

Friday 5 June 2015 – Afternoon

**GCSE GATEWAY SCIENCE
SCIENCE B**

B712/02 Science modules B2, C2, P2 (Higher Tier)

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

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The Periodic Table can be found on the back page.
- 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**.
- This document consists of **32** pages. Any blank pages are indicated.

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

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

GPE = mgh

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

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

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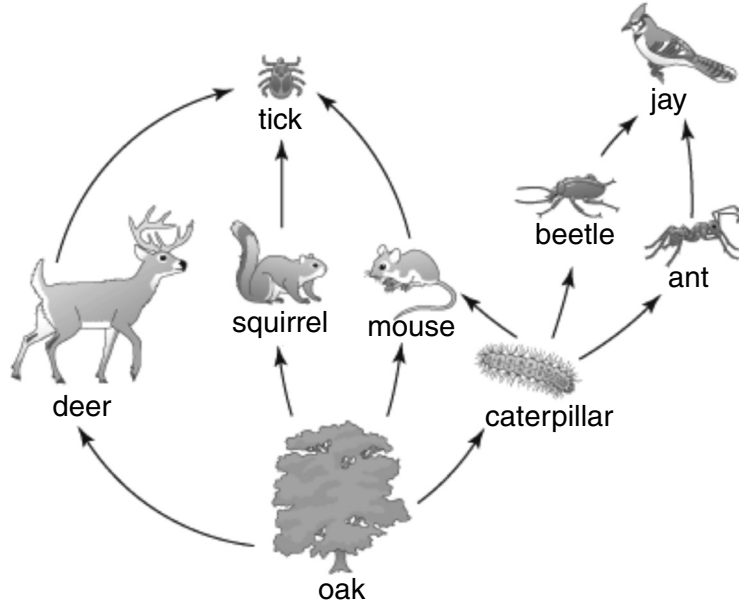
Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

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.

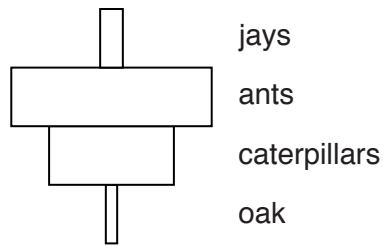
.....
..... [1]

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

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

.....
.....
..... [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.

.....

.....

..... [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.

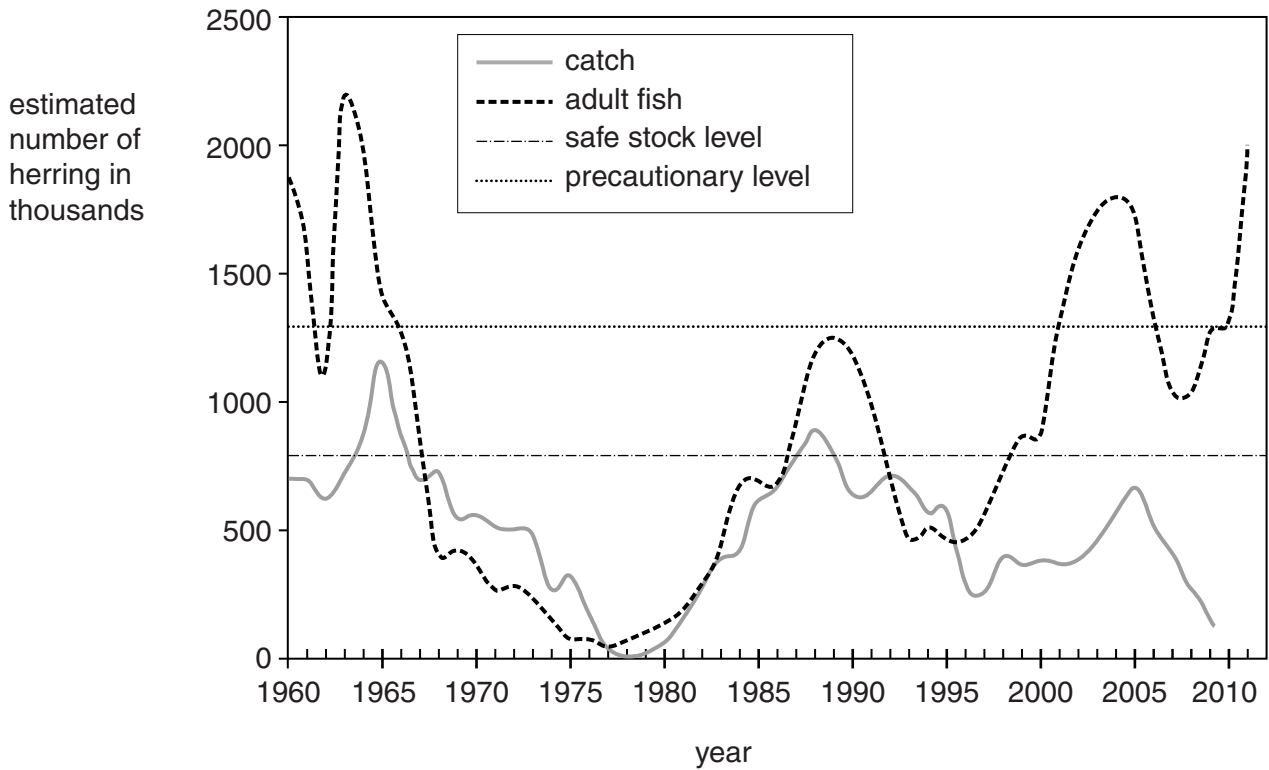
A mouse dies and decomposers convert protein from the mouse into

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.



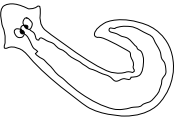

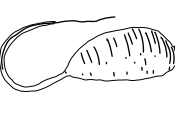

The precautionary level is the number of fish that organisations would like to have to make sure the herring population is safe.

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.

Clean water		Some pollution in water		Very polluted water	
caddis fly larva 	dragonfly nymph 	flatworm 	leech 	rat-tailed maggot 	bloodworm 

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

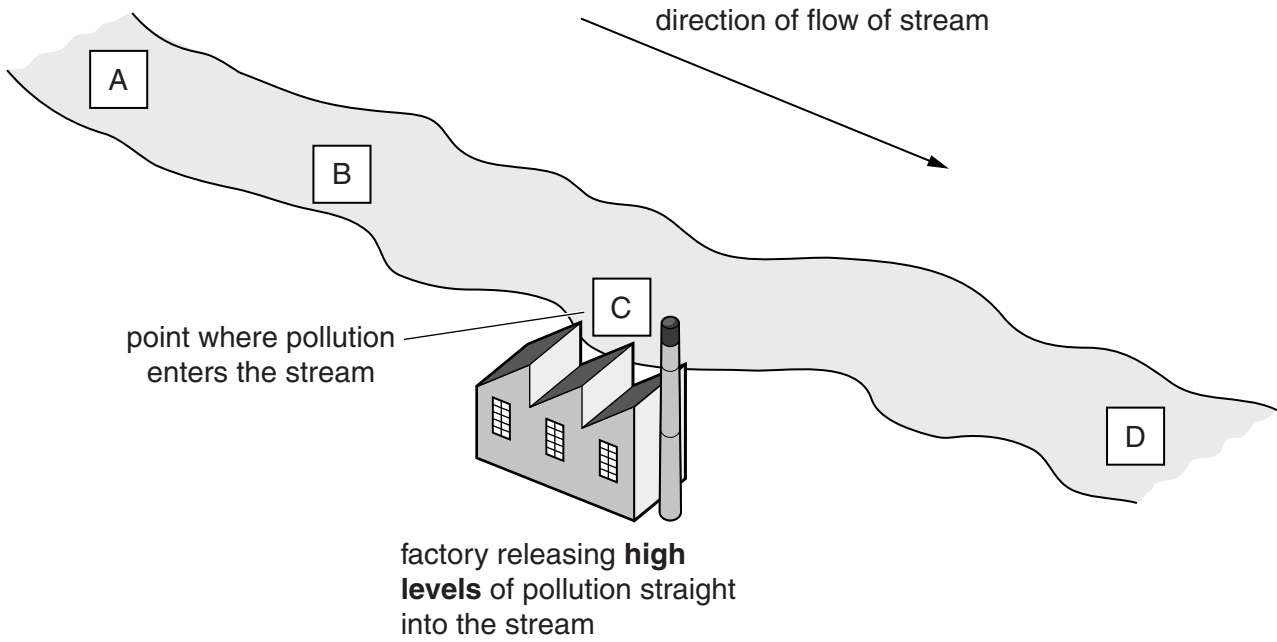
[2]

(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 This is a picture of the Mikado pheasant.



(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) The picture is of a male pheasant.

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]

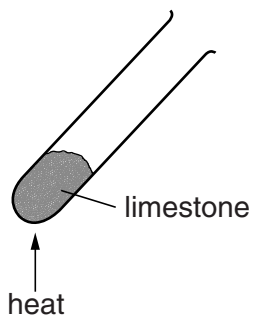
(d) Darwin and Lamarck both had different theories about natural selection.

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

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.....
..... [2]

SECTION B – Module C2

- 5 Bob and Gill heat some limestone.



Limestone is calcium carbonate, 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.

Mineral	Description of test
limestone	scratched by a copper penny
granite	not scratched by a steel knife but scratches steel
talc	scratched by a fingernail
marble	steel knife scratches it easily

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.

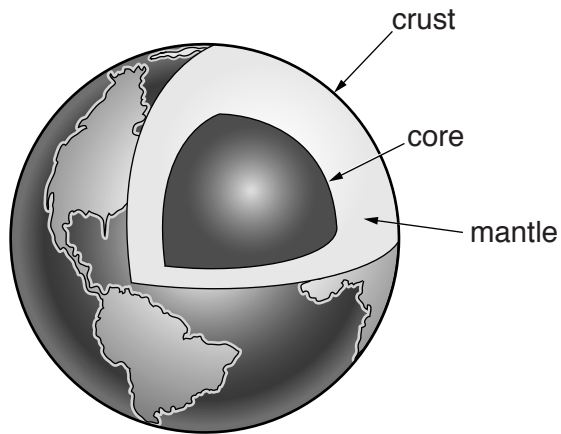
Use ideas about rock types to explain why.

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.....

..... [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**?

.....
..... [1]

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

Write about **one** of these problems.

.....
..... [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.

.....
.....
.....
..... [2]

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 ³	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.

Evaluate each of the metals and alloys in the table to make a car radiator.

Which one would you choose?

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[4]

(b) Many of the materials used to make cars are recycled.

Explain an **advantage** and a **disadvantage** of recycling the materials used to make a car.

.....

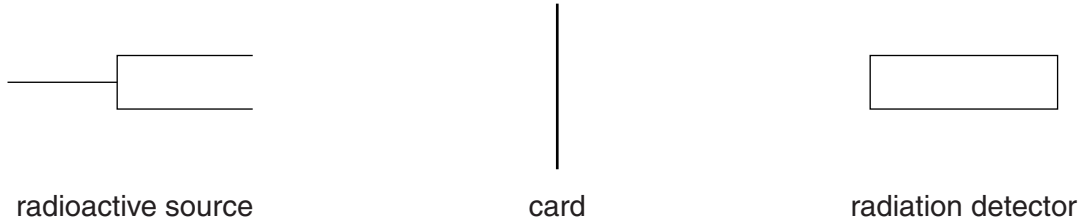
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..... [2]

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.

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

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
A	2010	1995	2008	2012	1992	2010
B	2010	23	24	22	23	24
C	2010	1900	1252	808	612	452

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]

(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.

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

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

answer kWh [1]

(ii) Electricity costs 16p 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.

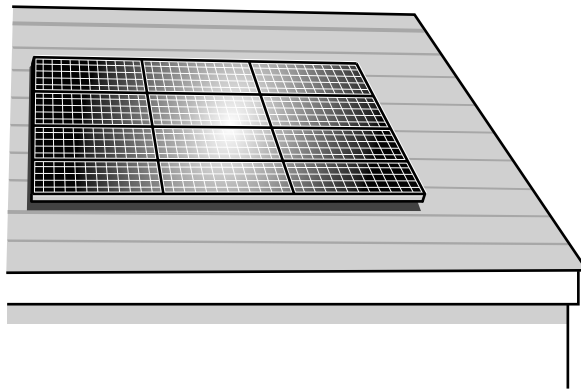
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..... [2]

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

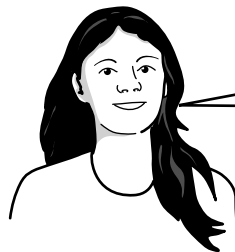


(a) Mia investigates how the current output of photocells depends on:

- light intensity
- surface area.

Look at her results.

Area in m²	0.30	0.30	1.20
Intensity in W/m²	200	400	400
Current in A	0.5	1.0	4.0



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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.....

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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.

.....
.....

answer W [1]

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

.....
.....
..... [1]

13 (a) There are several theories about how the Earth-Moon system was formed.

One of these theories is that the Moon was formed in a collision between the Earth and another planet.

Suggest why this theory has become more popular since the Moon landings in the 1970s.

.....

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..... [2]

(b) A force causes the Moon to orbit the Earth.

What is the name of this force and how does it keep the Moon in orbit?

.....

..... [2]

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

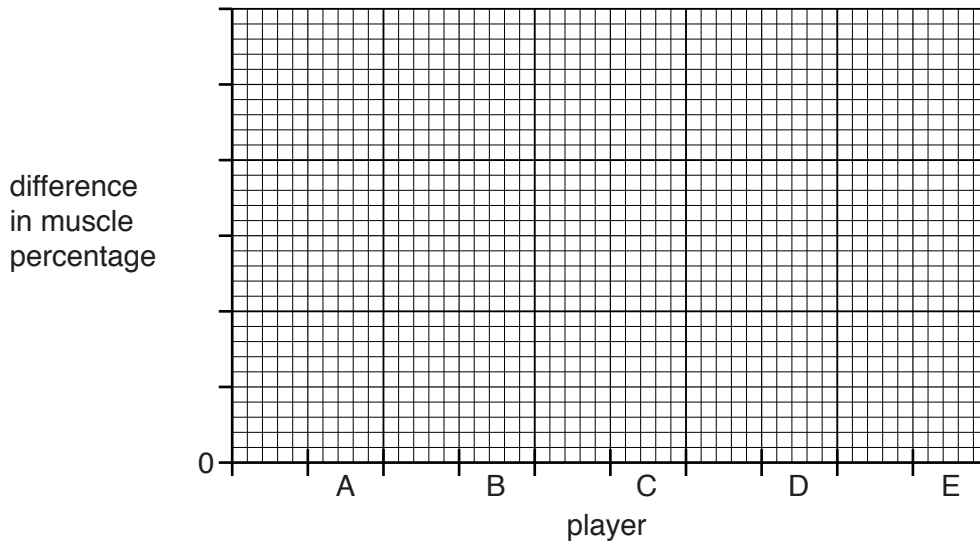
- (a) Calculate the mean value for the **difference** in **body fat percentage** for the five players.

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.

Food	Protein in g per 100 g	Fat in g per 100 g
steak	25	15
pork	23	29
salmon	20	13
venison	35	6
bacon	12	70
rabbit	27	8

Table 1

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

Player A		Player B		Player C	
Food eaten	Mass eaten in g	Food eaten	Mass eaten in g	Food eaten	Mass eaten in g
venison	200	salmon	200	pork	300
steak	200	rabbit	200	bacon	100

Table 2

Evaluate, using calculations, the protein and fat content of each player's diet.

Which player has the most protein and the least fat in their diet?

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..... [4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminium 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Ar argon 18								
	19 K potassium 19	20 Ca calcium 20	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	31 Ga gallium 31	32 Ge germanium 32	33 As arsenic 33	34 Se selenium 34	35 Br bromine 35	36 Kr krypton 36		
	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Tl thallium 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86
	[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1	H hydrogen 1
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relative atomic mass
atomic symbol
name
atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.