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H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B623/02

Unit 1 Modules B3 C3 P3 (Higher Tier)

OCE/18791

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)

Wednesday 20 January 2010
Morning

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

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EQUATIONS

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

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

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

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

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

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

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Answer **all** the questions.

Section A – Module B3

1 Look at the picture. It shows a mechanical heart.

(a) Mechanical hearts have been used to help patients while they wait for a heart transplant.

Finish the sentences about the heart.

Use words from this list.

arteries

backflow

blockage

capillaries

leakage

veins

The mechanical heart contains valves to prevent …… .

The heart is attached to blood vessels.

The vessels taking blood away from the heart are called …… . **[2]**

(b) Write down **one** problem of using mechanical hearts.

.....

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

(c) Some people need heart transplants because cholesterol has caused damage to their heart.

Describe how cholesterol build up could damage the heart.

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

[Total: 4]

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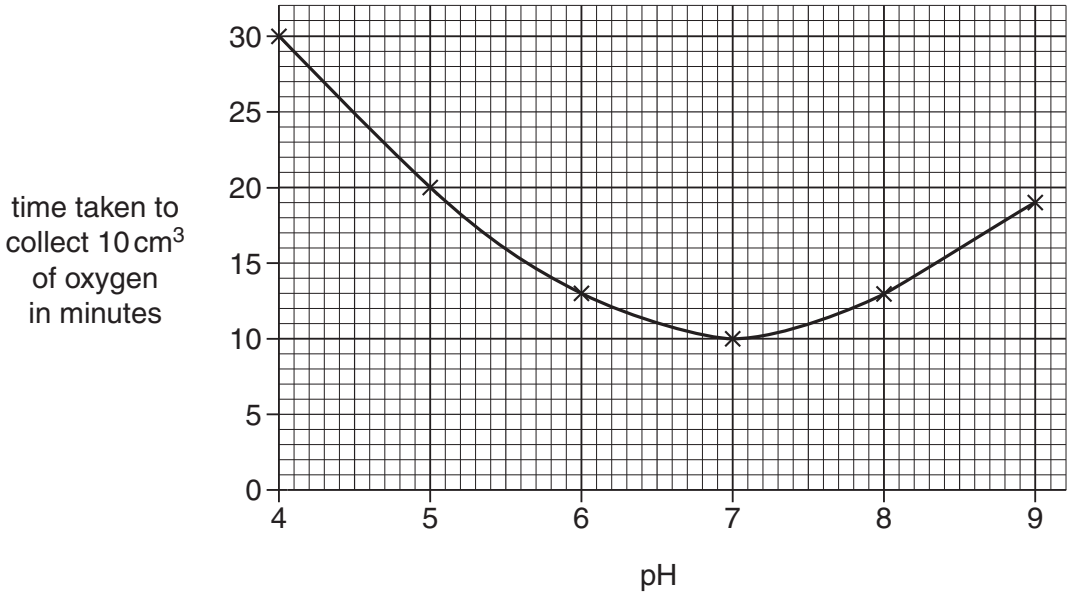
2 Tyrone is investigating the effect of pH on catalase enzyme.

He uses the enzyme to break down hydrogen peroxide into water and oxygen.

He times how long it takes to collect 10 cm^3 of oxygen.

The graph shows his results.

effect of pH on catalase activity



(a) Use the graph to answer these questions.

(i) Write down the **optimum** pH of the enzyme catalase.

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

(ii) Use your knowledge of enzymes to explain the shape of the graph.

.....

.....

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

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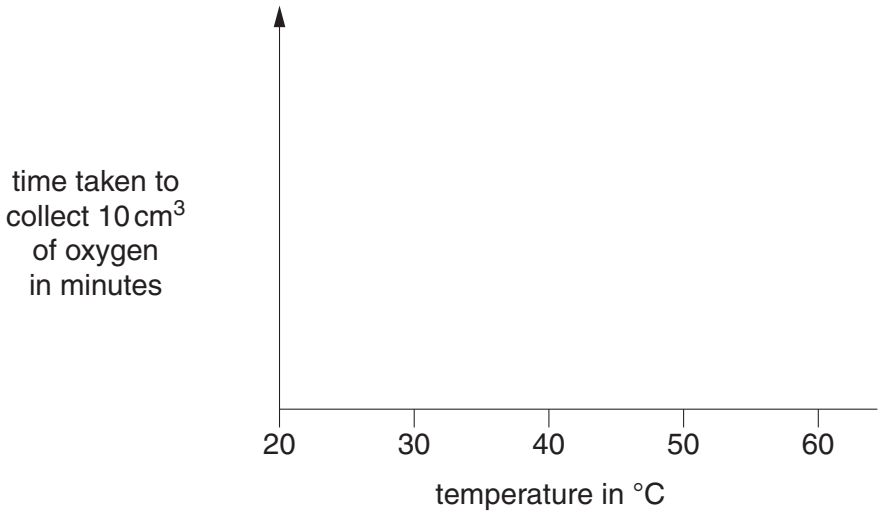
(b) Tyrone repeats his investigation.

This time he keeps the pH the same but changes the temperature.

He uses the temperatures 20 °C, 30 °C, 40 °C, 50 °C and 60 °C.

Catalase has an optimum temperature of 40 °C.

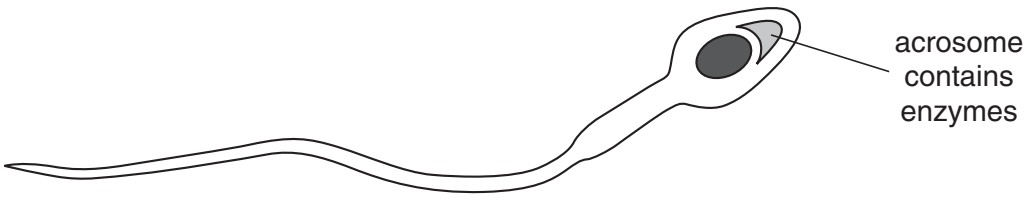
Draw a sketch graph to show the pattern Tyrone should expect in his results.



[2]

(c) Enzymes are found in cells.

The diagram shows where some enzymes are found in the **sperm cell**.



Write down the job of the enzymes in the acrosome.

.....

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

[Total: 6]

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3 Potato plants grow from potatoes.

(a) Nick puts a potato into the ground.

It grows into a potato plant.

This is an example of cloning.

Describe **one** advantage and **one** disadvantage of producing potato plants by cloning.

advantage .....

.....

disadvantage .....

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

(b) Plants can also be cloned by tissue culture.

One of the processes involved in tissue culture is selecting the plant with the correct characteristics.

Write about **two other** processes involved in tissue culture.

1 .....

.....

2 .....

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

(c) New varieties of potato can be produced using selective breeding.

Look at the statements about selective breeding.

Put ticks (✓) in the boxes to show if each statement is true or false.

	true	**false**
it reduces variation	☐	☐
it increases the rate of mutation	☐	☐

[1]

[Total: 5]

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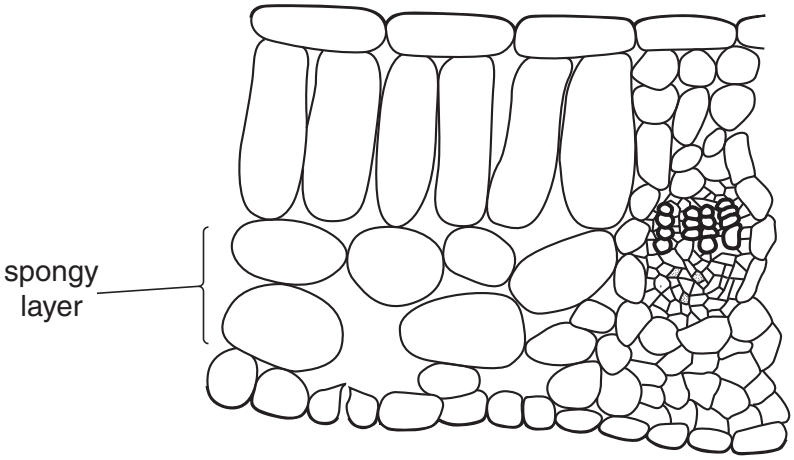
4 Look at the diagram. It shows the cells in the leaf of a plant.



(a) Oxygen moves out of the leaf during gas exchange.

What is the name of this process?

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

(b) The spongy layer is adapted for efficient gas exchange.

Explain how.

.....

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

(c) Cells have to differentiate to make all the different cells in a plant.

Cell differentiation in plants is different from animals.

Explain **one** way it is different.

.....

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

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Turn over for the remainder of question 4

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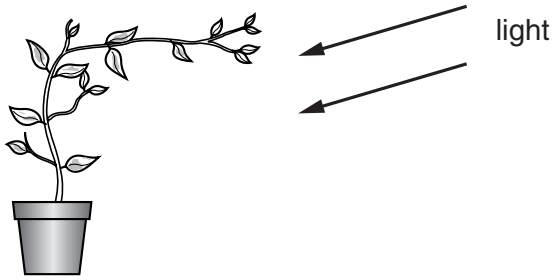
(d) Look at the diagram.

It shows a plant growing towards the light.



The plant grows towards the light because of auxin.

(i) Where in the plant stem is auxin made?

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

(ii) Plants grow towards light.

What is the name given to this response?

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

[Total: 5]

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Section B – Module C3

5 Sodium reacts with water.

A gas which burns with a 'pop' is made.

An alkaline solution is also made.

(a) Complete the **word** equation for this reaction.

sodium + water ⟶ ……..... + ……..... **[2]**

(b) All Group 1 elements react with water in a similar way.

Explain why. Use ideas about electronic structure.

.....

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

(c) Sodium reacts with water.

A sodium ion, Na^+, is made.

$$Na - e^- \longrightarrow Na^+$$

What type of reaction is this?

Choose from:

decomposition

electrolysis

oxidation

reduction

answer .....

Explain your answer.

.....

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

[Total: 5]

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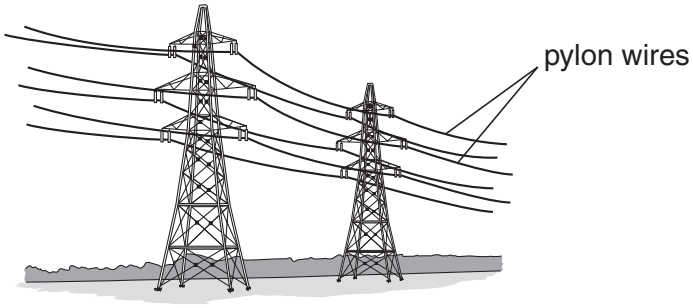
6 This question is about metals.

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

metal	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
iron	1535	7.9	11	400
silver	962	10.5	67	20 000
zinc	420	7.1	18	870

(a) Aluminium is used to make pylon wires.



Silver and copper are better electrical conductors than aluminium.

Silver and copper are **not** used to make pylon wires.

Explain why silver and copper are **not** used to make pylon wires.

Use the table to help you.

.....

.....

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

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(b) Which metal would be the best to use for a door stop for keeping doors open?

Choose from the table.

metal .....

Write down **two** reasons why.

.....

.....

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

(c) Metals are good conductors of electricity.

Explain how metals conduct electricity.

Use ideas about the structure of metals.

.....

.....

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

[Total: 6]

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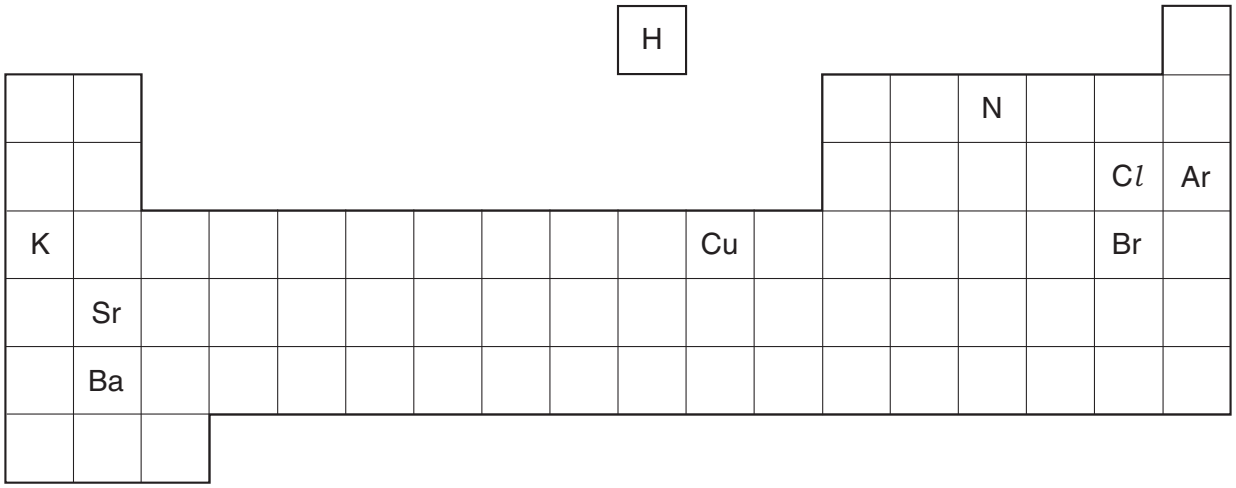
7 Look at the diagram. It shows an outline of the Periodic Table.



Answer the questions.

Choose your answers **only** from the symbols shown on the outline table.

Use the Periodic Table on the back page to help you.

Which symbol shows

(a) an element whose atoms have 8 electrons in their outer shell? ..... **[1]**

(b) an element that is a red/brown liquid? ..... **[1]**

(c) an element that forms blue compounds? ..... **[1]**

(d) the element in Group 2 and Period 5? ..... **[1]**

[Total: 4]

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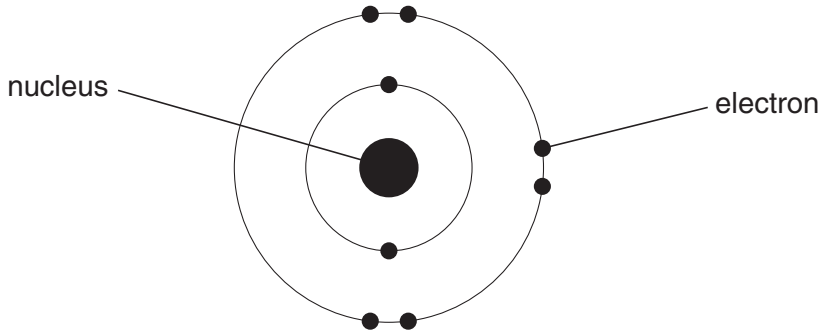
8 This question is about atoms.

Look at the diagram of an oxygen atom.



(a) The **atomic number** of oxygen is 8.

What is meant by atomic number?

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

(b) Oxygen reacts with sodium. Sodium oxide is made.

The electronic structure of oxygen is 2.6.

The electronic structure of sodium is 2.8.1.

Describe the bonding in sodium oxide, Na_2O.

Your answer should include

- a dot and cross diagram
- the charges on the ions made.

.....

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

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(c) An atom of chlorine can be represented by the symbol

$$^{37}_{17}Cl$$

Complete the table about this atom of chlorine.

number of protons	17
number of neutrons	
number of electrons	17
electronic structure	

[2]

[Total: 5]

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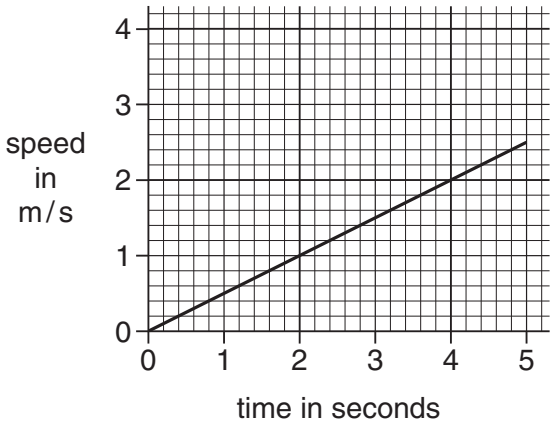
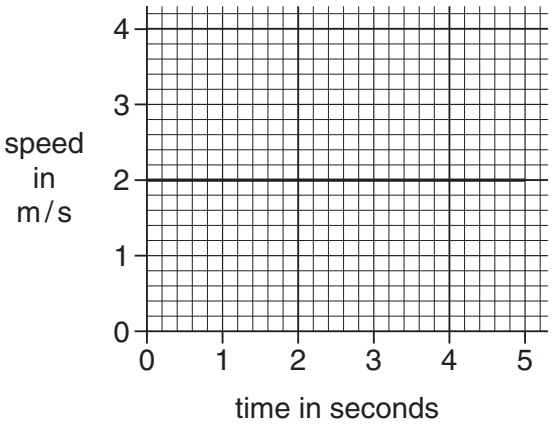
Section C – Module P3

9 Look at the four speed–time graphs.

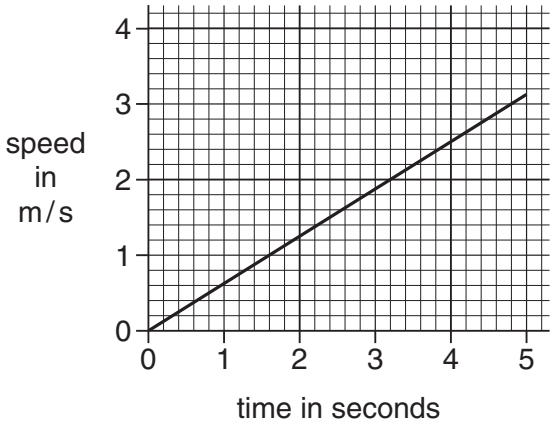
A



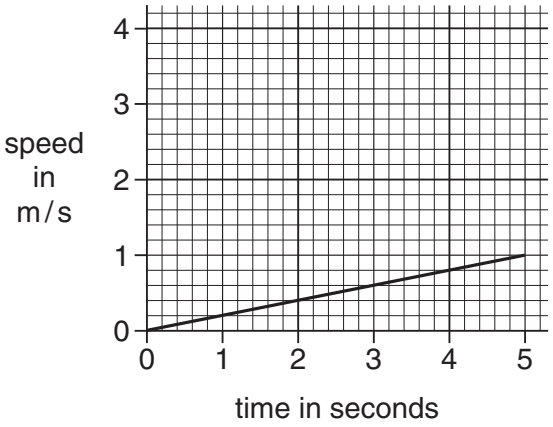
B



C



D



(a) (i) Which graph shows a distance of 5 m travelled in the first 4 seconds?

Choose from **A** **B** **C** **D**

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

(ii) Which graph shows an acceleration of 0.2 m/s^2?

Choose from **A** **B** **C** **D**

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

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Turn over for the remainder of question 9

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(b) Claire drives her car carefully. She needs to stop the car quickly.

(i) Some factors can increase or decrease her **thinking distance**.

Some factors do **not** change her thinking distance.

Complete the table.

The first one is done for you.

factor	**thinking distance**		
	increases	**decreases**	**unchanged**
drinking alcohol	✓		
worn tyres			
answering mobile phone			
higher speed			

[1]

(ii) Some factors can increase or decrease her **braking distance**.

Some factors do **not** change her braking distance.

Complete the table.

The first one is done for you.

factor	**braking distance**		
	increases	**decreases**	**unchanged**
drinking alcohol			✓
worn tyres			
answering mobile phone			
higher speed			

[1]

[Total: 4]

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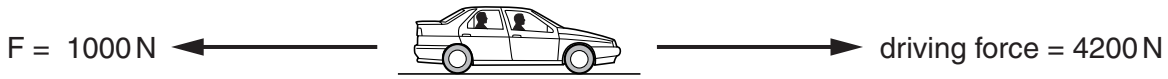
10 Carley drives a car.

The total mass of the car and all the people in it is 1600 kg.



The engine produces a driving force of 4200 N.

During acceleration there is a frictional force (F) of 1000 N.

Calculate the acceleration of the car.

The equations on page 2 may help you.

.....

.....

.....

.....

answer ..... m/s^2 **[3]**

[Total: 3]

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11 This question is about the engine sizes of cars and how much pollution they make.

(a) Look at the table.

car	engine size in cm^3	carbon dioxide emissions in g/km
A	6700	380
B	5700	360
C	4200	310
D	3500	280
E	1600	160
F	1100	115

There is a pattern between the size of engine and the carbon dioxide emissions.

What is the pattern?

.....

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

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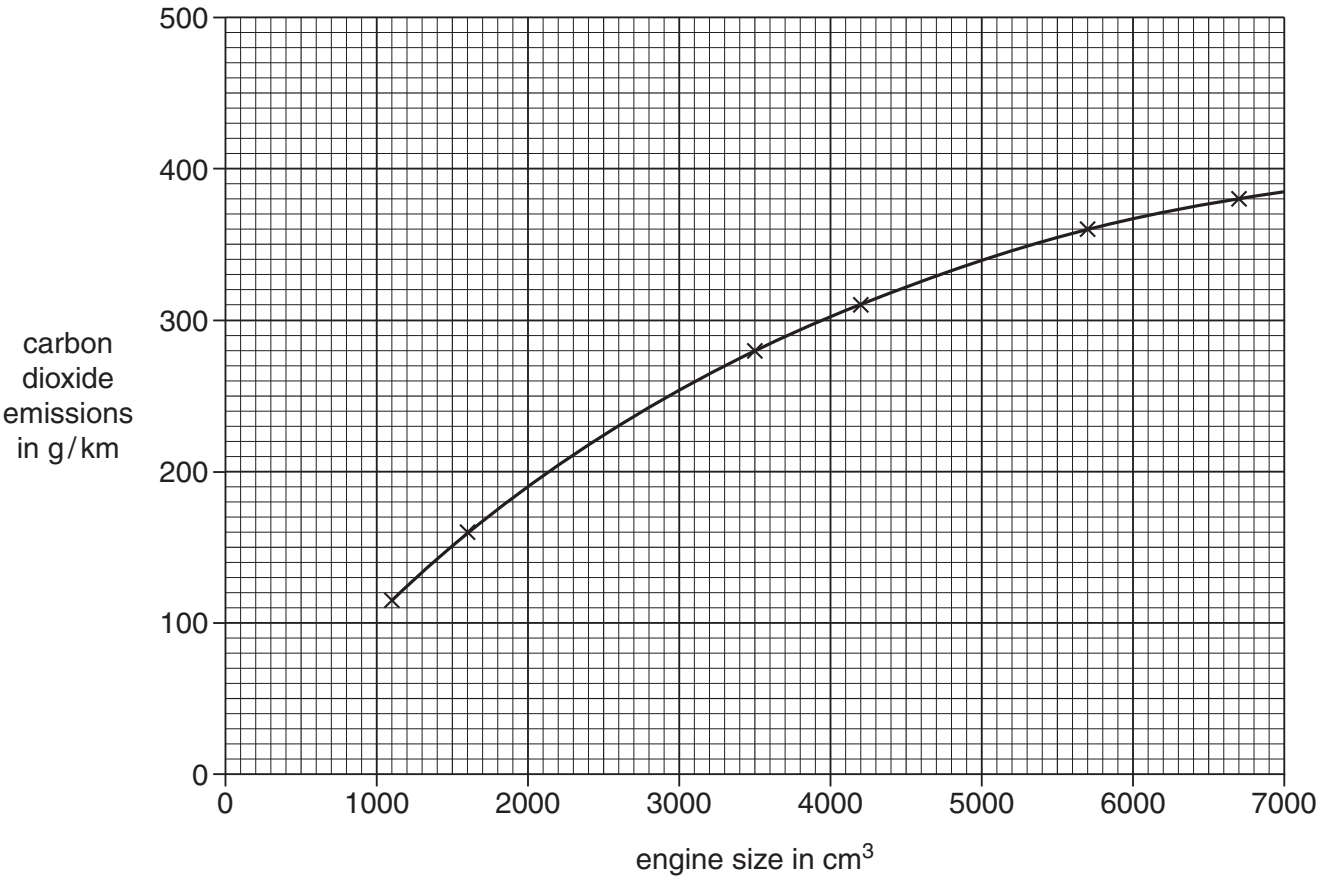
(b) The data is plotted on a graph.

Look at the graph.



(i) Many cars have an engine size of 2000 cm^3.

What is the carbon dioxide emission for an engine this size?

answer ..... g/km **[1]**

(ii) Many cars have smaller engines.

Extend the graph to find the carbon dioxide emission from a 600 cm^3 engine.

answer ..... g/km **[1]**

[Total: 3]

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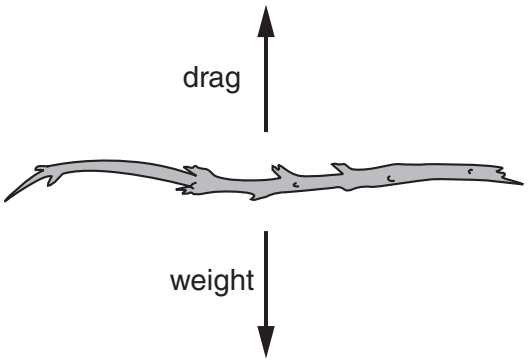
12 **(a)** Dina drops a twig from a high bridge.

When it hits the ground it is travelling at its terminal speed.



(i) The twig increases in speed when it is dropped.

Explain why.

.....

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

(ii) The twig travels at a terminal speed before it hits the ground.

Explain why.

.....

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

(b) The weight of the twig is 5 N.

Write down the size of the drag when the twig reaches **terminal speed**.

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

[Total: 3]

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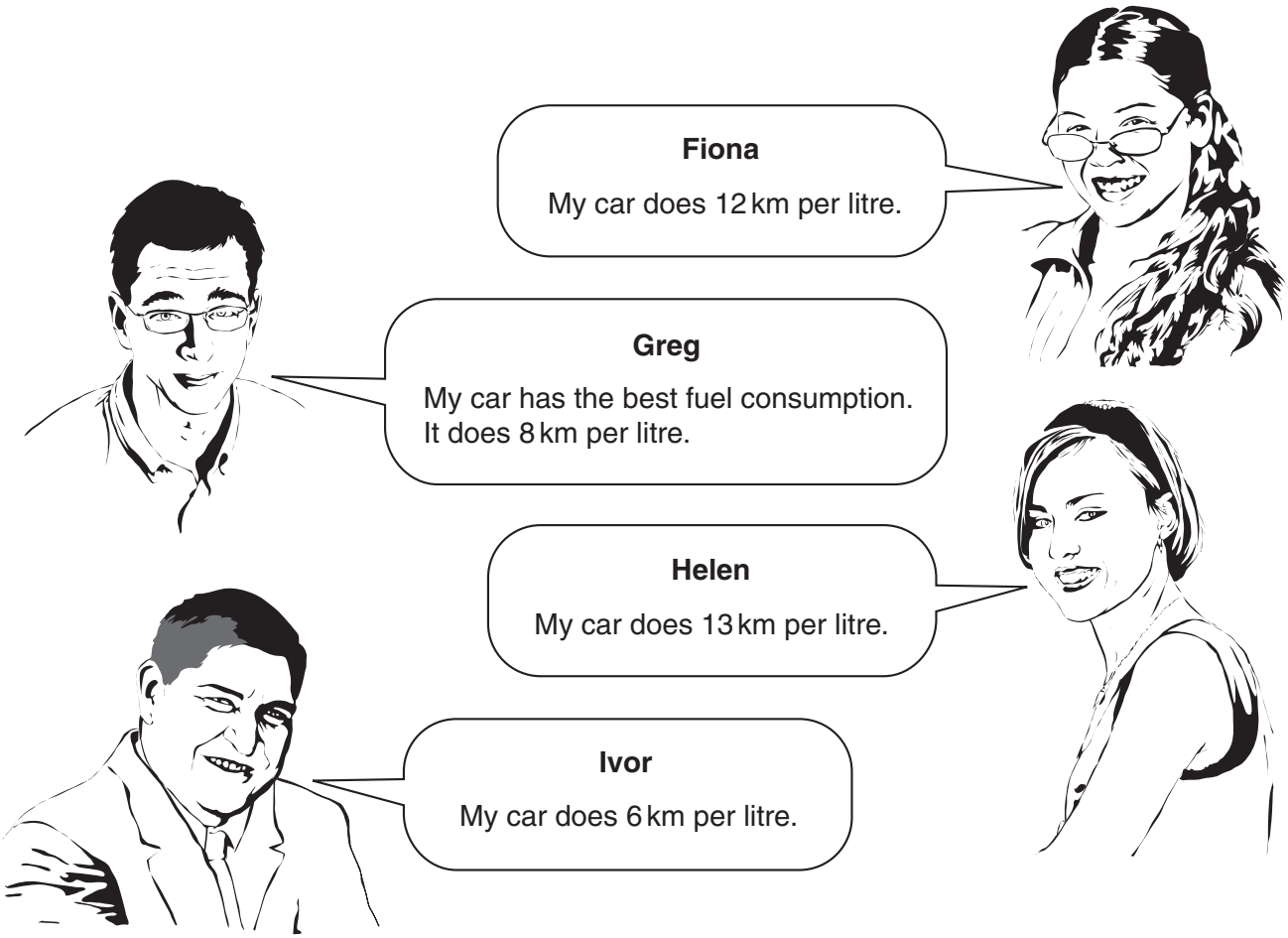
13 **(a)** Different cars have different fuel consumptions.

Look at what four drivers say about their cars.



Greg is wrong.

Whose car has the best fuel consumption? .....

Explain why.

.....

.....

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

(b) Switching on air conditioning increases the amount of fuel a car uses.

Write down one **other** factor that **increases** the amount of fuel a car uses.

Factor .....

Explain why this increases the amount of fuel used.

.....

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

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(c) Jennie's car is fitted with an air bag.

The car is involved in a crash.

(i) What does the air bag absorb in a crash?

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

(ii) An air bag reduces the forces on the driver in a crash.

Explain how.

In your answer write about

- stopping time
- acceleration.

.....

.....

.....

.....

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

(d) Tessa's car has electric windows.

They are a safety feature.

Suggest how electric windows can make cars safer.

.....

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

[Total: 7]

END OF QUESTION PAPER

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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.

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