THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

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Thursday 23 May 2013 – Morning

GCSE GATEWAY SCIENCE
SCIENCE B

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

B712226061 3

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

B712026

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

- Your 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 **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

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

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

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Question 1 begins on page 4

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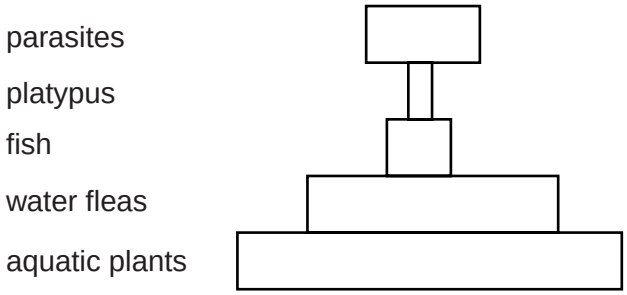
Answer **all** the questions.

SECTION A – Module B2

1 Look at the pyramid of numbers.



(a) (i) Sketch the pyramid of biomass for the same food chain.

[1]

(ii) Explain why this pyramid of biomass is a different shape.

.....

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

(b) When the platypus dies, nitrogen from the decomposing platypus is recycled.

The first stage involves decomposers converting proteins into ammonia.

The ammonia is then converted so that it can be used by plants.

Explain how ammonia is converted in the nitrogen cycle.

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.....

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

(c) The table shows the classification of the platypus.

Taxon (group)	Platypus Classification
kingdom	animals
phylum	chordates
class	mammals
order	monotremes
family	ornithorhynchidae
genus	
species	*Ornithorhynchus anatinus*

Write down the genus name for the platypus.

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

(d) The order monotremes contain the platypus and an animal called the echidna.

Look at the picture of the platypus and the echidna. (Not to scale)

platypus

echidna

Platypus and echidnas are in the same order but look very different.

Suggest why they have different shaped mouths and feet.

.....

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

(e) Platypus and echidnas are only found in Australia and New Guinea.

Australia and New Guinea are both islands. Platypus and echidnas are the only mammals to lay eggs. All other mammals evolved to give birth to live young.

Suggest reasons why platypus and echidnas evolved differently to other mammals.

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

[Total: 8]

2 This question is about heat loss.

Look at the pictures (not to scale).

penguin

cheetah

elephant

Read the information in the table.

Animal	Surface area in m^2	Volume in m^3	Surface area to volume ratio
penguin	1.13	0.03	37.67
cheetah	1.10	0.05	
elephant	18.80	5.00	3.76

(a) (i) Calculate the surface area to volume ratio of the cheetah.

answer = ... **[2]**

(ii) Cheetahs and elephants are kept in British zoos.

Which animal might cope better with a British winter? Cheetah or elephant?

Use the data to explain your answer.

.....

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

(b) Penguins have a counter-current exchange system to help prevent heat loss.

Explain how it works.

.....

.....

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

[Total: 6]

3 Read this information about red ruffed lemurs.

The red ruffed lemur lives in a rainforest in Madagascar. They can only be found in one rainforest, which is 2,300 square kilometres in size. Their population is said to be at a critical level.

Part of their habitat is protected by a small number of rangers. Some red ruffed lemurs live out of the protected area.

People will often enter the rainforest looking for rosewood. They can sell the rosewood for timber. This causes habitat destruction and disturbs the lemurs.

The local people use the rainforest for resources. These people cause very little disturbance to the lemurs. They also act as guides, taking people to see the lemurs.

(a) A wildlife conservation trust is helping to set up a conservation programme for red ruffed lemurs. This includes protecting their habitat.

The conservation programme could be both an advantage and a disadvantage to the people of Madagascar.

Use the information, and your scientific knowledge, to explain why there are advantages and disadvantages.

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

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..... **[6]**

(b) Madagascar has many different **species** of lemur.

What is meant by the term species?

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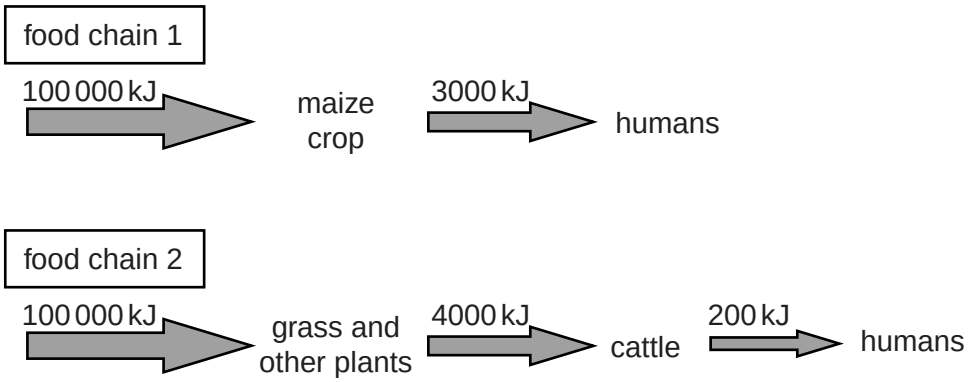
..... **[1]**

(c) The human population of Madagascar is increasing.

Farmers are trying to produce food for an increasing population.

Look at the two food chains.



(i) Calculate the efficiency of energy transfer from plants to humans for both food chains.

food chain 1 = ...%

food chain 2 = ...% **[2]**

(ii) Which food chain is better to feed an increasing population?

Explain your answer.

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

[Total: 11]

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SECTION B – Module C2

4 Alfie is a scientist. He investigates neutralisation.

He adds dilute nitric acid to potassium hydroxide solution.

(a) Complete the word equation for the reaction.

potassium hydroxide	+	nitric acid	→	....	+	water

[1]

(b) Alfie then reacts sulfuric acid, H_2SO_4, with sodium hydroxide solution, NaOH.

Sodium sulfate and water are made.

Write a **balanced symbol** equation for this reaction.

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

(c) Alfie publishes his scientific work.

Explain how he can do this, and why it is important.

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..... **[3]**

[Total: 6]

5 This question is about metals and alloys.

Look at the table. It shows some properties of metals and alloys.

Metal or alloy	Melting point in °C	Density in g/cm^3	Relative electrical conductivity	Cost per tonne in £
aluminium	660	2.7	40	1350
copper	1083	8.9	64	3800
tin	232	5.7	9	10 000
silver	962	10.5	67	20 000
solder	188	8.2	20	6700
lead	328	11.3	5	1500

(a) Which metal, or alloy, would be best for making aeroplane bodies?

Choose from the table.

Explain your answer.

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..... **[3]**

(b) Pylon wires, which carry electricity, are made of metal.

Aluminium, copper and silver are all possible choices for the metal.

(i) Evaluate each of these three metals for use in making pylon wires.

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..... **[3]**

(ii) Which **one** would be the best choice for making pylon wires?

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

[Total: 7]

6 Many chemicals, like ammonia, are made in industrial processes.

Ethanol is another chemical made in an industrial process.

Ethene reacts with steam to make ethanol.

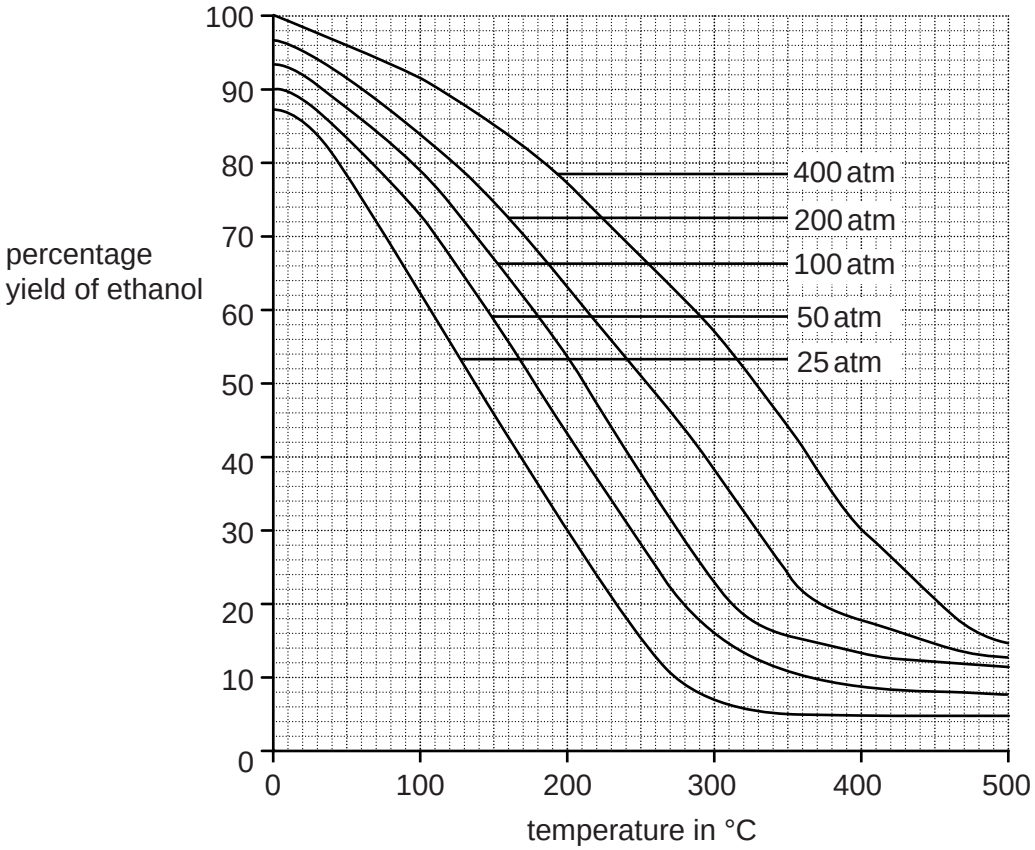
$$\text{ethene} + \text{steam} \rightleftharpoons \text{ethanol}$$

The conditions used are:

- a catalyst
- 300 °C
- a pressure of 70 atmospheres.

Look at the graph.

It shows the yield of ethanol made under different conditions of temperature and pressure.



(a) What is the percentage yield of ethanol at **100 °C** and **200 atmospheres**?

answer = ... % **[1]**

(b) How does increasing the **temperature** change the percentage yield?

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

(c) How does increasing the **pressure** change the percentage yield?

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

(d) At 0 °C and 400 atmospheres the percentage yield is 100%.

The actual conditions used are 300 °C and 70 atmospheres pressure.

Use ideas about percentage yield and rate of reaction to suggest why 300 °C and 70 atmospheres pressure are used.

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..... **[3]**

[Total: 6]

Question 7 begins on page 16

7 Farmers use fertilisers.

Potassium nitrate, KNO_3, and ammonium phosphate, $(NH_4)_3PO_4$, are fertilisers.

Fertilisers provide essential elements.

Excessive use of fertilisers can cause **eutrophication**.

Describe and explain eutrophication, and describe some arguments in favour of using fertilisers.

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

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..... **[6]**

[Total: 6]

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Question 8 begins on page 18

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SECTION C – Module P2

8 **(a)** James has a canal boat.

The boat has electrical appliances that run off batteries.

James uses a wind turbine to recharge the batteries.

Write down one **advantage** and one **disadvantage** of using a wind turbine on this boat.

advantage .....

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disadvantage .....

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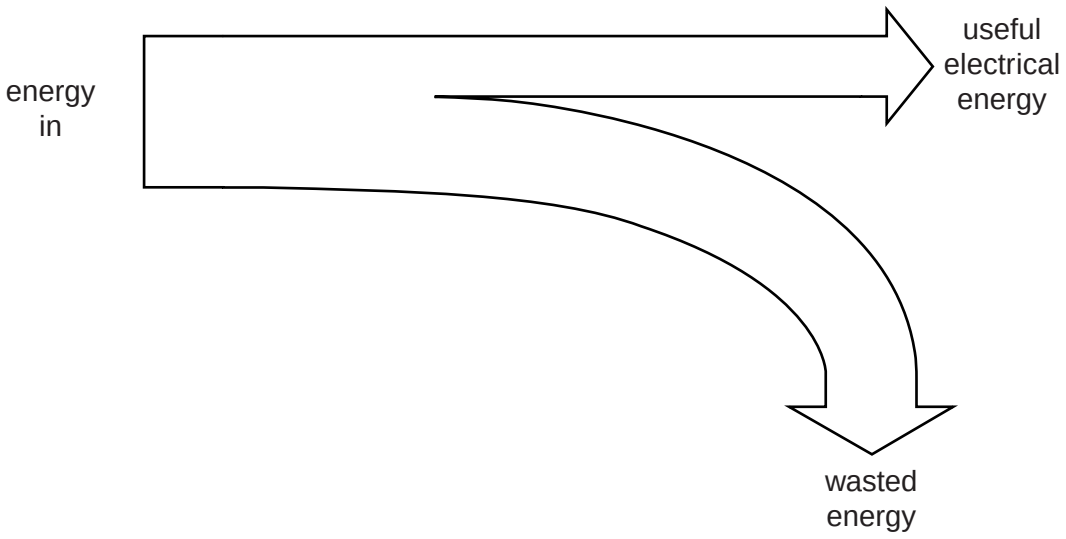
[2]

(b) In a small scale power station, 40% of the energy supplied is converted into useful electrical energy.



The power station produces 5 000 000 joules of electrical energy each second.

(i) Calculate the total energy **input** and the energy **wasted** each second.

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total energy input = ... J

energy wasted = ... J

[2]

(ii) The total energy input is the energy supplied by the fuel.

Each kilogram of fuel used supplies 33 000 joules of energy.

How much fuel is burned each second to provide the total energy input?

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.....

fuel = ... **[1]**

(c) The output of the power station is 5 000 000 W.

The power station sells electricity at 8p per kWh.

Calculate the cost of the electricity if the power station is working at full capacity for 24 hours.

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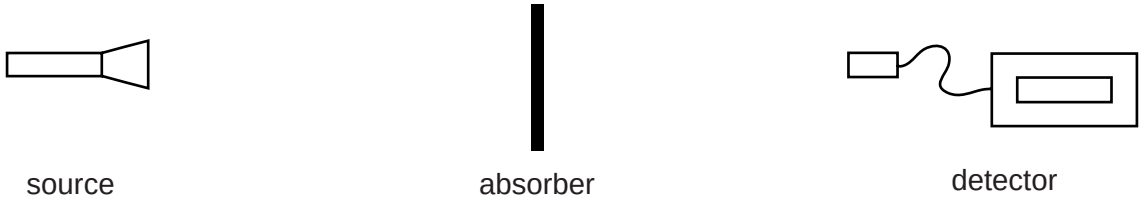
cost = ... **[2]**

[Total: 7]

9 OCRA Industries have an unlabelled radioactive source.

One of their scientists needs to find out what radiation it is emitting.

She sets up this equipment.



Look at her results.

Source in position	Absorber	Detector reading in counts per minute
no	none	38
yes	none	2500
yes	paper	2498
yes	3 mm aluminium	1795
yes	1 cm lead	40

21

Use the information to identify the type, or types, of radiation emitted by the source.

Give reasons for your answer and a clear explanation of why you eliminated the other type, or types, of radiation.

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

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..... **[6]**

[Total: 6]

10 (a) OCRA Electricity is planning to build a new power station.

They could choose any of the energy sources in the table.

They decide to use **nuclear**.

Look at the information in the table.

Energy source	Supply	Environmental issues	Availability
coal	100+ years	ash, greenhouse gases and acid rain	24/7
uranium (nuclear)	80+ years	used fuel rods	24/7
wind	indefinite	noisy, visual pollution	wind speeds above 5 m/s

Justify their decision.

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

(b) Scientists have recently improved the efficiency of photocells.

People are being encouraged by the Government to install panels of photocells on the roofs of their houses.

Suggest how this might benefit both the home owner and the Government.

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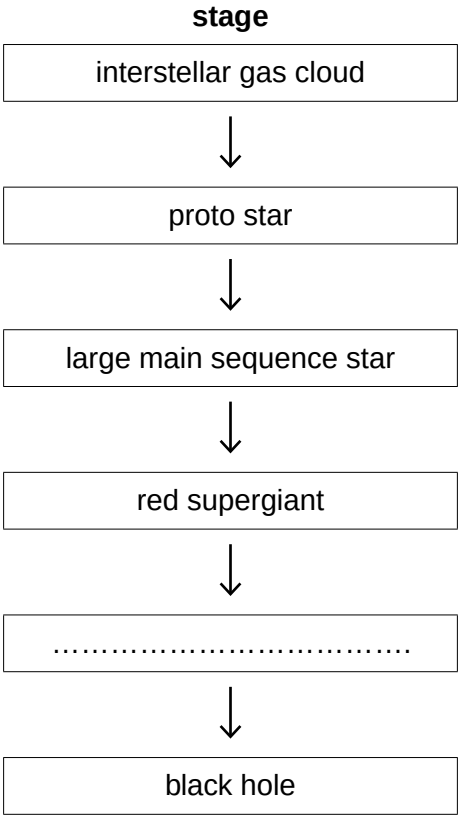
..... **[2]**

[Total: 4]

11 **(a)** Stars are continually being made and eventually die.

Massive stars start as an interstellar gas cloud and end as a black hole.

(i) Complete the box to show the missing stage in the life cycle of a massive star.



[1]

(ii) Explain how the interstellar gas cloud becomes a proto star.

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

(b) It is widely accepted that the Universe started with the Big Bang.

Complete the sentences.

The light from most galaxies is shifted towards the red end of the spectrum.

This is called **red shift**.

This happens because..... .

The greatest red shift is seen from galaxies that are ..... the Earth.

This is because these galaxies..... .

[2]

[Total: 4]

12 **(a)** Scientists think that the Earth-Moon system was caused by the collision of two planets.

What evidence is there that this is how the Earth and Moon were made?

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

(b) There is an asteroid belt between Mars and Jupiter.

In the past, some asteroids have collided with Earth.

Describe some evidence for these collisions.

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

[Total: 4]

SECTION D

13 This question is about the effect of drinking alcohol on driving ability.

A motoring organisation tested different drivers before and after drinking 4 units of alcohol.

They were tested on emergency stops.

Driver	Test	Reaction time in seconds	Stopping distance in metres
Peter	before drinks	0.62	32
	after drinks	0.86	41
Mike	before drinks	0.66	34
	after drinks	0.91	45
Lucy	before drinks	0.59	28
	after drinks	0.90	42
Emily	before drinks	0.59	28
	after drinks	0.76	36

(a) (i) Which driver was affected **most** by drinking 4 units of alcohol?

Explain your answer.

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

(ii) The drivers are affected differently by alcohol.

Quote data from the table to support this view.

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

(iii) Suggest a reason why drivers are affected differently by alcohol.

.....

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

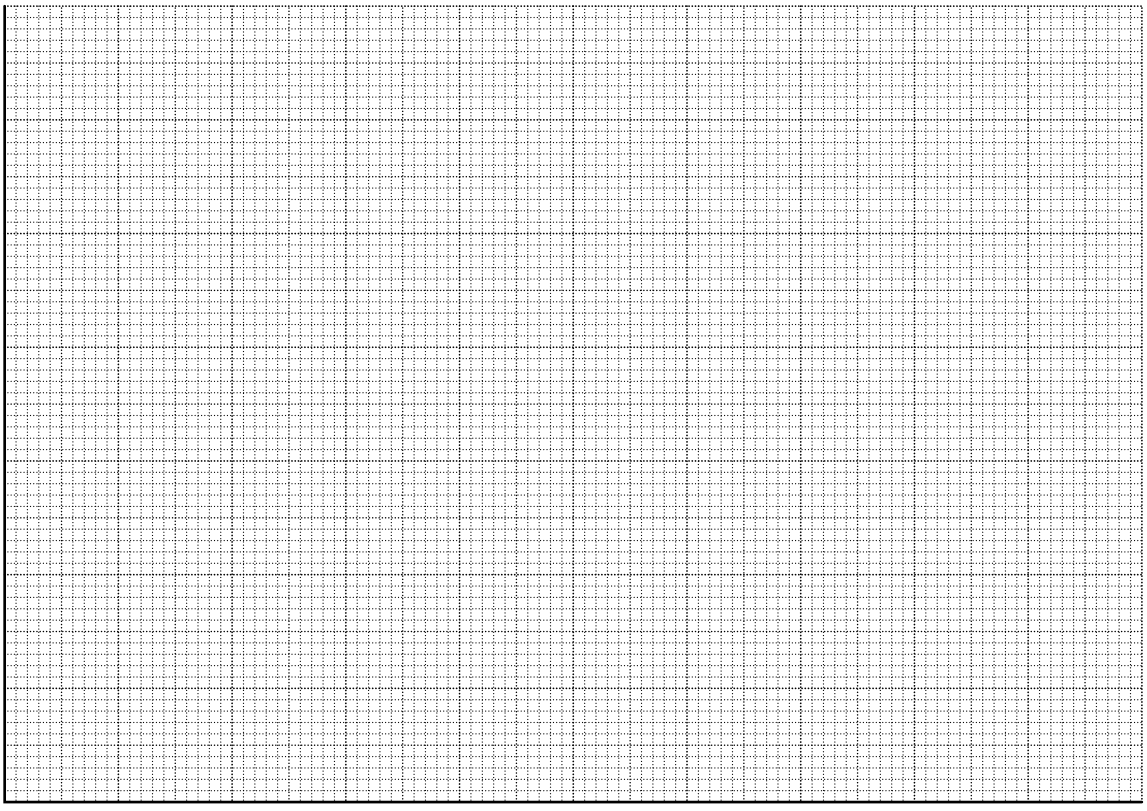
(b) Jeff has drunk 8 units of alcohol.

He was tested to find out how quickly the alcohol was removed from his blood.

Time since drinking in hours	Alcohol content of blood in mg per 100 cm^3
0	130
1	115
2	100
3	85
4	70
5	55

(i) Plot these results on the grid. Draw the best line through the points in order to work out how long it would take for **all** of the alcohol to be removed from Jeff's blood.

blood alcohol content in mg per 100 cm^3



time since drinking in hours

[2]

(ii) How long would it take for **all** of the alcohol to be removed from Jeff's blood?

answer = ...hours **[1]**

(c) Look at the table.

It shows the legal alcohol limit in different countries and data on the number of deaths due to road accidents in 2004.

Country	Number of deaths due to road accidents in 2004	Population in 2004 in millions	Legal alcohol limit (%)	Deaths due to road accidents per million of population in 2004
USA	42 636	293.5	0.08	145.3
UK	3221	60.3	0.08	53.4
Hungary	1296	10.0	0.00	129.6
Spain	4751	40.3	0.02	117.9
Canada	2730	31.9	0.08	85.6
Sweden	480	9.0	0.05	53.3
Norway	257	4.6	0.02	55.9

Use this data to decide if there is a link between the legal limit for alcohol and the death rate due to road accidents.

Comment on your conclusion.

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.....

.....

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

[Total: 10]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										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	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

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.