OCR
Oxford Cambridge and RSA

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Wednesday 14 June 2017 – Morning

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B721/01 Additional Science modules B3, C3, P3 (Foundation 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 15 minutes

* B 7 2 1 0 1 *

* 6 7 5 1 4 6 3 2 2 1 *

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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

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

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

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Question 1 begins on page 4

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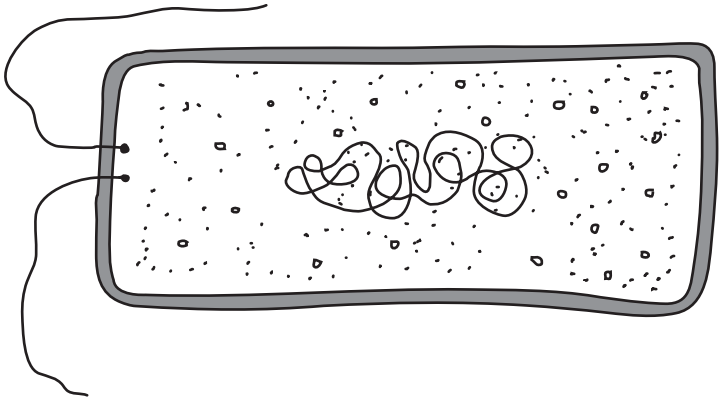
Answer **all** the questions.

SECTION A – Module B3

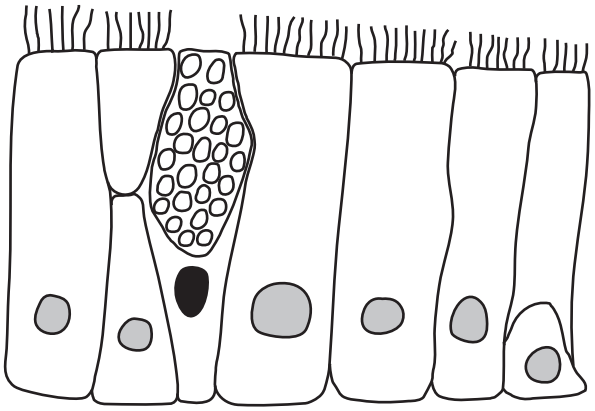
1 Look at the diagrams.

They show cells taken from two different organisms.

organism A



organism B



(a) Organism **A** is a simple organism but organism **B** is a complex organism.

Explain how you can tell this.

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

(b) Look at the diagram.

It shows a reaction involving an enzyme.

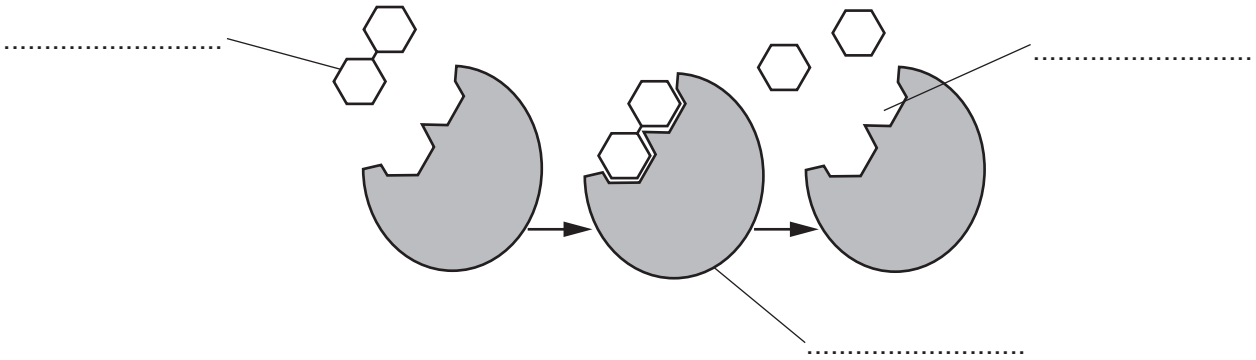
Label the diagram.

Choose words from the list.

active site

enzyme

substrate



[2]

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Question 2 begins on page 7

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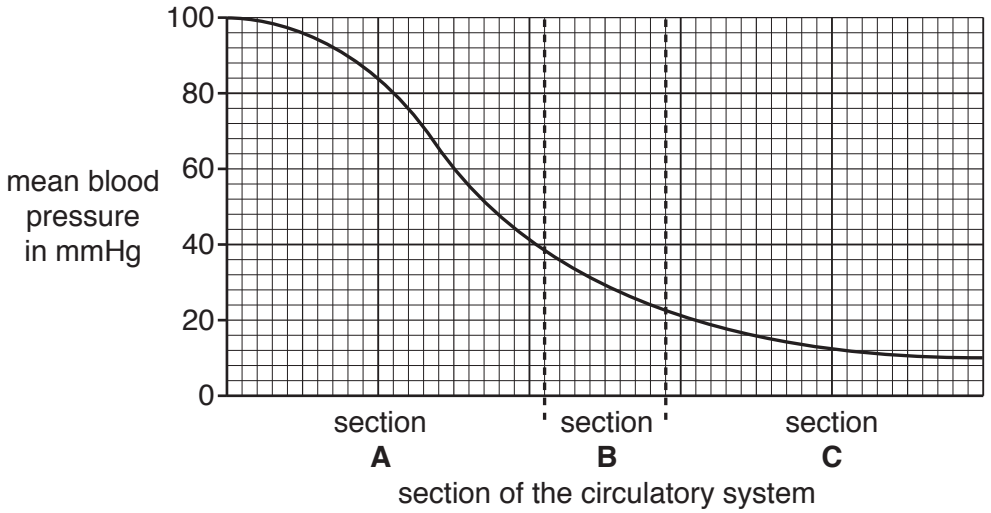
2 This question is about the circulatory system.

Look at the graph.

It shows how blood pressure changes as blood flows through three different sections of the circulatory system.



(a) **(i)** Calculate the change in mean blood pressure between the start of section **A** and the end of section **C**.

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

(ii) What direction does blood flow through sections **A**, **B** and **C**?

Explain how you can tell this from the graph.

.....

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

(b) In which section would blood be flowing through **arteries**?

Choose from **A**, **B** or **C** and explain your answer.

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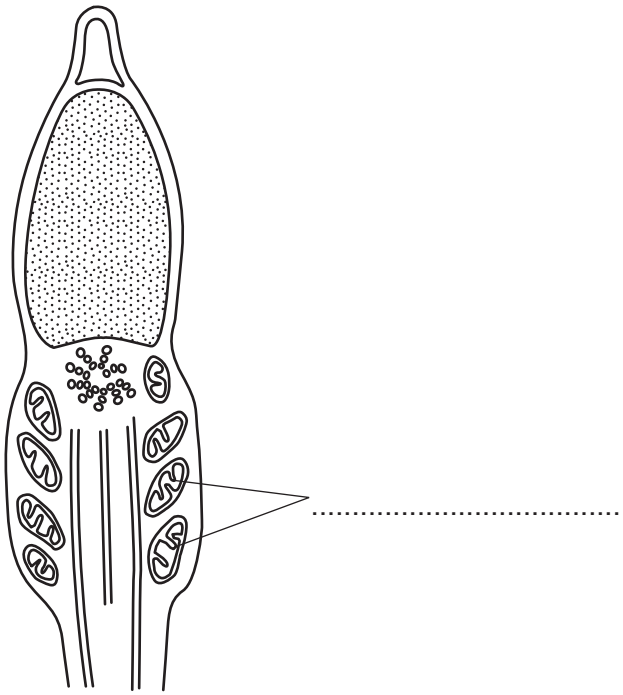
..... **[2]**

3 **(a)** Look at the diagram.

It shows the head and middle sections of a sperm cell.



Which word is missing from the label on the diagram?

Put a tick (✓) in the box next to the correct answer.

chloroplasts ☐

chromosomes ☐

genes ☐

mitochondria ☐

[1]

(b) Scientists can genetically engineer the DNA of animals.

Chickens can be made to produce anti-cancer proteins in their eggs.

Goats can be made to produce anti-clotting proteins in their milk.

Scientists can quickly make medicines from these chickens and goats.

(i) What would scientists need to genetically engineer into chickens to make them produce anti-cancer proteins?

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

(ii) Some people agree with these genetically engineered chickens and goats but other people are against them.

Suggest one reason why they may **agree** and one reason why they may be **against** them.

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

(c) Scientists have recently been able to make changes to human DNA.

How might this help humans in the future?

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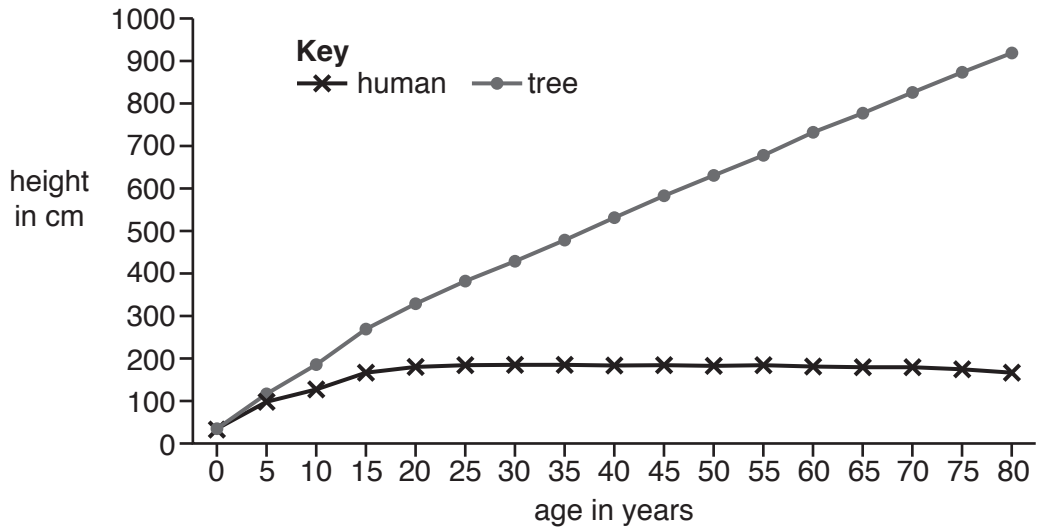
..... **[2]**

4 This question is about growth and development.

Look at the graph. It shows how the height changes in a human and a tree over 80 years.



(a) Plant growth differs from animal growth.

Explain how.

Use data from the graph to help you answer.

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

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

(b) Growth involves cell division.

During cell division **chromosomes** must be copied.

Why is it important that chromosomes are copied?

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

(c) Sperm cells are the male gametes in animals.

Why are sperm cells produced in large numbers?

.....

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

(d) Garden centres take cuttings of their plants to produce new plants to sell.

Cuttings are clones.

Write down one **advantage** and one **disadvantage** of taking cuttings to produce new plants.

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

SECTION B – Module C3

5 Magnesium reacts with hydrochloric acid.

Hydrogen and magnesium chloride are made.

(a) Write down the **word** equation for this reaction.

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

(b) Peter adds 0.10 g of magnesium powder to 25.0 dm^3 of dilute hydrochloric acid.

The mean (average) rate of this reaction is 50 cm^3 of hydrogen per minute.

(i) Estimate the total volume of hydrogen made in the first 3 minutes.

volume of hydrogen = ... cm^3 **[1]**

(ii) Peter repeats this experiment but uses magnesium lumps instead of powder.

The mean rate of reaction is 10 cm^3 of hydrogen per minute.

Use the reacting particle model to explain why.

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

(iii) Peter repeats the experiment with magnesium lumps but also adds a catalyst.

Predict a value for the mean rate of reaction.

..... cm^3 of hydrogen per minute **[1]**

6 Hydrogen peroxide solution breaks down to make water and oxygen.

$$\text{hydrogen peroxide} \longrightarrow \text{water} + \text{oxygen}$$

(a) The molecular formula for hydrogen peroxide is H_2O_2.

Calculate the relative formula mass, M_r, of hydrogen peroxide.

The relative atomic mass of H = 1 and of O = 16

relative formula mass = …….. **[1]**

(b) In an experiment 6.8 g of hydrogen peroxide makes 3.2 g of oxygen.

(i) Use the principle of conservation of mass to predict the mass of water made.

mass of water = ……g **[1]**

(ii) What mass of oxygen can be made from 680 g of hydrogen peroxide?

mass of oxygen = ……..g **[2]**

7 Pharmaceutical drugs are often made in a **batch** process.

Chemicals such as ammonia are made in a **continuous** process.

(a) Describe the differences between a batch process and a continuous process.

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

(b) Pharmaceutical drugs need to be thoroughly tested before they can be licensed for use.

Explain why.

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

(c) One way to test if a pharmaceutical drug is pure is to find its melting point.

Sarah finds the melting point of five different samples of a pharmaceutical drug.

Look at her results.

Sample	Melting point in °C
A	152
B	153–158
C	155
D	155–157
E	157–160

Sarah knows that a pure sample of the pharmaceutical drug has a melting point of 157 °C.

Sarah concludes that sample **E** is the purest sample of the drug.

Do the results support her conclusion?

Explain your answer using evidence from the table.

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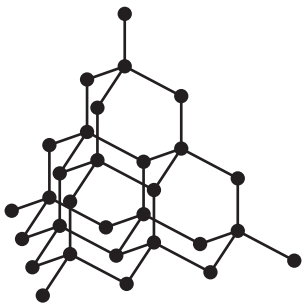
..... **[2]**

8 Diamond is a form of carbon.

It has a giant molecular structure.



Write about **four** of the physical properties of diamond and explain, in terms of properties, why diamond is used in cutting tools.

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

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

9 A chemical can be made by several different chemical reactions.

Look at the table. It shows the percentage yield and atom economy for each different reaction.

Reaction	Percentage yield	Atom economy
V	30	60
W	40	20
X	45	50
Y	50	90
Z	90	100

(a) Which reaction is the **greenest** process?

.....

Explain your answer.

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

(b) During these reactions some product is always lost.

Which reaction loses the **most** product?

Explain your answer.

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

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Question 10 begins on page 18

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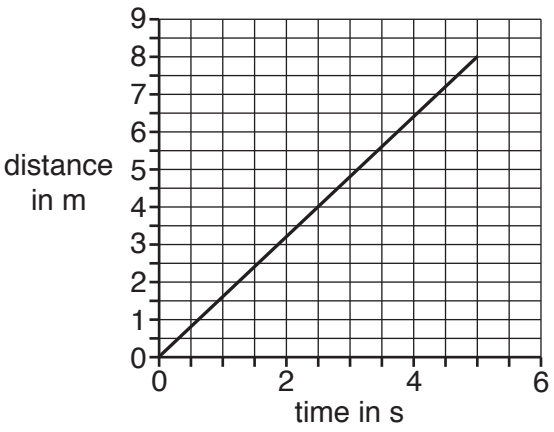
SECTION C – Module P3

10 (a) Pedro draws a distance-time graph for a moving object.



What does the **gradient** of Pedro's graph show?

Choose from

acceleration

distance

speed

time

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

(b) What is the **difference** between speed and velocity?

Choose from

speed has direction

speed is faster than velocity

velocity has direction

velocity is faster than speed

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

(c) Look at the diagram of car **A** and car **B**.

car A

speed of **car A** = 10 m/s

car B

speed of **car B** = 15 m/s

(i) What is the relative velocity of the cars?

Choose from

5 m/s

10 m/s

15 m/s

20 m/s

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

(ii) Car **B** accelerates from 0 m/s to 15 m/s in 3 seconds.

Calculate the acceleration.

answer = ... m/s^2 **[2]**

(iii) Car **B** now decelerates.

Describe what happens to the speed of the car.

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

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Question 11 begins on page 21

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11 Sanjay learns about forces and planets.

He collects information about the weight of the same object on different planets.

Planet	Mass of object in kg	Weight and force to lift the object in N	Work done to lift the object 20 m
Mercury	1	3.8	76
Venus	1	8.8	176
Earth	1	10.0	200
Mars	1	3.9	.....

(a) The object has the same mass on each planet but has a different weight.

Why does the object have a different weight on each planet?

.....

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

(b) Sanjay has **not** put the unit for work done in the table.

Calculate the work done to lift the object 20 m on Mars.

Write down the unit for work done in your answer.

work done = ... unit ..... **[3]**

(c) The amount of work to lift the object on Earth is greater than the value given in the table.

This is because the object has frictional forces acting on it.

Explain why frictional forces increase the amount of work done.

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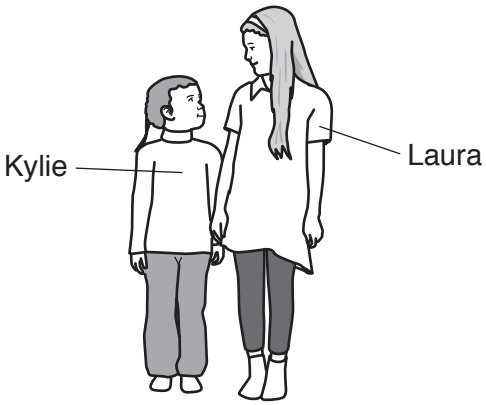
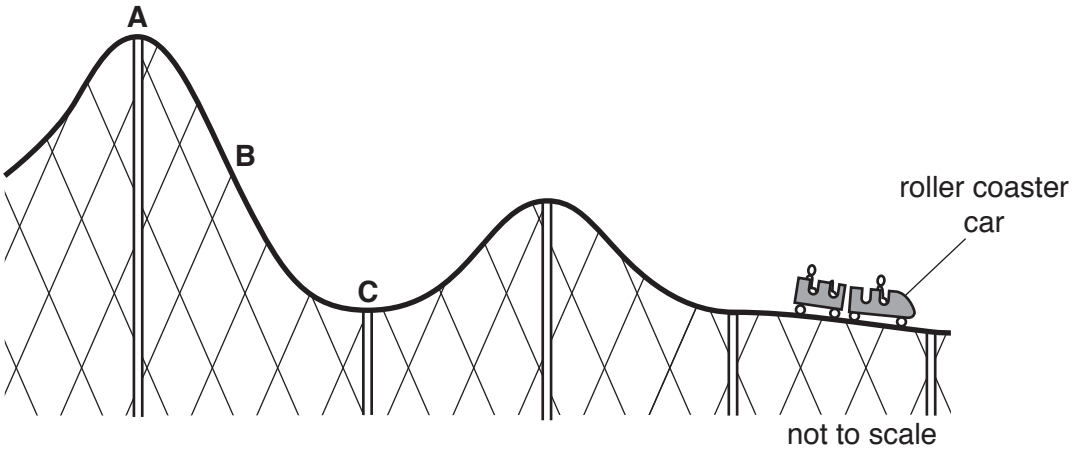
..... **[2]**

12 Kylie and Laura ride in a roller coaster car.

They have different masses.



The diagram shows the girls in the roller coaster car at the end of the ride.



Describe why Kylie and Laura have different kinetic energy (KE) to each other at **B**.

Describe how their gravitational potential energy (GPE) changes as the roller coaster car moves.

Use letters **A**, **B** and **C** from the diagram in your answer.

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

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

13 **(a)** George makes notes about stopping distance for his homework.

> **Homework notes on stopping distance**
>
> Stopping distance is thinking distance + braking distance.
>
> Thinking distance is the time between seeing something and putting your foot on the brake pedal.
>
> Braking distance is the distance the car travels before you brake.
>
> Only braking distance is important for road safety.

There are three mistakes in his homework.

Identify the **three** mistakes.

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

(b) Average speed cameras are used when there are road works on a motorway.

Average speed is often **reduced** to 50 miles per hour.

Explain how this helps to protect the people working on the motorway.

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

(c) There are various **risks** and **benefits** that may be important when driving a car.

Put the following statements in the correct column in the table.

One has been done for you.

A Seat belts stop you hitting the windscreen in a crash.

B Crumple zones absorb energy during a crash.

C Seat belts may trap you in your seat after a crash.

D There is a sudden change in momentum in a crash.

E Seat belts change shape during a crash.

Risk	Benefit
	A

[2]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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.