

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**B712/02**

**GATEWAY SCIENCE  
SCIENCE B**

**Science modules B2, C2, P2  
(Higher Tier)**

**FRIDAY 5 JUNE 2015: Afternoon**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED 24pt**

|                               |  |                              |  |
|-------------------------------|--|------------------------------|--|
| <b>Candidate<br/>forename</b> |  | <b>Candidate<br/>surname</b> |  |
|-------------------------------|--|------------------------------|--|

|                          |  |  |  |  |  |                             |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|
| <b>Centre<br/>number</b> |  |  |  |  |  | <b>Candidate<br/>number</b> |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|

**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**A copy of the Periodic Table**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**

**Use black ink. HB pencil may be used for graphs and diagrams only.**

**Answer ALL the questions.**

**Read each question carefully. Make sure you know what you have to do before starting your answer.**

**Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil () .**

**A list of equations can be found on pages 4–5.**

**The number of marks is given in brackets [ ] at the end of each question or part question.**

**The total number of marks for this paper is 85.**

**Any blank pages are indicated.**

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## **EQUATIONS**

**energy = mass × specific heat capacity × temperature change**

**energy = mass × specific latent heat**

**efficiency =  $\frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$**

**wave speed = frequency × wavelength**

**power = voltage × current**

**energy supplied = power × time**

**average speed =  $\frac{\text{distance}}{\text{time}}$**

**distance = average speed × time**

**$s = \frac{(u + v)}{2} \times t$**

**acceleration =  $\frac{\text{change in speed}}{\text{time taken}}$**

**force = mass × acceleration**

**weight = mass × gravitational field strength**

**work done = force × distance**

**power =  $\frac{\text{work done}}{\text{time}}$**

**power = force × speed**

$$\text{KE} = \frac{1}{2}mv^2$$

**momentum = mass × velocity**

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

$$\text{GPE} = mgh$$

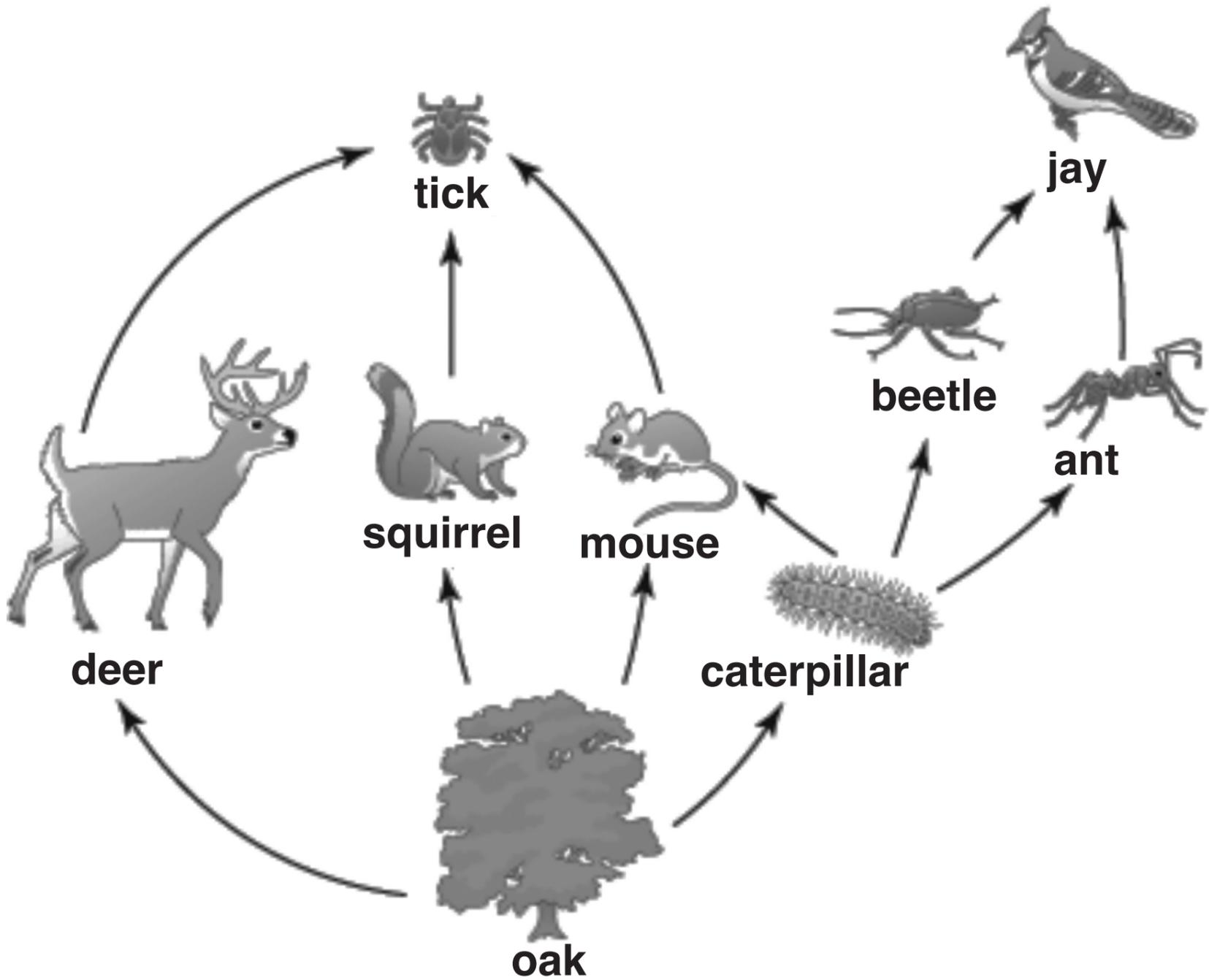
$$mgh = \frac{1}{2}mv^2$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer ALL the questions.

SECTION A – Module B2

1 Look at the food web.



(a) Ticks are parasites.

Use the food web and your scientific knowledge to explain why ticks are parasites.

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[1]

**(b) Explain what is meant by the term INTERSPECIFIC competition.**

**Include ONE example from the food web in your answer.**

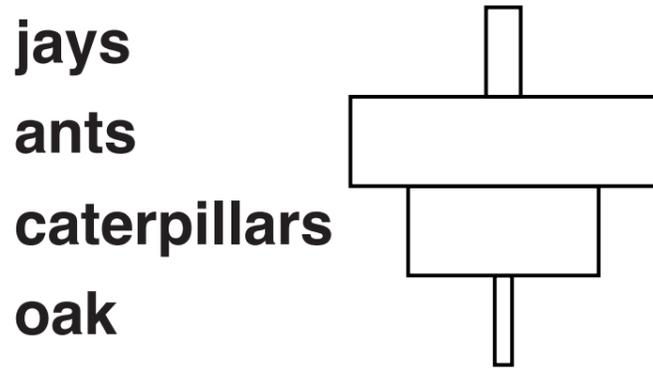
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**[2]**

**(c) Look at the pyramid of NUMBERS for one food chain from the food web.**



**A pyramid of BIOMASS for the food chain would look different to this pyramid of numbers.**

**Draw a pyramid of biomass and explain why it is different to the pyramid of numbers.**

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[2]

**(d) Nitrogen is recycled within the food web.**

**The sentences describe one way nitrogen is recycled.**

**Finish the sentences by adding ONE different word in each space.**

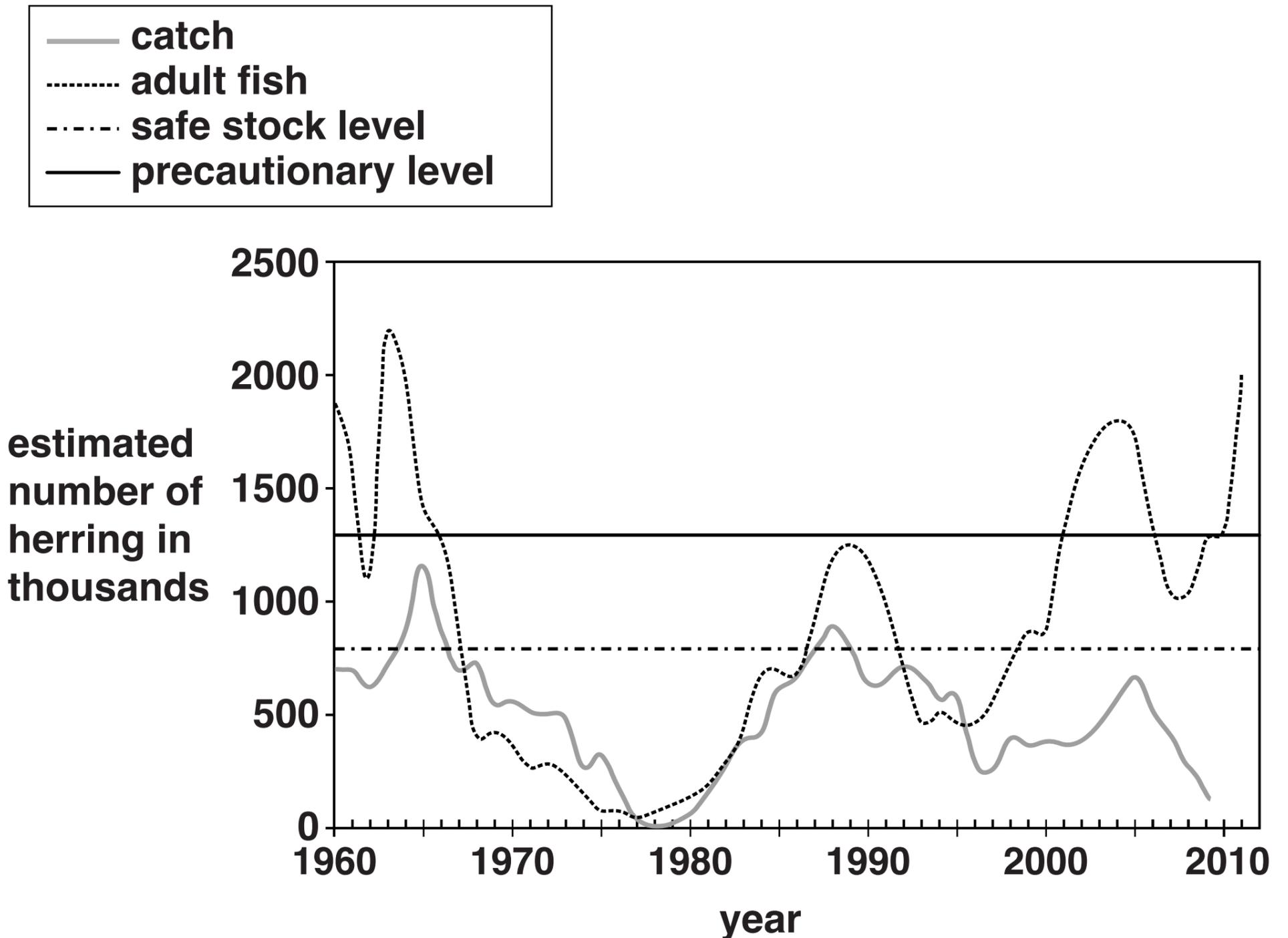
**A mouse dies and decomposers convert protein from the mouse into \_\_\_\_\_ .**

**This chemical is then converted into nitrates by \_\_\_\_\_ bacteria.**

**The oak can then take up the nitrates from the soil. [2]**

## 2 Look at the graph.

It shows the estimated number of herring in part of the North Sea and the number of herring that were caught.



The safe stock level is the number of fish there needs to be to prevent the risk of extinction.

The precautionary level is the number of fish that organisations would like to have to make sure the herring population is safe.

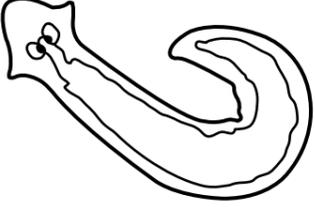
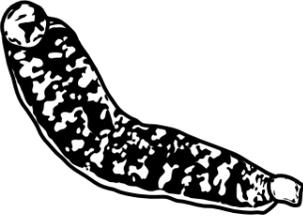


**3 Zack investigates water pollution levels in a stream.**

**He does this by taking water samples from the stream.**

**Zack then looks for INDICATOR SPECIES within the sample.**

**The chart shows the indicator species he looks for.**

| <b>CLEAN WATER</b>  |   |
|---|---|
| <b>caddis fly larva</b><br>   | <b>dragonfly nymph</b><br> |
| <b>SOME POLLUTION IN WATER</b>  |   |
| <b>flatworm</b><br>          | <b>leech</b><br>          |
| <b>VERY POLLUTED WATER</b>  |   |
| <b>rat-tailed maggot</b><br> | <b>bloodworm</b><br>       |

**Zack takes five water samples from the same part of a stream.**

Look at the table.

It shows his results.

| Indicator species | Number in each sample |          |          |          |          | Mean |
|-------------------|-----------------------|----------|----------|----------|----------|------|
|                   | Sample 1              | Sample 2 | Sample 3 | Sample 4 | Sample 5 |      |
| caddis fly lava   | 1                     | 1        | 0        | 0        | 1        | 1    |
| dragonfly nymph   | 1                     | 0        | 0        | 1        | 0        | 0    |
| flatworm          | 6                     | 6        | 9        | 8        | 7        | 7    |
| leech             | 7                     | 5        | 9        | 10       | 7        |      |
| rat-tailed maggot | 4                     | 0        | 2        | 2        | 1        | 2    |
| bloodworm         | 3                     | 1        | 1        | 3        | 0        | 2    |

(a) The mean number of leech is missing from the table.

(i) Calculate the mean for the leech.

Give your answer to the nearest whole number.

Mean number of leech \_\_\_\_\_ [2]

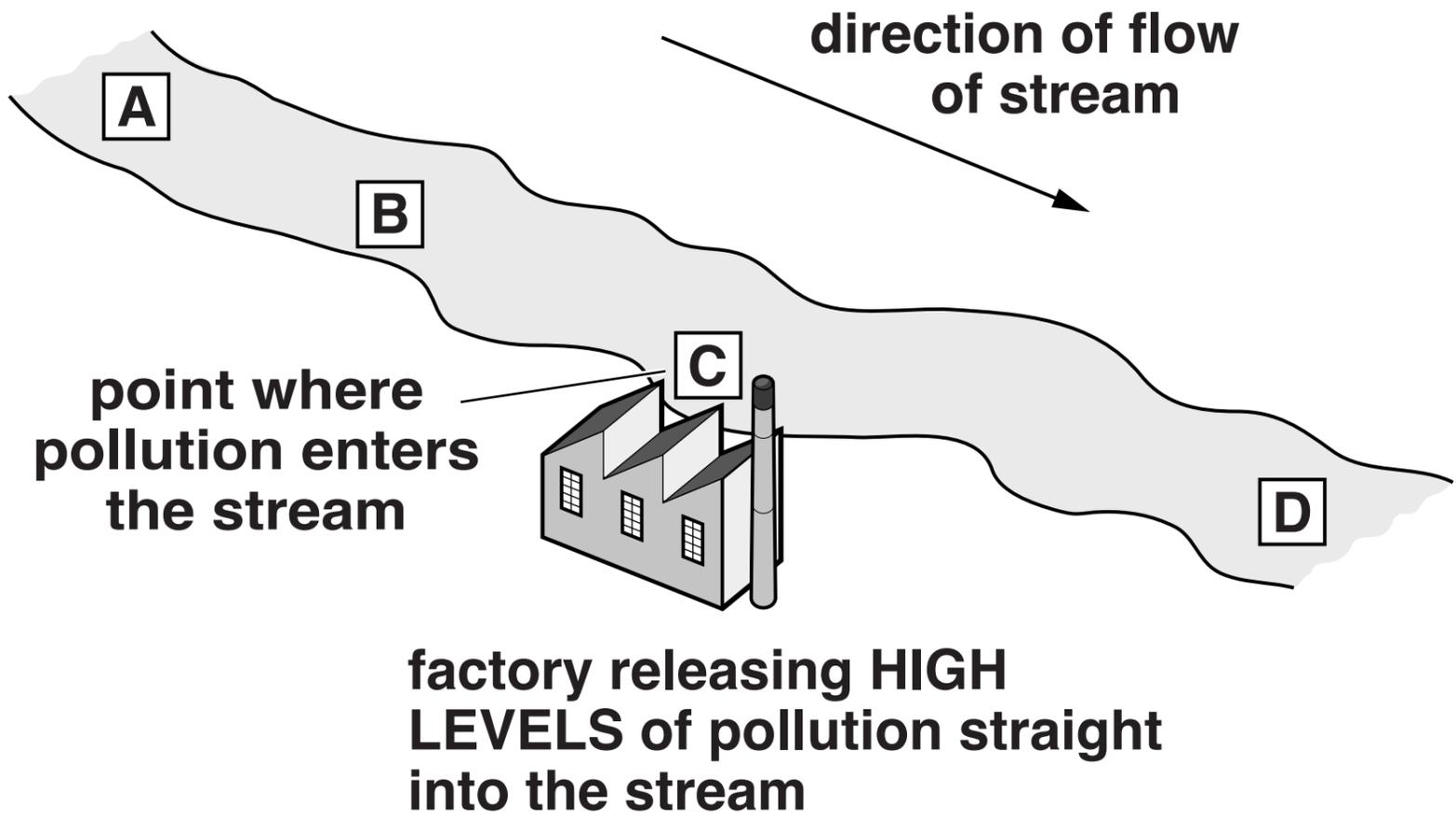
(ii) Explain how the means show the water in the samples is polluted.

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ [2]

**(b) Look at the diagram.**

**It shows four parts of the stream, A, B, C and D.**



**Look at the results.**

**(i) Where did Zack take his samples from?**

**Choose from A, B, C or D**

\_\_\_\_\_

**[1]**

**(ii) Explain your answer.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[2]**

- 4 (a) The binomial name for the Mikado pheasant is *Syrmaticus mikado*.

Which genus does the pheasant belong to?

\_\_\_\_\_ [1]

- (b) The pheasant is under threat of becoming an **ENDANGERED SPECIES**.

To become endangered the number of pheasants must fall below a certain level.

What is this level called?

Choose from the list.

critical

crucial

quota

vital

viable

answer \_\_\_\_\_

[1]

**(c) Male pheasants are brightly coloured to attract a mate.**

**The pheasants evolved to have bright colours because of natural selection.**

**Look at the list of stages in natural selection.**

**organisms show variation**

**there is competition for resources**

**features are inherited**

**Which stage of natural selection is missing?**

\_\_\_\_\_ **[1]**

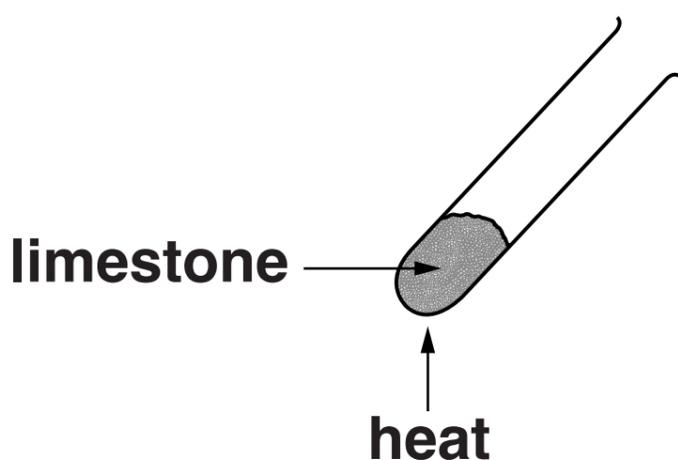
**(d) Darwin and Lamarck both had different theories about natural selection.**

**Explain why an understanding of genetics has made scientists favour Darwin's ideas.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

## SECTION B – Module C2

5 Bob and Gill heat some limestone.



Limestone is calcium carbonate,  $\text{CaCO}_3$ .

Calcium carbonate thermally decomposes to make calcium oxide and carbon dioxide.

(a) Write a **BALANCED SYMBOL** equation for this reaction.

\_\_\_\_\_ [2]

(b) What is meant by **THERMAL DECOMPOSITION**?

\_\_\_\_\_ [1]

(c) Cement is made using limestone.

Write about how cement can be made from limestone.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(d) Bob and Gill also investigate the hardness of different minerals.**

**Look at the table. It shows their results.**

| <b>MINERAL</b>   | <b>DESCRIPTION OF TEST</b>                                |
|------------------|---|
| <b>limestone</b> | <b>scratched by a copper penny</b>                        |
| <b>granite</b>   | <b>not scratched by a steel knife but scratches steel</b> |
| <b>talc</b>      | <b>scratched by a fingernail</b>                          |
| <b>marble</b>    | <b>steel knife scratches it easily</b>                    |

**Steel is harder than copper.**

**Place the minerals in order of their hardness.**

**Put the hardest first.**

**hardest** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**softest** \_\_\_\_\_

**[2]**

**(e) Granite and limestone have different hardnesses.**

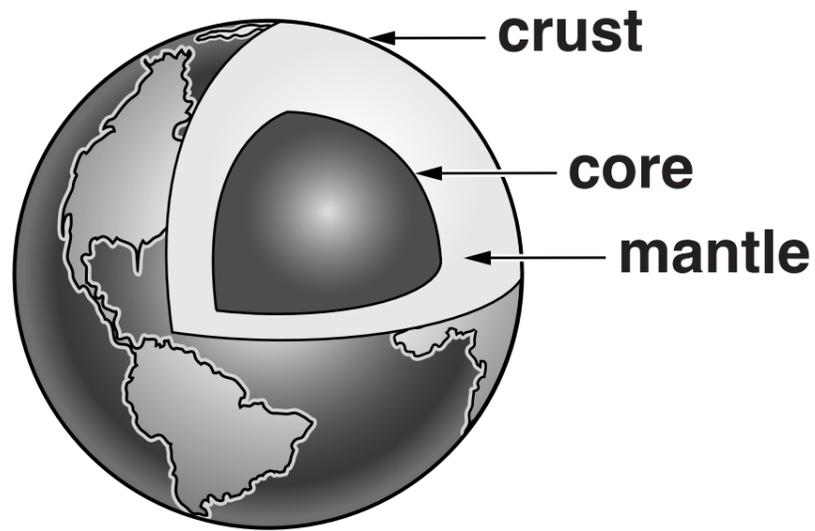
**Use ideas about rock types to explain why.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[2]**

**6 The diagram shows the structure of the Earth.**



**NOT TO SCALE**

**(a) The lithosphere is part of the structure of the Earth.**

**What is meant by the LITHOSPHERE?**

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**[1]**

**(b) Geologists have problems studying the structure of the Earth.**

**Write about ONE of these problems.**

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**[1]**

**(c) The theory of plate tectonics did not exist in 1900.**

**The theory of plate tectonics is now widely accepted by scientists.**

**Describe some of the stages in the development of the theory of plate tectonics.**

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**[2]**

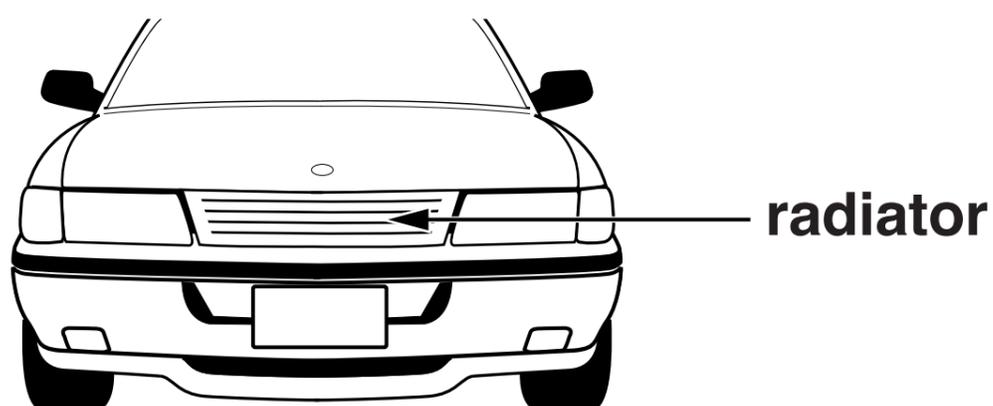
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## 7 Brass is an alloy of copper and zinc.

Look at the table. It shows some properties of copper, brass and zinc.

| METAL OR ALLOY | PROPERTY            |                              |                               |                   |                                     |
|----------------|---------------------|------------------------------|-------------------------------|-------------------|-------------------------------------|
|                | Melting point in °C | Density in g/cm <sup>3</sup> | Relative conductivity of heat | Relative strength | Malleability                        |
| brass          | 900                 | 8.4                          | 109                           | 55                | malleable                           |
| copper         | 1083                | 8.9                          | 401                           | 22                | very malleable                      |
| zinc           | 420                 | 7.1                          | 116                           | 15                | brittle except at high temperatures |

(a) Car engines are fitted with radiators.



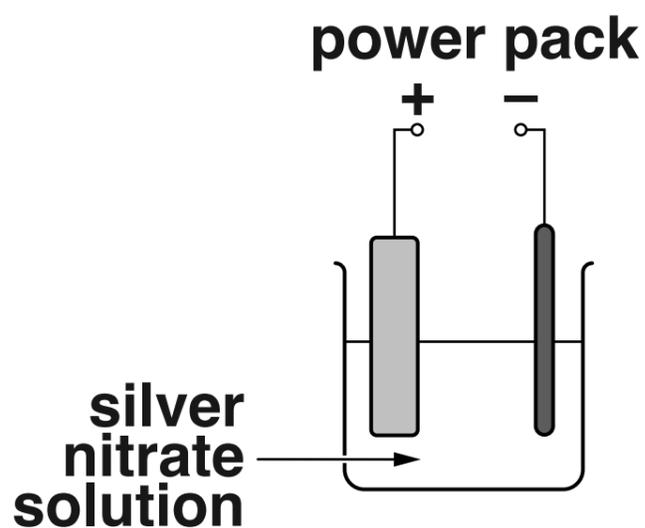
Hot water from the engine gives out heat in the radiator to keep the engine cool.



8 John wants to purify some impure silver.

John's friend tells him that silver is purified IN A SIMILAR WAY TO COPPER.

Look at the diagram of the apparatus John uses to purify silver.



Silver nitrate solution contains silver ions,  $\text{Ag}^+$ .

Suggest how John could purify impure silver by electrolysis.

Your answer should include the equations for the reactions at the positive and negative electrodes. Use  $e^-$  to represent an electron.



The quality of written communication will be assessed in your answer to this question.

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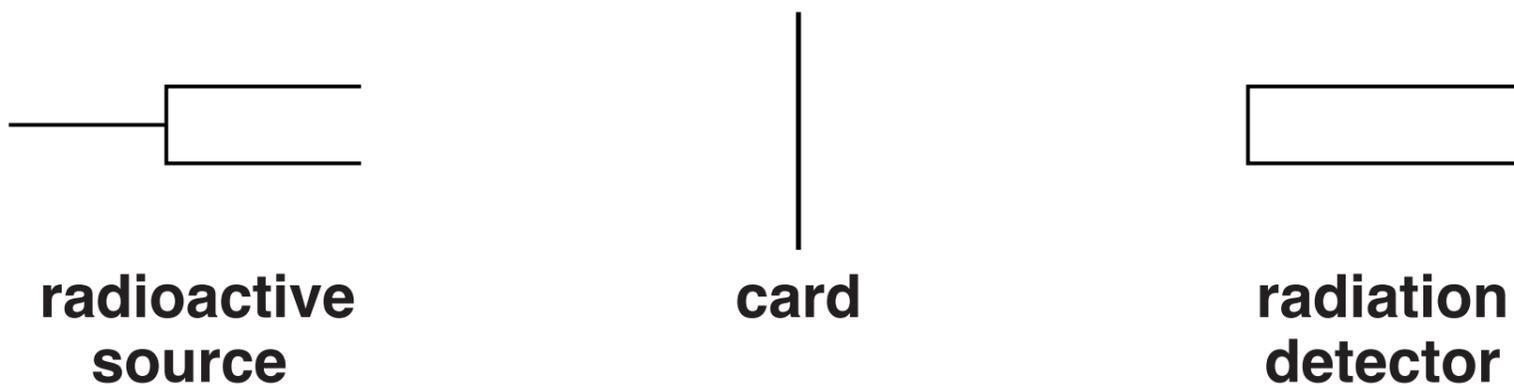
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[6]

## SECTION C – Module P2

- 9 Katy investigates how the count rate from radioactive sources changes when different thicknesses of card are placed between a source and a detector.

Look at the diagram.



- (a) Look at the table of results opposite.

It shows the count rates in counts per minute (cpm) for three radioactive sources.

Each source in the table gives out only one type of radiation.

Use the results to identify the TYPE of radiation given out by each source A, B and C.

Source A \_\_\_\_\_

Source B \_\_\_\_\_

Source C \_\_\_\_\_

[2]

| Radioactive source | Radiation detected in cpm for different thicknesses of card |         |         |         |         |         |  |
|--------------------|---|---------|---------|---------|---------|---------|--|
|                    | no card   | 0.05 mm | 0.10 mm | 0.15 mm | 0.20 mm | 0.25 mm |  |
| <b>A</b>           | 2010  | 1995    | 2008    | 2012    | 1992    | 2010    |  |
| <b>B</b>           | 2010  | 23      | 24      | 22      | 23      | 24      |  |
| <b>C</b>           | 2010  | 1900    | 1252    | 808     | 612     | 452     |  |

**(b) Industries that use radioactive materials and nuclear experiments produce waste.**

**These are two types of waste:**

- 1 contaminated work clothing that has a low level of radioactivity**
- 2 radioactive materials that will remain radioactive for a long time but are no longer useful.**

**Write about the ways that these types of waste can be disposed of safely.**

**1** \_\_\_\_\_  
\_\_\_\_\_

**2** \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ **[2]**

**10 Louis has several electrical appliances in his home.**

**(a) Look at the information in the table.**

| <b>Appliance</b>      | <b>Mean power in kW</b> | <b>Time used each week in hours</b> | <b>Energy used each week in kWh</b> |
|-----------------------|-------------------------|-------------------------------------|-------------------------------------|
| <b>Tumble dryer</b>   | <b>2.0</b>              | <b>2.0</b>                          | <b>4.0</b>                          |
| <b>Kettle</b>         | <b>2.5</b>              | <b>3.0</b>                          | <b>7.5</b>                          |
| <b>Lights</b>         | <b>0.1</b>              | <b>40.0</b>                         | <b>4.0</b>                          |
| <b>Television</b>     | <b>0.5</b>              | <b>5.0</b>                          |                                     |
| <b>Vacuum cleaner</b> | <b>1.0</b>              | <b>1.0</b>                          | <b>1.0</b>                          |

**(i) Calculate the energy used each week by the television.**

**answer \_\_\_\_\_ kWh [1]**

**(ii) Electricity costs 16 p per unit.**

**Calculate the total cost of the electricity for the tumble dryer AND the kettle each week.**

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**answer \_\_\_\_\_ pence [2]**

**(b) Louis uses off peak electricity for some of his energy.**

**He does not use off peak electricity for his vacuum cleaner.**

**Explain why.**

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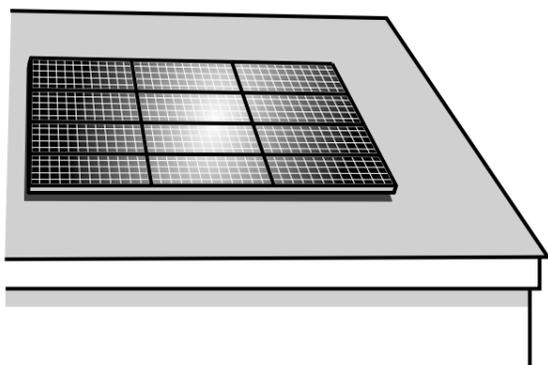
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**[2]**



**12 The solar panels on this house are made up of photocells.**



**(a) Mia investigates how the current output of photocells depends on:**

**light intensity**

**surface area.**

**Look at her results.**

|                                     |             |             |             |
|-------------------------------------|-------------|-------------|-------------|
| <b>Area in m<sup>2</sup></b>        | <b>0.30</b> | <b>0.30</b> | <b>1.20</b> |
| <b>Intensity in W/m<sup>2</sup></b> | <b>200</b>  | <b>400</b>  | <b>400</b>  |
| <b>Current in A</b>                 | <b>0.5</b>  | <b>1.0</b>  | <b>4.0</b>  |

**Mia says ‘If you double the surface area and also double the light intensity then the current doubles.’**

**Use the information in the table to explain why Mia’s statement is incorrect.**

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**[2]**

**(b) In some parts of the world electricity is produced using solar power stations.**

**A solar power station has a useful output of 60 MJ/s and an input of 333 MJ/s.**

**Calculate the percentage efficiency of this power station.**

**answer \_\_\_\_\_ % [2]**

**(c) Each solar panel produces a current of 2.5 A at a voltage of 20V.**

**(i) Calculate the power output of the solar panel.**

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**answer \_\_\_\_\_ W [1]**

**(ii) Calculate the number of these solar panels needed to produce an output of 60 MW.**

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**\_\_\_\_\_ [1]**



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## SECTION D

14 A rugby team wants to improve the fitness of its players.

Five players were put on a special diet.

The aim of the diet was to reduce body fat and increase muscle.

Look at the table.

It shows the body fat percentage and muscle percentage for the five players before and after the diet.

| Player | Body fat percentage |       |            | Muscle percentage |       |            |
|--------|---------------------|-------|------------|-------------------|-------|------------|
|        | Before              | After | Difference | Before            | After | Difference |
| A      | 25.6                | 20.2  | -5.4       | 56.6              | 61.0  | +4.4       |
| B      | 16.5                | 15.9  | -0.6       | 59.7              | 62.5  | +2.8       |
| C      | 22.5                | 20.1  | -2.4       | 52.6              | 54.4  | +1.8       |
| D      | 13.6                | 11.9  | -1.7       | 60.0              | 63.4  | +3.4       |
| E      | 25.5                | 22.4  | -3.1       | 54.6              | 57.8  | +3.2       |

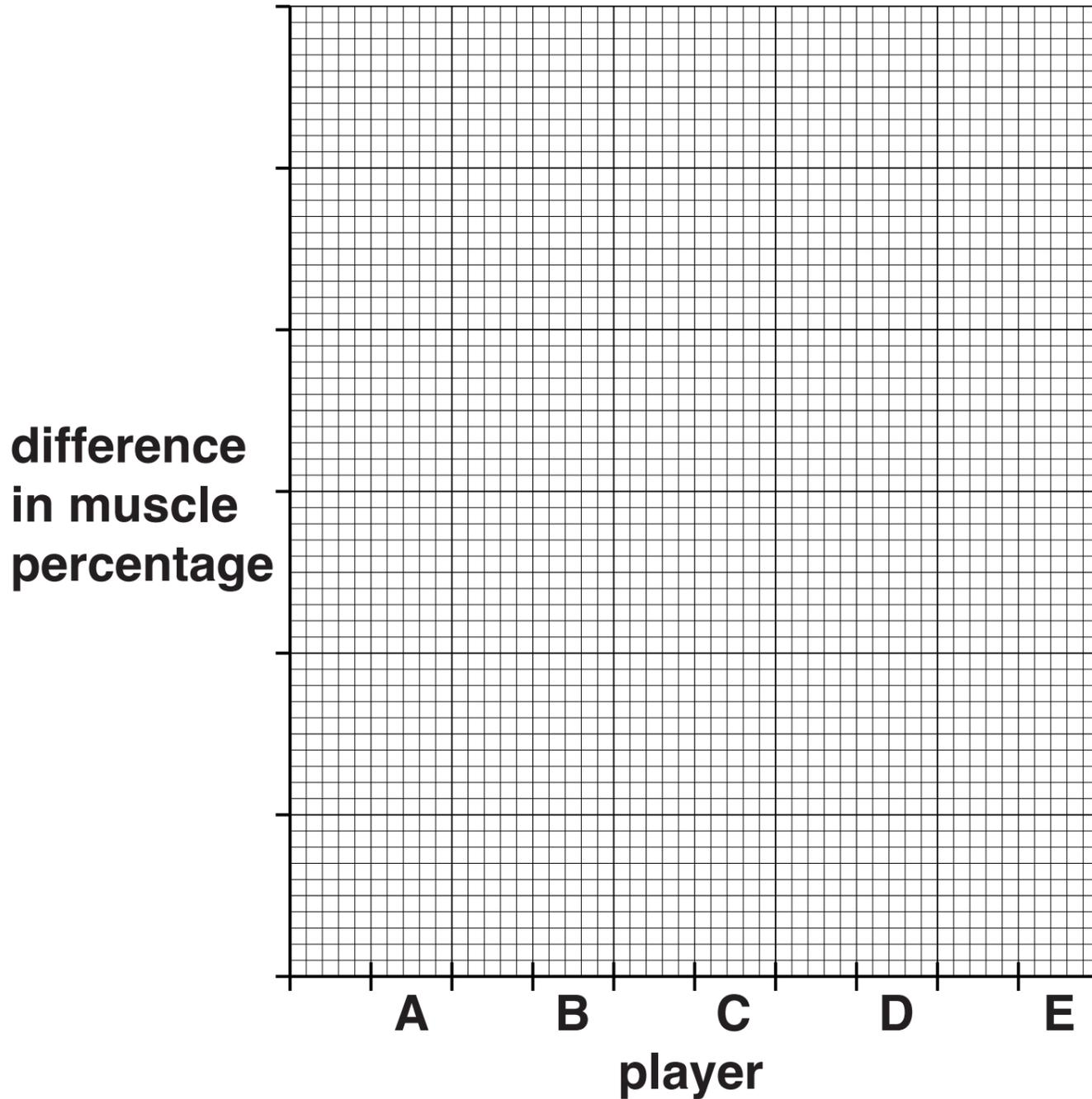
(a) Calculate the mean value for the DIFFERENCE in BODY FAT PERCENTAGE for the five players.

answer \_\_\_\_\_ %

[2]

(b) Look at the data for muscle percentage.

Draw a bar chart to show the **DIFFERENCE** in **MUSCLE PERCENTAGE** for players A, B, C, D and E.



[2]

(c) Use your bar chart and the table to decide which player benefited the **MOST** from the diet.

Player \_\_\_\_\_

Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

(d) The team doctor recommends a **HIGH PROTEIN** but **LOW FAT** diet for the players.

Look at Table 1. It shows the protein and fat content of some foods.

**TABLE 1**

| <b>Food</b>    | <b>Protein<br/>in g per 100 g</b> | <b>Fat<br/>in g per 100 g</b> |
|----------------|-----------------------------------|-------------------------------|
| <b>steak</b>   | <b>25</b>                         | <b>15</b>                     |
| <b>pork</b>    | <b>23</b>                         | <b>29</b>                     |
| <b>salmon</b>  | <b>20</b>                         | <b>13</b>                     |
| <b>venison</b> | <b>35</b>                         | <b>6</b>                      |
| <b>bacon</b>   | <b>12</b>                         | <b>70</b>                     |
| <b>rabbit</b>  | <b>27</b>                         | <b>8</b>                      |

Look at Table 2. It shows some of the food that three of the players eat in one day.

**TABLE 2**

| <b>Player A</b>   |                            | <b>Player B</b>   |                            | <b>Player C</b>   |                            |
|-------------------|----------------------------|-------------------|----------------------------|-------------------|----------------------------|
| <b>Food eaten</b> | <b>Mass eaten<br/>in g</b> | <b>Food eaten</b> | <b>Mass eaten<br/>in g</b> | <b>Food eaten</b> | <b>Mass eaten<br/>in g</b> |
| <b>venison</b>    | <b>200</b>                 | <b>salmon</b>     | <b>200</b>                 | <b>pork</b>       | <b>300</b>                 |
| <b>steak</b>      | <b>200</b>                 | <b>rabbit</b>     | <b>200</b>                 | <b>bacon</b>      | <b>100</b>                 |



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