OCR
Oxford Cambridge and RSA

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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.	**Duration:** 1 hour 30 minutes
OCR supplied materials: None	
Other materials required: • Pencil • Ruler (cm/mm)	

B71202

Candidate forename		Candidate surname	

Centre number					Candidate number				

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.

OCR is an exempt Charity

Turn over

2

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

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

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

3

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Question 1 begins on page 4

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4

Answer **all** the questions.

SECTION A – Module B2

1   Look at the food web.
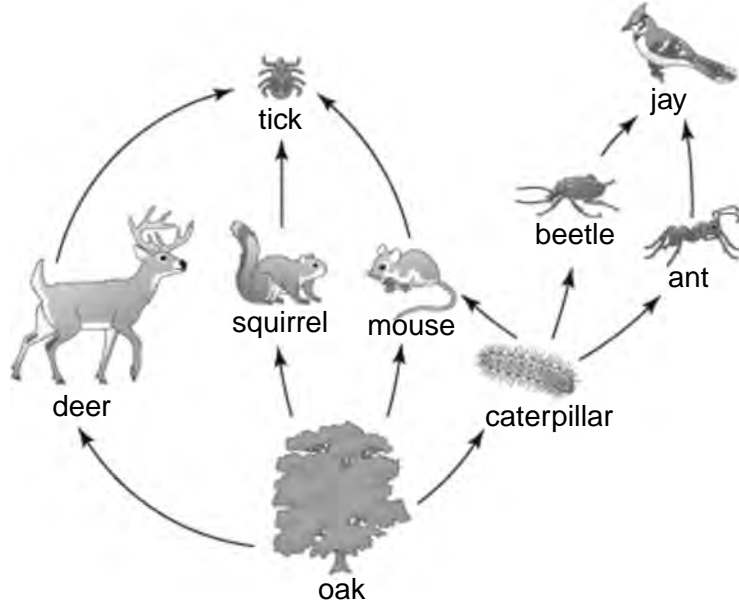
(a) Ticks are parasites.

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]**

5

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

jays

ants

caterpillars

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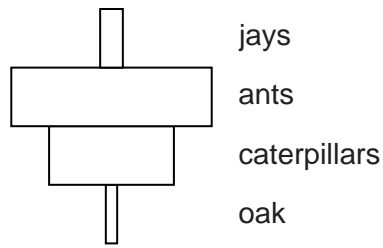
A pyramid of **biomass** for the food chain would look different to this pyramid of numbers.

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]**

Turn over

6

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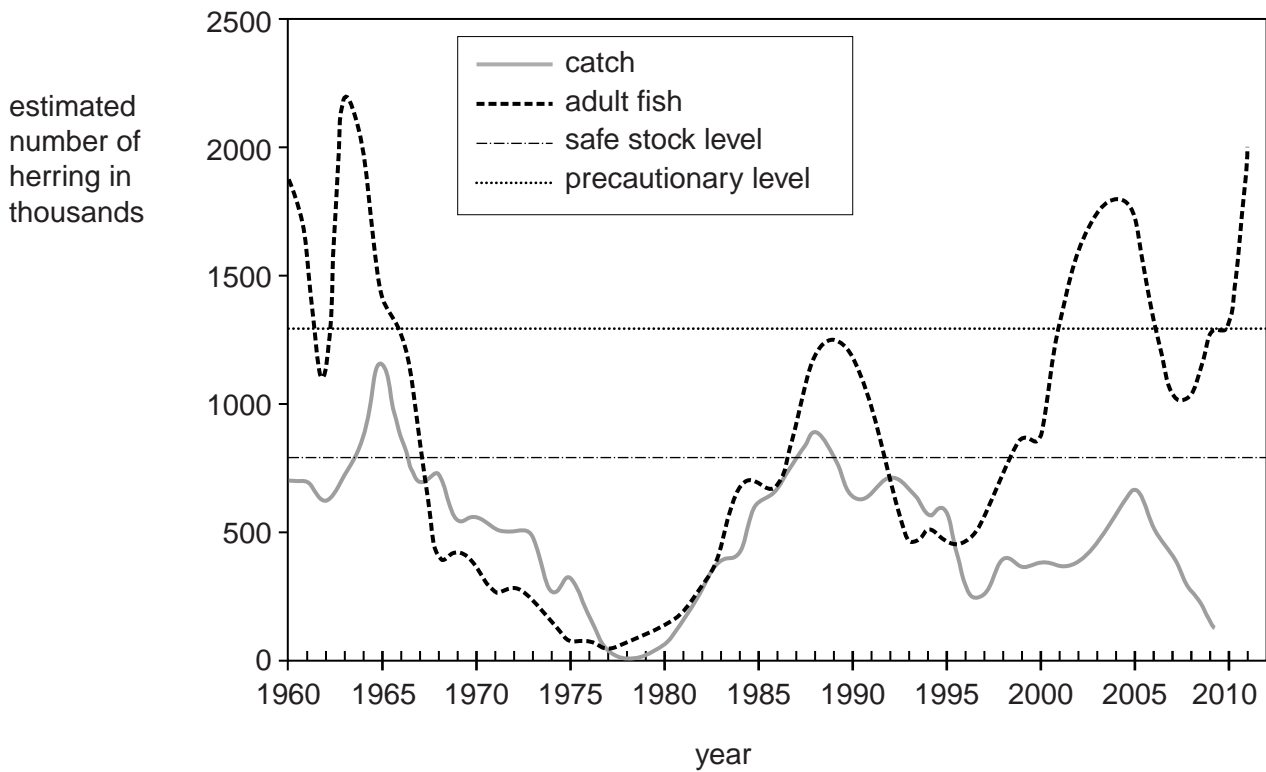
The safe stock level is the number of fish there needs to be to prevent the risk of extinction.

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

7

Herring in the North Sea are fished by several different countries.

Sustainable fishing of the herring was first attempted in 1980.

What is sustainable fishing?

Evaluate the success of the sustainable fishing in saving the herring population and suggest any problems there might have been.

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

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.... **[6]**

Turn over

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]**

9

(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**.

direction of flow of stream

A

B

C

point where pollution
enters the stream

D

factory releasing **high
levels** of pollution straight
into the stream
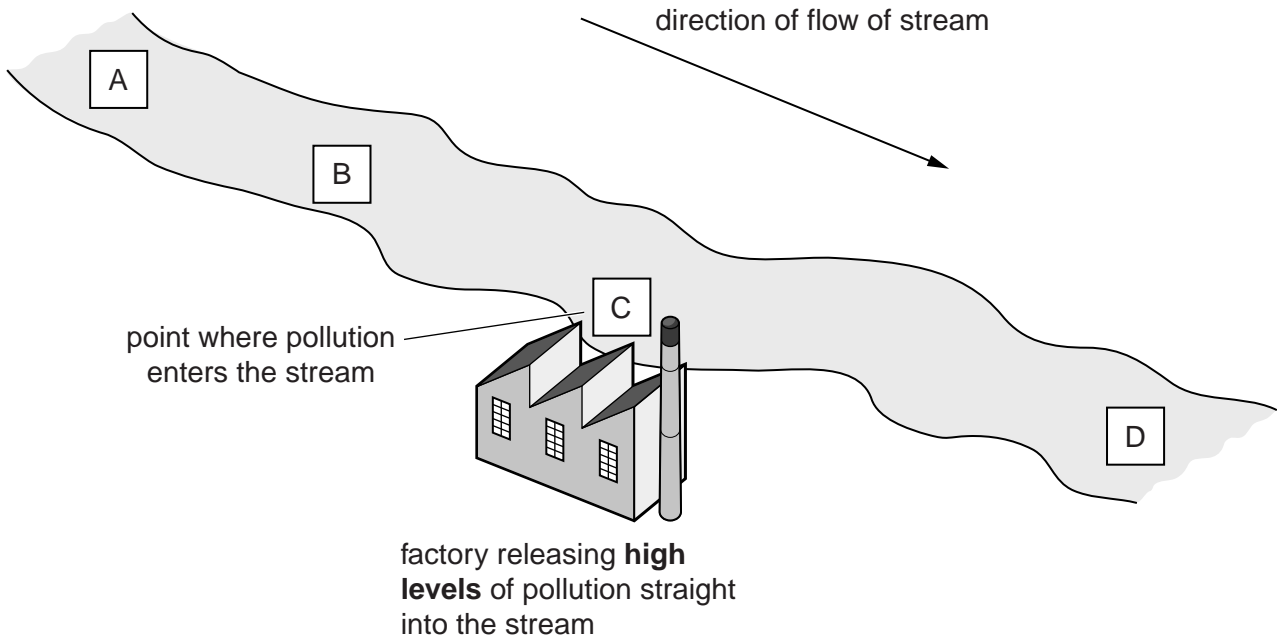
Look at the results.

(i) Where did Zack take his samples from?

Choose from **A**, **B**, **C** or **D** .... **[1]**

(ii) Explain your answer.

....

....

.... **[2]**

Turn over

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]**

Turn over

12

SECTION B – Module C2

5 Bob and Gill heat some limestone.

limestone

heat
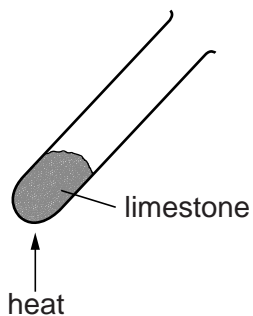
Limestone is calcium carbonate, $CaCO_3$.

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.

....

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.... **[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]**

14

6 The diagram shows the structure of the Earth.
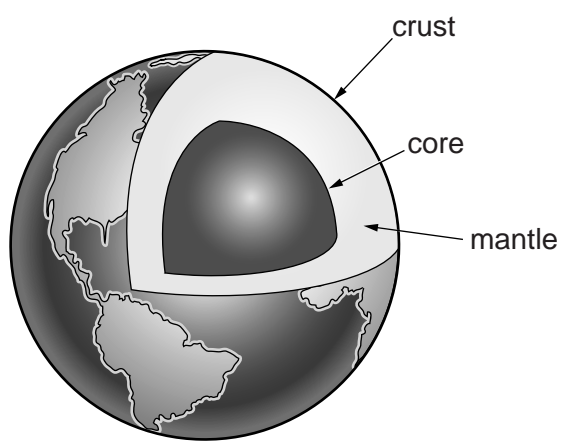
not to scale

(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]**

15

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.

radiator

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]**

Turn over

16

(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.

....

....

.... **[2]**

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.

power pack

silver nitrate solution

Silver nitrate solution contains silver ions, 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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.... **[6]**
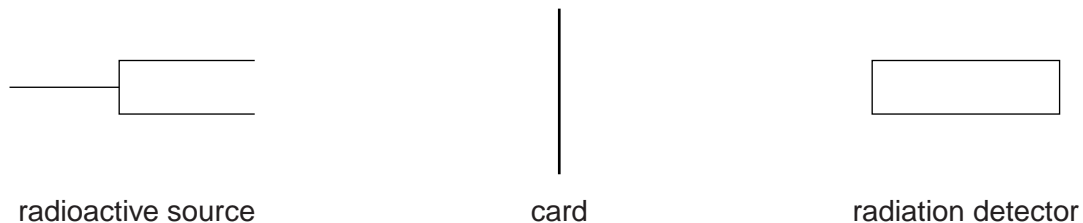
18

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.

radioactive source   card   radiation detector

(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]**

Turn over

20

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.

....

....

....

answer .... pence **[2]**

21

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

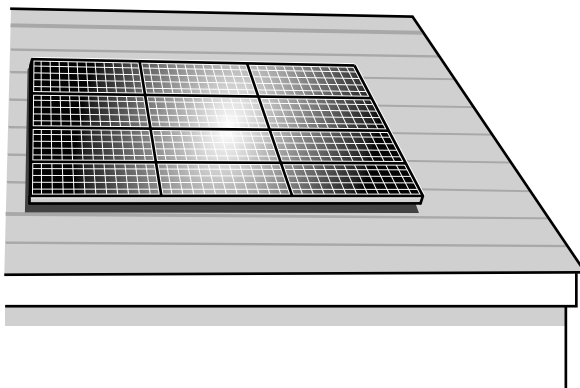He does not use off peak electricity for his vacuum cleaner.

Explain why.

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.... **[2]**

Turn over

PMT

11 A new power station needs to be built.

There are two proposals:

*   a nuclear power station

*   a coal fired power station.

Describe and explain the advantages and disadvantages of using each of the fuels to produce electricity.

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

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.... **[6]**

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 m^2	0.30	0.30	1.20
Intensity in W/m^2	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.

....

....

....

.... **[2]**

24

(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 20 V.

   (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]**

Turn over

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**.

difference
in muscle
percentage

0 ⊥

A   B   C   D   E
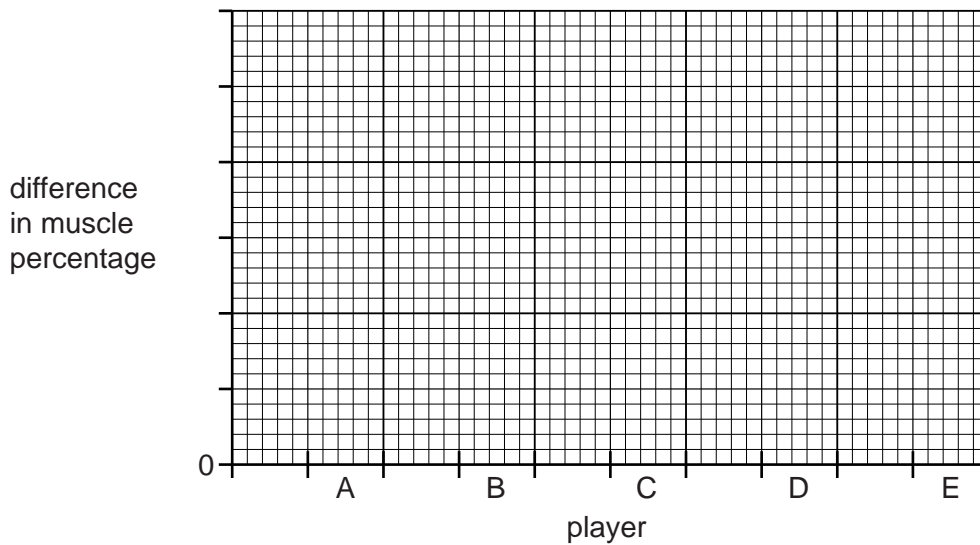
player

[2]

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

Player ....

Explain your answer.

....

....

....

.... **[2]**

Turn over

(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

29

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

30
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The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1	2												3	4	5	6	7	0
																		4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4												11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12												27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30		70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48		115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80		204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **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								

1 **H** hydrogen 1

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* 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.