

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B623/02

ADDITIONAL SCIENCE B

Unit 1 Modules B3 C3 P3 (Higher Tier)

**Wednesday 20 January 2010
Morning**

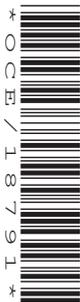
Duration: 1 hour

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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.

2

EQUATIONS

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

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

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

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

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

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

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

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

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

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]

Turn over

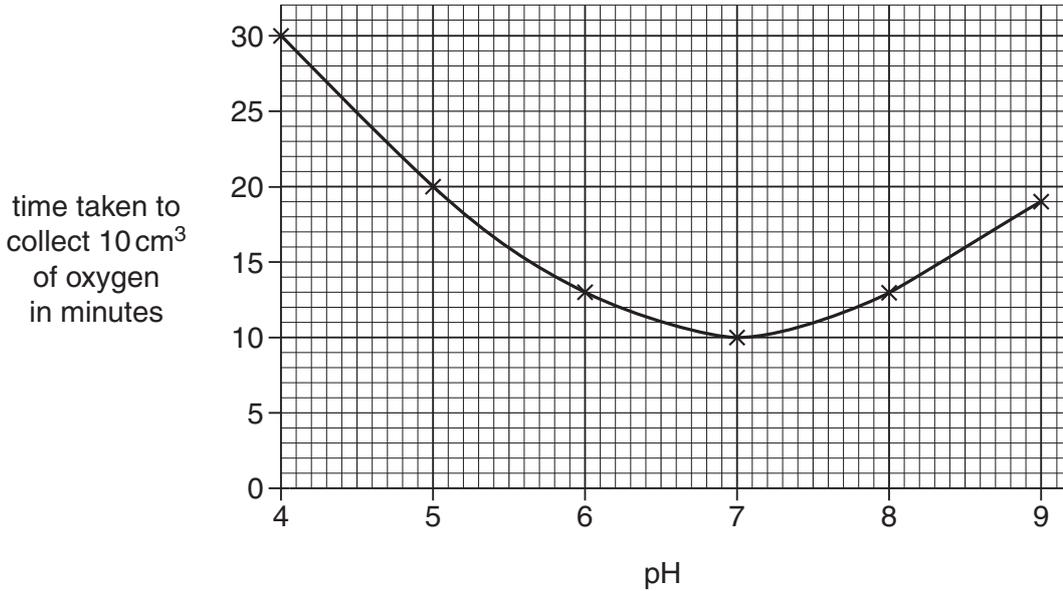
2 Tyrone is investigating the effect of pH on catalase enzyme.

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

He times how long it takes to collect 10 cm³ 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]

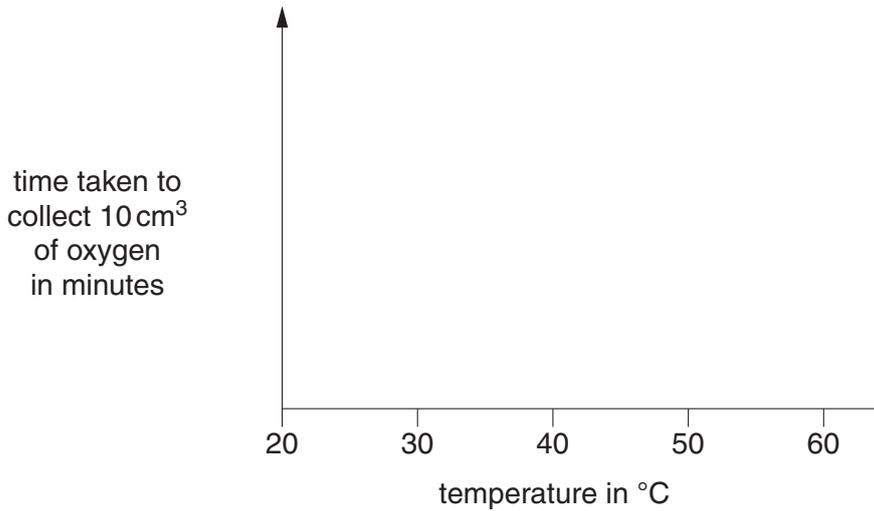
(b) Tyrone repeats his investigation.

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.

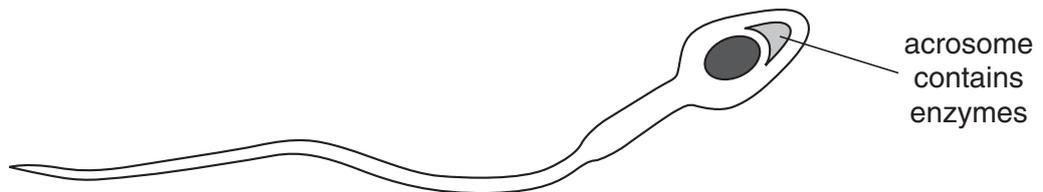
Draw a sketch graph to show the pattern Tyrone should expect in his results.



[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]

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.

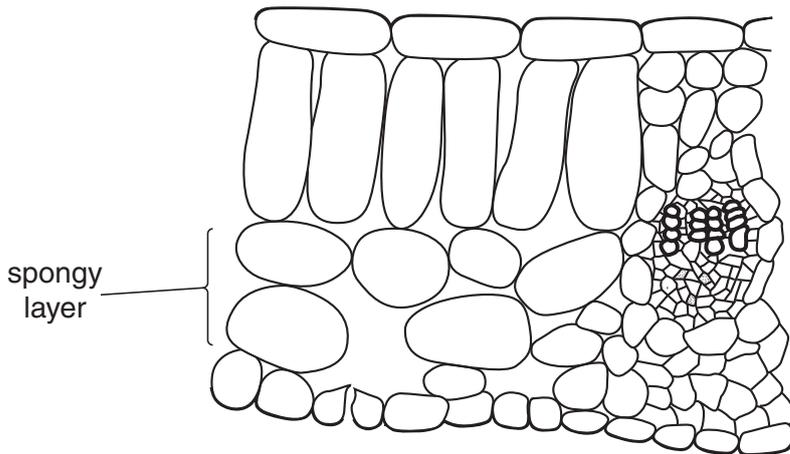
Put ticks (✓) in the boxes to show if each statement is true or false.

	true	false
it reduces variation	<input type="checkbox"/>	<input type="checkbox"/>
it increases the rate of mutation	<input type="checkbox"/>	<input type="checkbox"/>

[1]

[Total: 5]

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.

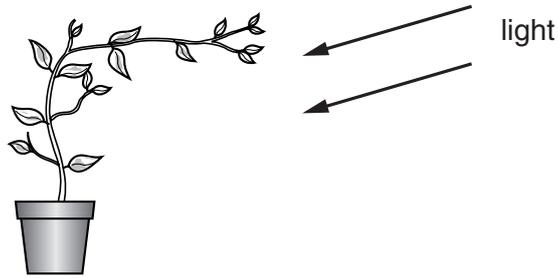
Cell differentiation in plants is different from animals.

Explain **one** way it is different.

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

(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]

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 \rightarrow + [2]

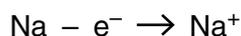
(b) All Group 1 elements react with water in a similar way.

Explain why. Use ideas about electronic structure.

.....
 [1]

(c) Sodium reacts with water.

A sodium ion, Na^+ , is made.



What type of reaction is this?

Choose from:

decomposition

electrolysis

oxidation

reduction

answer

Explain your answer.

.....
 [2]

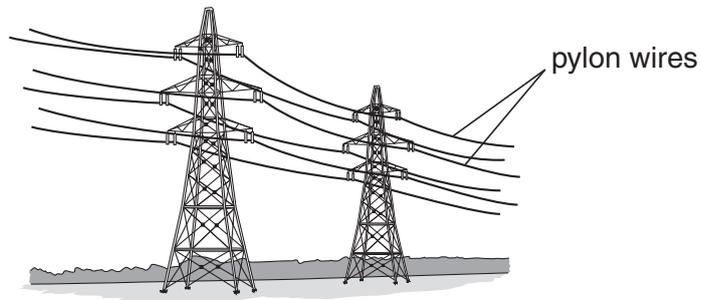
[Total: 5]

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	20000
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]

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



door stop

Choose from the table.

metal

Write down **two** reasons why.

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

(c) Metals are good conductors of electricity.

Explain how metals conduct electricity.

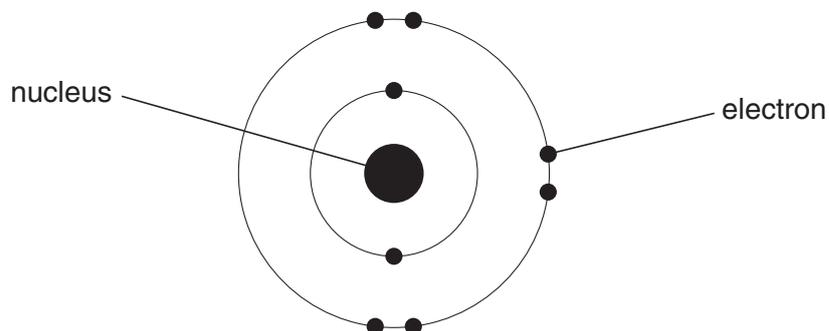
Use ideas about the structure of metals.

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

[Total: 6]

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 .

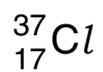
Your answer should include

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

.....
 [2]

14

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



Complete the table about this atom of chlorine.

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

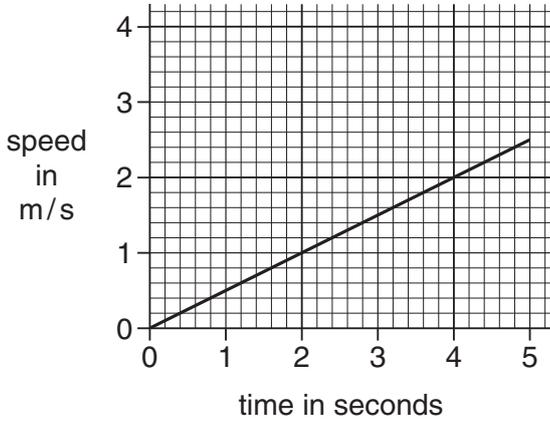
[2]

[Total: 5]

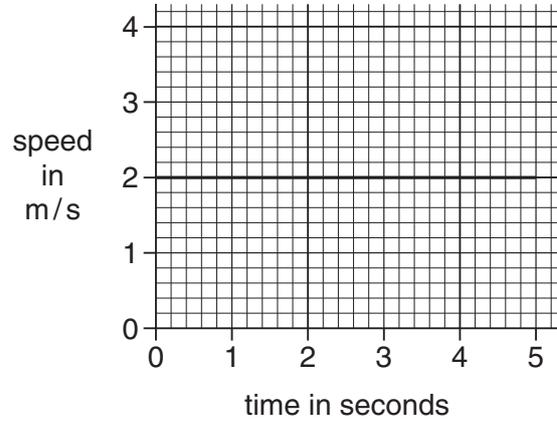
Section C – Module P3

9 Look at the four speed–time graphs.

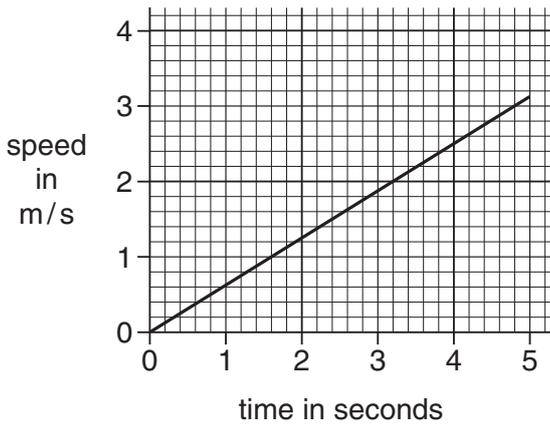
A



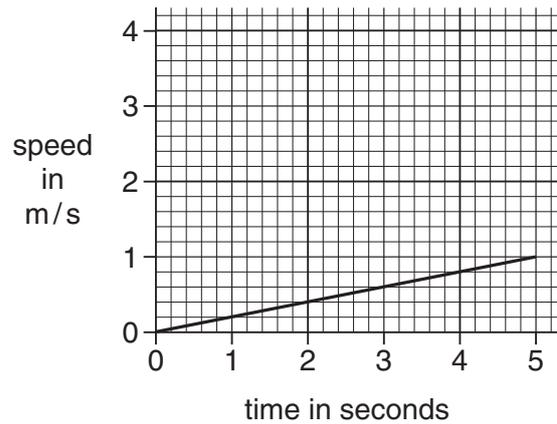
B



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]

(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]

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/s² [3]

[Total: 3]

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

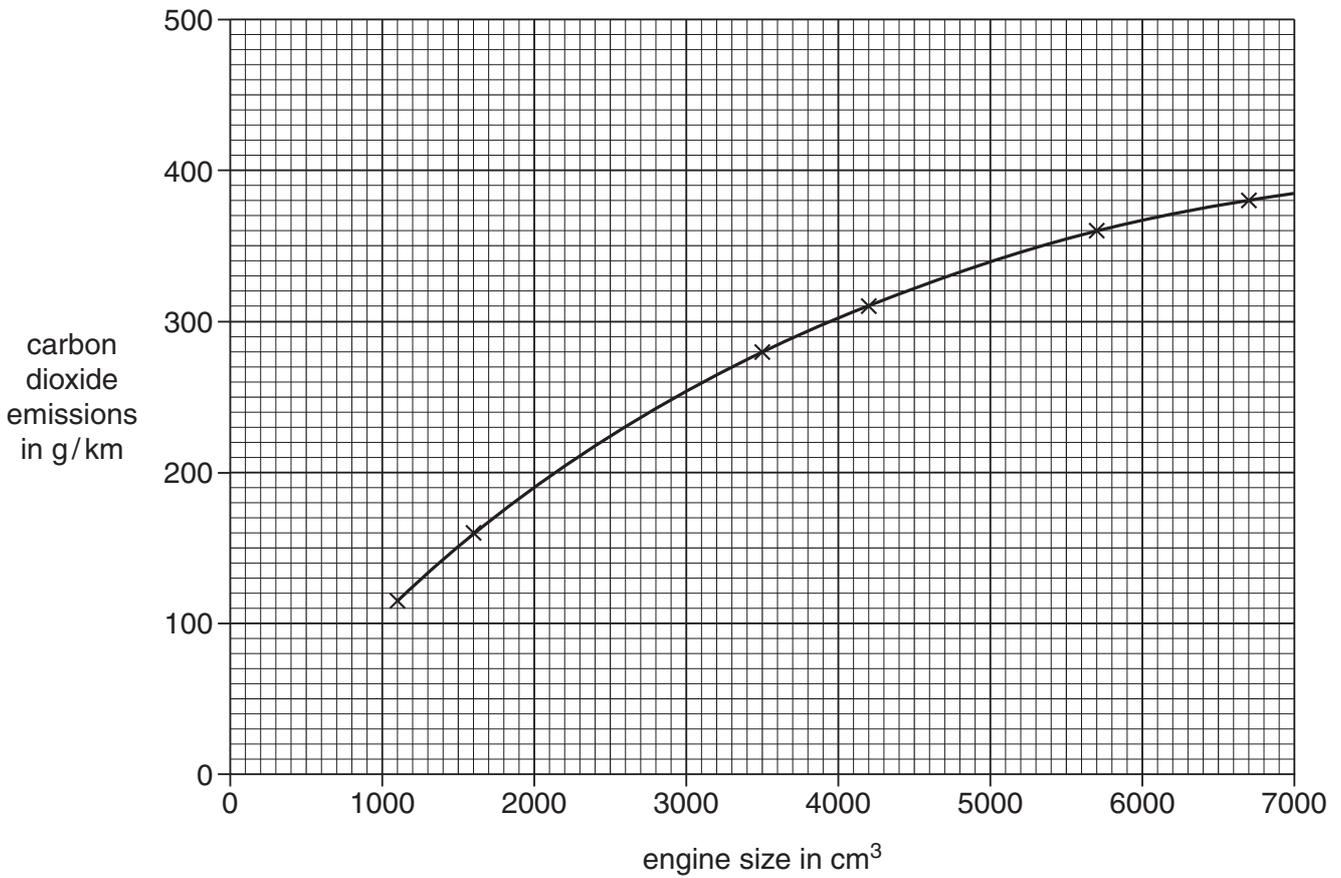
There is a pattern between the size of engine and the carbon dioxide emissions.

What is the pattern?

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

(b) The data is plotted on a graph.

Look at the graph.



(i) Many cars have an engine size of 2000 cm³.

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 cm³ engine.

answer g/km [1]

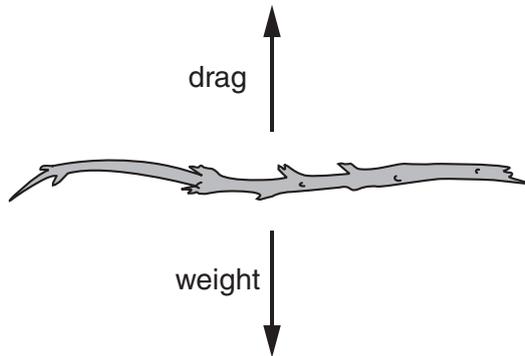
[Total: 3]

20
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PLEASE DO NOT WRITE ON THIS PAGE

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]

13 (a) Different cars have different fuel consumptions.

Look at what four drivers say about their cars.

Fiona
My car does 12 km per litre.

Greg
My car has the best fuel consumption.
It does 8 km per litre.

Helen
My car does 13 km per litre.

Ivor
My car does 6 km per litre.

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]

(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	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27
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
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
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
133	137	139	178	181	184	186	190	192
133 Cs caesium 133	137 Ba barium 137	139 La* lanthanum 139	178 Hf hafnium 178	181 Ta tantalum 181	184 W tungsten 184	186 Re rhenium 186	190 Os osmium 190	192 Ir iridium 192
209	209	209	209	209	209	209	209	209
209 Bi bismuth 209	209 Pb lead 209	209 Tl thallium 209	209 Pb lead 209	209 Bi bismuth 209	209 Po polonium 209	209 At astatine 209	209 Rn radon 209	209 Fr francium 209
112	112	112	112	112	112	112	112	112
112 Cd cadmium 112	112 In indium 112	112 Sn tin 112	112 Pb lead 112	112 Bi bismuth 112	112 Po polonium 112	112 At astatine 112	112 Rn radon 112	112 Fr francium 112
65	65	65	65	65	65	65	65	65
65 Zn zinc 65	65 Ga gallium 65	65 Ge germanium 65	65 As arsenic 65	65 Se selenium 65	65 Br bromine 65	65 Kr krypton 65	65 Xe xenon 65	65 Rn radon 65
59	59	59	59	59	59	59	59	59
59 Ni nickel 59	59 Cu copper 59	59 Zn zinc 59	59 Ga gallium 59	59 Ge germanium 59	59 As arsenic 59	59 Se selenium 59	59 Br bromine 59	59 Kr krypton 59
106	106	106	106	106	106	106	106	106
106 Pd palladium 106	106 Ag silver 106	106 Cd cadmium 106	106 In indium 106	106 Sn tin 106	106 Pb lead 106	106 Bi bismuth 106	106 Po polonium 106	106 At astatine 106
103	103	103	103	103	103	103	103	103
103 Rh rhodium 103	103 Pd palladium 103	103 Ag silver 103	103 Cd cadmium 103	103 In indium 103	103 Sn tin 103	103 Pb lead 103	103 Bi bismuth 103	103 Po polonium 103
56	56	56	56	56	56	56	56	56
56 Fe iron 56	56 Co cobalt 56	56 Ni nickel 56	56 Cu copper 56	56 Zn zinc 56	56 Ga gallium 56	56 Ge germanium 56	56 As arsenic 56	56 Se selenium 56
101	101	101	101	101	101	101	101	101
101 Ru ruthenium 101	101 Rh rhodium 101	101 Pd palladium 101	101 Ag silver 101	101 Cd cadmium 101	101 In indium 101	101 Sn tin 101	101 Pb lead 101	101 Bi bismuth 101
93	93	93	93	93	93	93	93	93
93 Zr zirconium 93	93 Nb niobium 93	93 Mo molybdenum 93	93 Tc technetium 93	93 Ru ruthenium 93	93 Rh rhodium 93	93 Pd palladium 93	93 Ag silver 93	93 Cd cadmium 93
48	48	48	48	48	48	48	48	48
48 Ti titanium 48	48 V vanadium 48	48 Cr chromium 48	48 Mn manganese 48	48 Fe iron 48	48 Co cobalt 48	48 Ni nickel 48	48 Cu copper 48	48 Zn zinc 48
178	178	178	178	178	178	178	178	178
178 Hf hafnium 178	178 Ta tantalum 178	178 W tungsten 178	178 Re rhenium 178	178 Os osmium 178	178 Ir iridium 178	178 Pt platinum 178	178 Au gold 178	178 Hg mercury 178
207	207	207	207	207	207	207	207	207
207 Pb lead 207	207 Bi bismuth 207	207 Po polonium 207	207 At astatine 207	207 Rn radon 207	207 Fr francium 207	207 Ra radium 207	207 Ac* actinium 207	207 La* lanthanum 207
131	131	131	131	131	131	131	131	131
131 Xe xenon 131	131 Kr krypton 131	131 Ar argon 131	131 Ne neon 131	131 He helium 131	131 Li lithium 131	131 Be beryllium 131	131 B boron 131	131 C carbon 131

1
H
hydrogen
1

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.