (c) (i)** The height that the student dropped the parachute from was a control variable.

Name **one** other control variable in this experiment.

.....

*(1 mark)*

**3 (c) (ii)** Use the student's hypothesis to predict which parachute, **A**, **B** or **C**, will hit the ground first.

Write your answer in the box. ☐

Give a reason for your answer.

.....

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*(2 marks)*

12

**Turn over for the next question**

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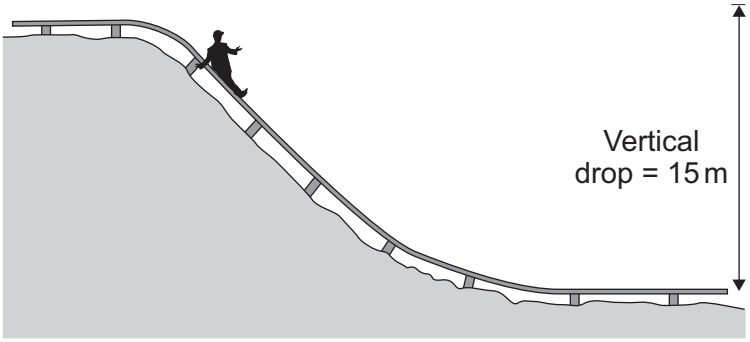
**ANSWER IN THE SPACES PROVIDED**

**4** The miners working in a salt mine use smooth wooden slides to move quickly from one level to another.




**4 (a)** A miner of mass 90 kg travels down the slide.

Calculate the change in gravitational potential energy of the miner when he moves 15m vertically downwards.

| gravitational field strength = 10 N/kg |
|---|

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Change in gravitational potential energy = ..... J

*(2 marks)*

**4 (b)** Calculate the **maximum** possible speed that the miner could reach at the bottom of the slide.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

Give your answer to an appropriate number of significant figures.

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Maximum possible speed = ..... m/s

*(3 marks)*

**4 (c)** The speed of the miner at the bottom of the slide is much less than the calculated maximum possible speed.

Explain why.

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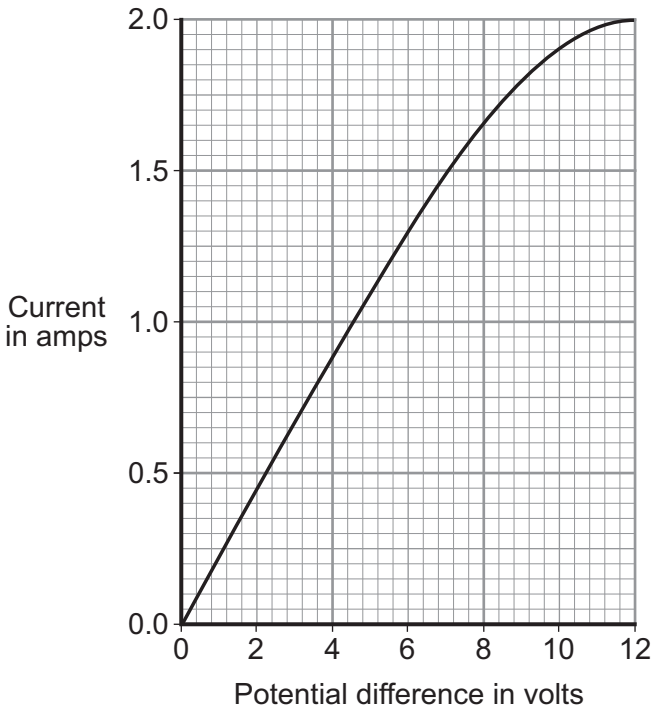
*(3 marks)*

8

**Turn over for the next question**

**5** The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.




**5 (a)** What is the meaning of the following terms?

electric current

.....

.....

potential difference

.....

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*(2 marks)*

**5 (b)** The resistance of the metal filament inside the bulb increases as the potential difference across the bulb increases.

Explain why.

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*(3 marks)*

**5 (c)** Use data from the graph to calculate the rate at which the filament bulb transfers energy, when the potential difference across the bulb is 6 V.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Rate of energy transfer = ..... W

*(2 marks)*

7

**Turn over for the next question**

**There are no questions printed on this page**

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**ANSWER IN THE SPACES PROVIDED**

**6 (a)** As part of its life cycle, a star changes from being a protostar to a main sequence star.

Explain the difference between a protostar and a main sequence star.

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*(2 marks)*

**6 (b)** The early Universe contained only atoms of hydrogen. The Universe now contains atoms of over one hundred different elements.

Explain how the different elements now contained in the Universe were formed.

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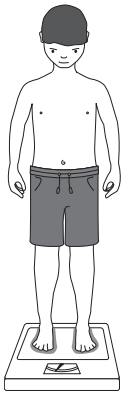
*(3 marks)*

5

**Turn over for the next question**

**7 (a)** The picture shows a person using a set of electronic 'Body Fat Scales'. When the person stands on the scales, a small, harmless, electric current passes through the person's body. The scales then calculate the resistance of the person's body and convert the resistance into a *prediction* of body fat content.



**7 (a) (i)** The scales contain two 3 V cells joined in series.

Calculate the resistance of a person's body, if when he stands on the scales, a current of 0.12 mA passes through his body.

1000 mA = 1 A

Use the correct equation from the Physics Equations Sheet.

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

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Resistance = .....

*(3 marks)*

**7 (a) (ii)** The scales can only produce a *prediction* of body fat content and not an accurate measurement.

Suggest why.

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*(1 mark)*

**7 (a) (iii)** It is recommended that the scales are **not** used immediately after a person has drunk a large amount of water.

Suggest why.

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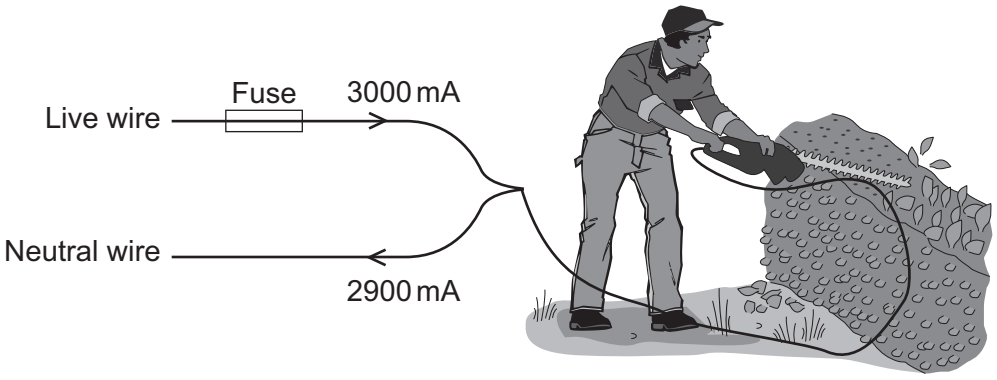
*(2 marks)*

**Question 7 continues on the next page**

**7 (b)** The diagram shows how someone could get an electric shock from accidentally cutting into an electric cable. If this happens, and a Residual Current Circuit Breaker (RCCB) is being used, the circuit will switch off automatically.




**7 (b) (i)** A faulty appliance or circuit can be switched off by a RCCB or a fuse.

Compare the action of a RCCB with the action of a fuse.

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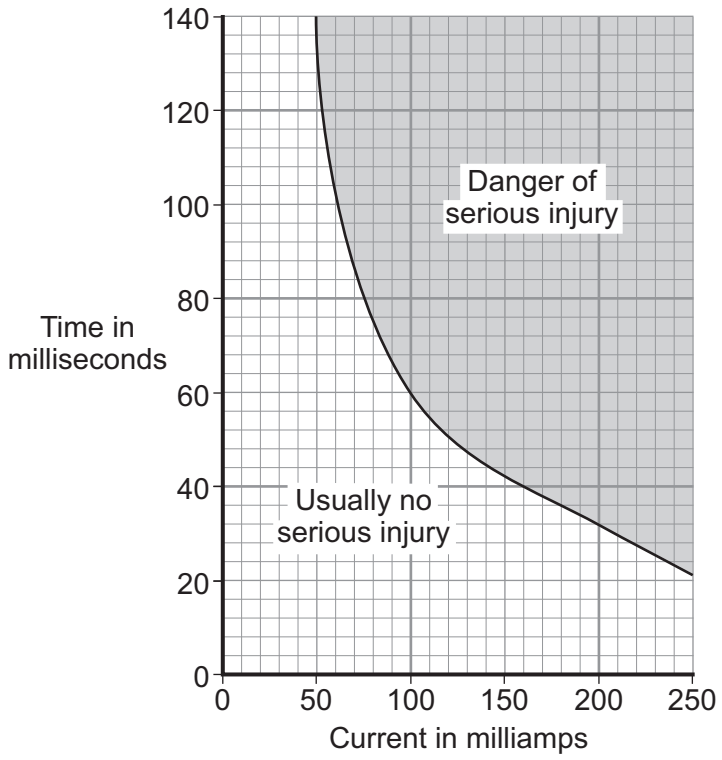
*(2 marks)*

**7 (b) (ii)** The graph shows how the severity of an electric shock depends on the size of the current and the time that the current flows through the body.




Using the RCCB helps prevent an electric shock seriously injuring the person using the hedge trimmers.

Using information from both the diagram and the graph explain how.

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*(2 marks)*

10

**END OF QUESTIONS**

**There are no questions printed on this page**

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**ANSWER IN THE SPACES PROVIDED**