| Candidate forename | | | | | Candidate surname | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Centre number | | | | | Candidate number | | | | |

# OXFORD CAMBRIDGE AND RSA EXAMINATIONS
## GENERAL CERTIFICATE OF SECONDARY EDUCATION

# B623/02

# GATEWAY SCIENCE

# ADDITIONAL SCIENCE B

## Unit 1  Modules B3 C3 P3 (Higher Tier)

### WEDNESDAY 19 JANUARY 2011: Morning
### DURATION: 1 hour

### SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

**Candidates answer on the question paper.**
**A calculator may be used for this paper.**

**<u>OCR SUPPLIED MATERIALS:</u>**
**None**

**<u>OTHER MATERIALS REQUIRED:</u>**
**Pencil**
**Ruler (cm/mm)**

**<u>READ INSTRUCTIONS OVERLEAF</u>**

## INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

- Use black ink. Pencil may be used for graphs and diagrams only.

- 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).

- Answer <u>ALL</u> the questions.


## 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 three.

- The Periodic Table is printed on the back page.

- The total number of marks for this paper is <u>60</u>.

# EQUATIONS

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

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

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

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

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

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

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

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

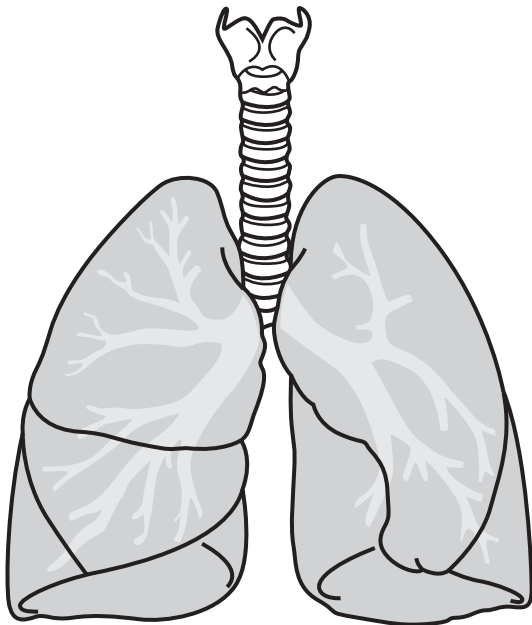$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

**Answer ALL the questions.**

**SECTION A – MODULE B3**

1   The diagram shows human lungs.

Air passes down the windpipe to lots of small air sacs.

The air sacs allow gases to pass into and out of the blood.



(a) What is the name of the small air sacs in the lungs?

_____ [1]

(b) The air sacs are adapted to allow efficient movement of gases into and out of the blood.

Write down ONE way in which they are adapted.

_____ [1]

**(c)** Julie has difficulty getting air into her lungs.

This is because her windpipe is damaged.

Doctors repair her windpipe using stem cells.

Suggest why they use stem cells.

_____

_____ **[1]**

**[Total: 3]**

**2** The table shows some information about the three main types of blood vessel in the body.

| type of blood vessel | diameter in mm | average thickness of wall in mm | percentage of the body's blood contained in the vessel |
|---|---|---|---|
| arteries | 4 – 25 | 1 | |
| capillaries | 0.01 | 0.001 | 5 |
| veins | 5 – 30 | 0.5 | 60 |

(a) Capillaries carry blood from arteries to veins.

(i) What is ANOTHER function of capillaries in the body?

_____

_____ [1]

(ii) Explain how ONE adaptation of capillaries allows them to work efficiently.

You must include information from the table in your answer.

adaptation _____

explanation _____

_____ [2]

**(b) (i)** The heart contains 12% of the body's blood.

Calculate the percentage of the body's blood contained in the arteries.

_____

_____

answer _____ %                    [1]

**(ii)** The heart pumps blood out into two arteries.

One of these is the pulmonary artery.

Write down the name of the OTHER artery.

_____ [1]

[Total: 5]

**3** **Read this newspaper article carefully.**

**SCIENTISTS CLONE A FROZEN MOUSE**



**Scientists have produced clones of a mouse that has been dead and frozen for 16 years.**

**This comes 11 years after the first living adult mammal was cloned.**

**Cloning dead, frozen animals was thought to be impossible due to cell damage.**
**Genetic material is destroyed when ice crystals form inside cells.**

**The scientists used genetic material from brain cells because the high fat content protected the cells from ice damage.**

**This work may be used on humans in the future. This would raise many ethical issues.**

**(a)** Finish the following sentences about the cloned mice.

The cloned mice contain the same genetic material as the frozen mouse.

The genetic code is determined by the sequence

of _____ in DNA.

Identical genetic material will code for the

production of identical _____

molecules. [2]

**(b)** The mice were produced by a cloning process similar to the one used to produce Dolly the sheep.

Write about how this cloning process is performed.

_____

_____

_____

_____

_____ [3]

**(c)** The article claims that there are possible ethical issues if this technique were to be used on humans.

ONE of these statements does NOT contain an ethical issue.

Put a tick (✓) in the box next to this statement.

In the future, humans could be frozen after death and cloned. ☐

The technique took years to develop. ☐

Many of the embryos produced by this technique die because they are abnormal. ☐
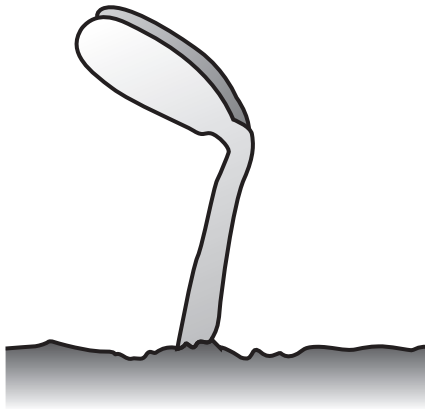
Children produced by cloning may be expected to develop certain skills. ☐

[1]

[Total: 6]

# BLANK PAGE

4   The diagram shows a soya plant growing in soil.



(a) When a plant grows, new cells are made by cell division.

Where in the plant does cell division occur?

_____

_____ [1]

(b) The shoot of the soya plant is growing towards light.

(i)  What name is given to this growth response?

_____ [1]

(ii) The growth of the soya plant is controlled by plant hormones.

Write down the name of ONE of these plant hormones.

_____ [1]

(c) Scientists have used genetic engineering to produce soya plants that are resistant to herbicide (weed killer).

(i) Suggest why some farmers want to grow these genetically engineered plants.

_____

_____ [1]

(ii) Some people are against the use of such genetically engineered plants and some people think that they are useful.

Suggest how people's views on this subject may be affected by where they live in the world.

_____

_____

_____ [2]

[Total: 6]

# SECTION B – MODULE C3

5  This question is about the elements in the Periodic Table.

Look at the list of elements.

| | | |
|---|---|---|
| **aluminium** | **bromine** | **chlorine** |
| **fluorine** | **gold** | **helium** |
| **hydrogen** | **iron** | **oxygen** |
| **phosphorus** | **sulfur** | **zinc** |

Answer the questions.

Choose your answers from the list.

Each element can be used ONCE, MORE THAN ONCE or NOT AT ALL.

The Periodic Table on the back page may help you.

(a) Which element is a green gas at room temperature?

_____ [1]

(b) Which element is an orange liquid at room temperature?

_____ [1]

**(c)** Dilute sulfuric acid is electrolysed.

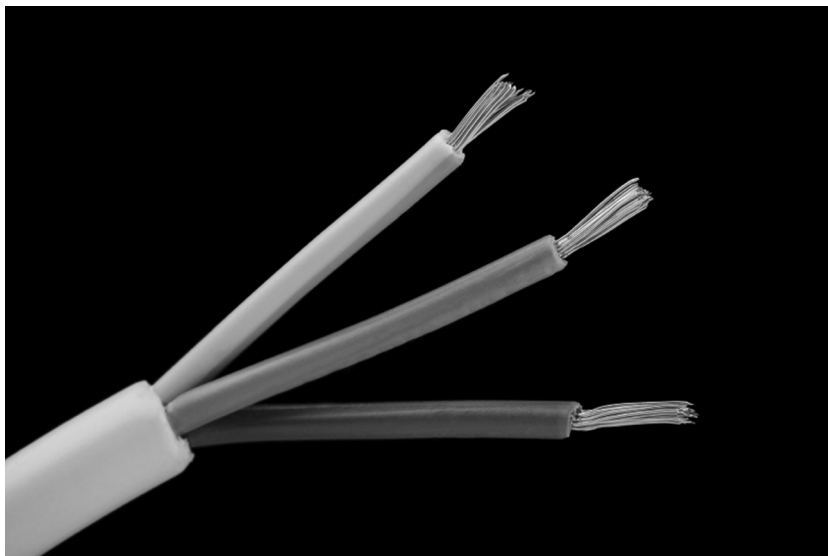Which element is made at the positive electrode (anode)?

_____ [1]

**(d)** Which element is used as a catalyst in the Haber process?

_____ [1]

[Total: 4]

**6** **Iron and copper are typical metals.**

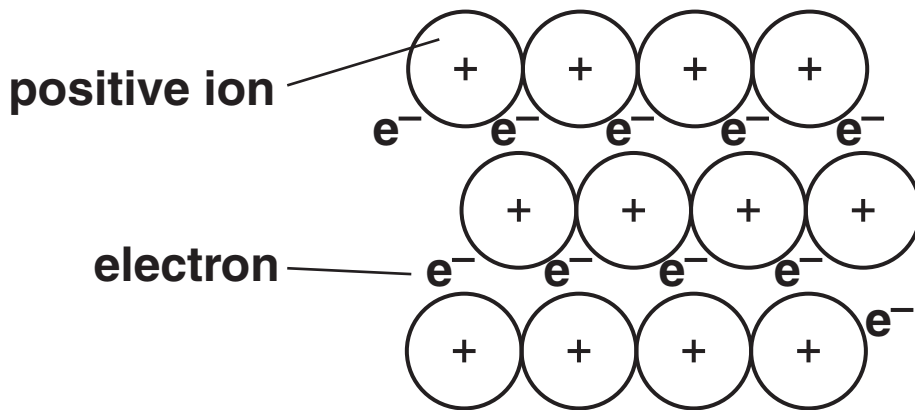**(a) Look at the picture of some electrical wires.**



Copper is used to make electrical wire even though it is expensive.

This is because copper is a good conductor of electricity.

Write down one OTHER reason why copper is used to make electrical wires.

_____ [1]

**(b)** Look at the diagram. It shows the structure of a metal.

positive ion

electron



   **(i)** Copper conducts electricity.

   Explain why. Use ideas about the structure of metals.

   _____

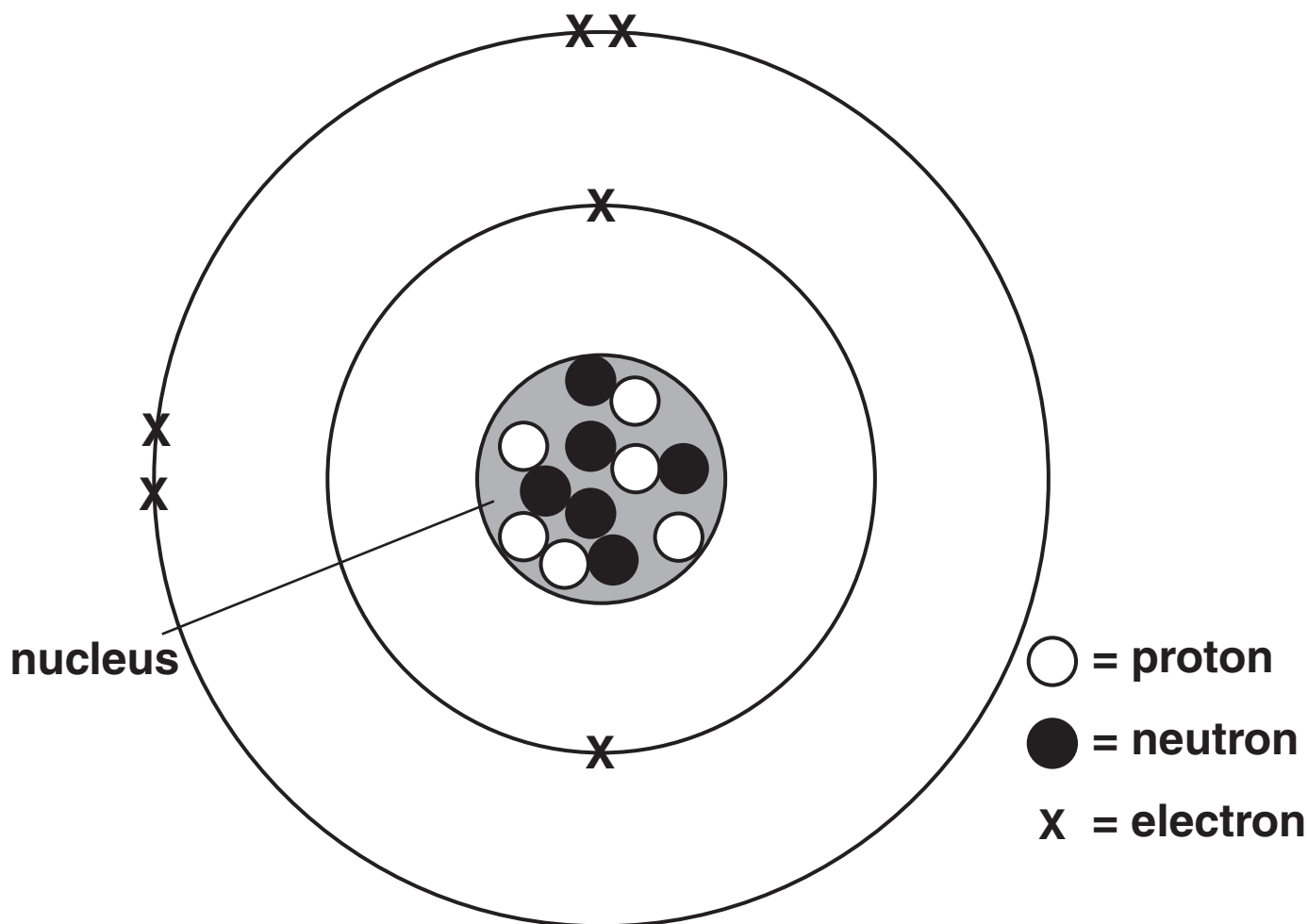   _____ **[1]**

   **(ii)** Iron has a very high melting point.

   Explain why. Use ideas about the structure of metals.

   _____

   _____

   _____

   _____ **[2]**

   **[Total: 4]**

7    All elements are made up of atoms.

Look at the diagram of an atom of an element.



nucleus

○ = proton

● = neutron

X = electron

(a) To which GROUP of the Periodic Table does the element belong?

_____                    [1]

(b) This element is in period 2 of the Periodic Table.

How can you tell from the diagram of the atom?

_____[1]

**(c)** The atom has a mass number of **12.**

How can you tell from the diagram of the atom?

_____ [1]

**(d)** Complete the table about the particles found in atoms.

| particle | relative electric charge | relative mass |
|----------|--------------------------|---------------|
| electron | _____ | 0.0005 |
| neutron | 0 | _____ |
| proton | +1 | 1 |

[2]

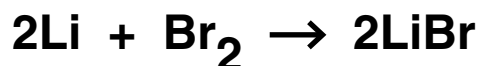**(e)** Explain why an atom of this element is neutral.

_____

_____ [1]

[Total: 6]

**8**   Fluorine, chlorine and bromine are halogens.

Lithium, sodium and potassium are alkali metals.

Lithium reacts with bromine to make lithium bromide.

$$2Li + Br_2 \longrightarrow 2LiBr$$

In this reaction lithium ions are made.

(a) Lithium atoms make lithium ions, $Li^+$.

Finish the sentence about how this happens.

Lithium atoms lose _____ to

make positive lithium ions.                                      [1]

(b) Potassium reacts with fluorine to make potassium fluoride.

Write the BALANCED SYMBOL equation for this reaction.

_____ [2]

(c) The reaction between potassium and fluorine is more violent than that of lithium and bromine.

One reason is that fluorine is more reactive than bromine.

Explain why fluorine is more reactive.

Use ideas about gain of electrons.

_____

_____ [1]

(d) Chlorine has the electronic structure 2.8.7.

Draw a 'dot and cross' diagram to show the bonding in a chlorine molecule, $Cl_2$.

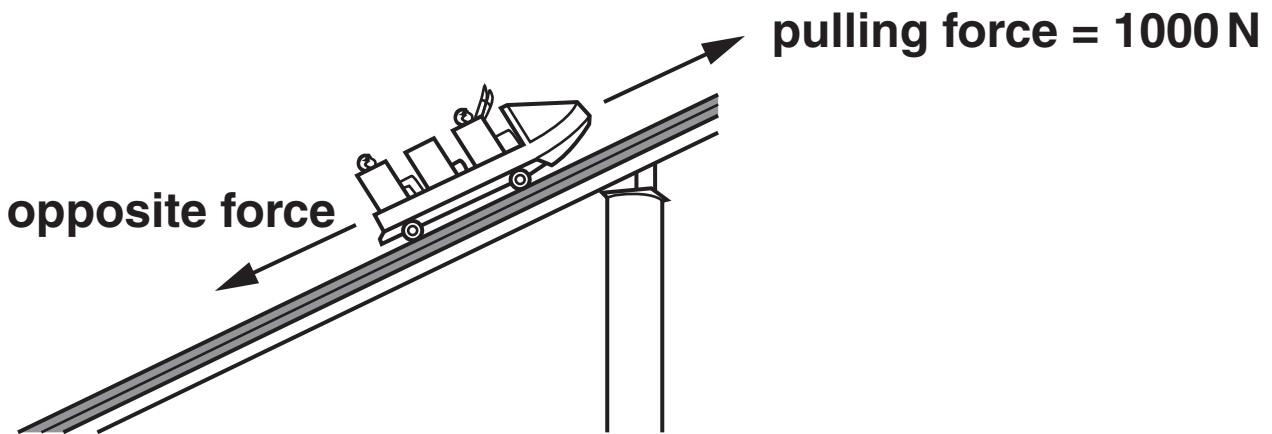You only need to draw the electrons in the outer shells.

[2]

[Total: 6]

## SECTION C – MODULE P3

**9**  **This question is about the energy and speed of a roller coaster.**

**(a)  An electric motor pulls the roller coaster car up the slope.**



pulling force = 1000 N

opposite force

**(i)  The car moves 20 m.**

**The pulling force is 1000 N.**

**Calculate the work done on the car.**

**The equations on page 3 may help you.**

_____

_____

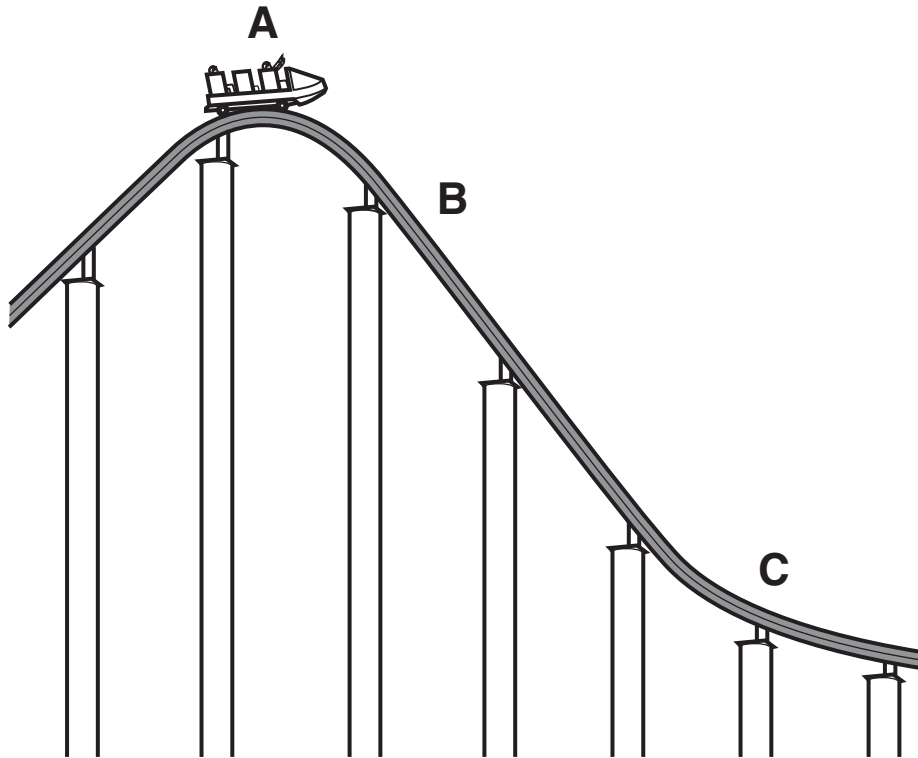**answer** _____ **J**                    **[2]**

**(ii)  The car climbs the slope at a STEADY SPEED.**

**What is the size of the opposite force when the speed is steady?**

**answer**_____ **N**                    **[1]**

**(b)** Look at the diagram of the roller coaster.



The car stops at point A.

What type of energy does the car have when it stops here?

_____ [1]

**(c)** The car rolls down the slope.

At point B its speed is 6 m/s.

At point C its speed has doubled to 12 m/s.

What happens to its KINETIC energy between point B and point C?

_____

_____ [2]

[Total: 6]

**10** **Look at the diagram.**

**It shows the stopping distance of a car travelling at 16 m/s.**

| thinking distance = 12 m | braking distance = 24 m |
|---|---|

**(a)** **Thinking distance AND braking distance both increase when cars go faster.**

**(i)** **Write down two OTHER things that can increase the THINKING distance.**
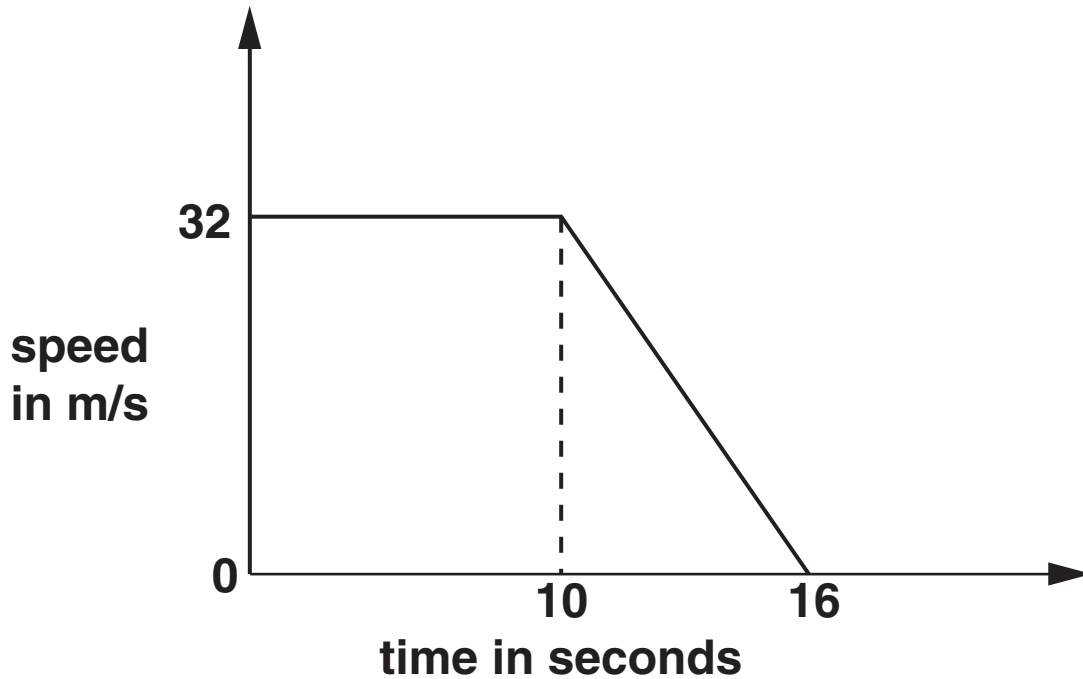
1 _____

2 _____ **[2]**

**(ii)** **Write down one OTHER thing that can increase BRAKING distance.**

_____ **[1]**

**(b)** Another car travels at 32 m/s.

This car brakes suddenly.

Look at the speed – time graph of the car.



The car brakes in 6 s.

Use the graph to calculate the distance the car moves while BRAKING.

_____

_____

answer _____ m                    [2]

[Total: 5]

**11** This question is about the fuel consumption of different vehicles.

Look at the information on fuel consumption.

| type of vehicle | fuel consumption in kilometres per litre | number of people carried by vehicle |
|:---:|:---:|:---:|
| bus | 3 | 60 |
| car | 11 | 4 |
| motorbike | 23 | 2 |
| tractor | 4 | 1 |

(a) The motorbike has the lowest fuel consumption.

How far can the motorbike travel on 5 litres of fuel?

_____

answer _____ km          [1]

(b) The bus is better for the environment than the motorbike.

Use the information in the table to explain why.

_____

_____ [1]

**(c)** The average fuel consumption of the car is 11 kilometres per litre but this consumption can vary from 7 to 13 kilometres per litre.
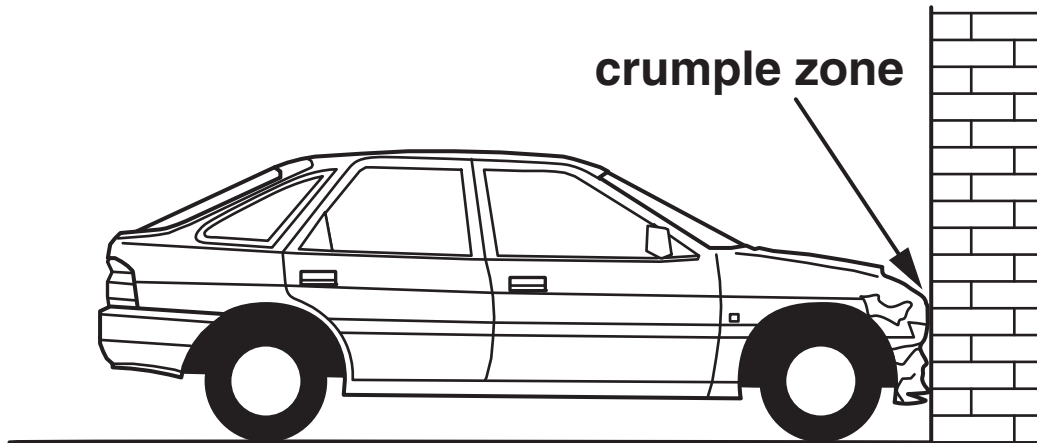
Suggest TWO reasons for this variation.

1 _____

_____

2 _____

_____ **[2]**

**[Total: 4]**

**12** **Cars have crumple zones.**



crumple zone

**Crumple zones absorb energy and help to reduce injuries in a crash.**

**Explain why.**

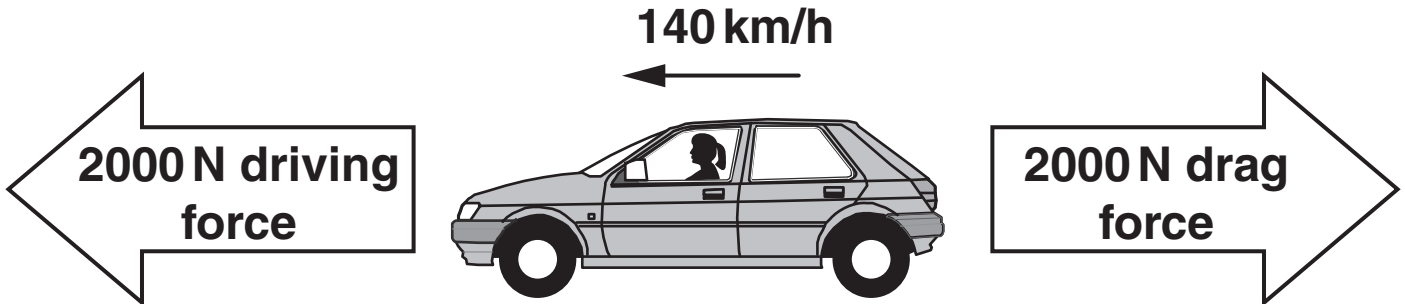**In your answer use ideas about**

- **force**

- **time**

- **acceleration.**

_____

_____

_____

_____

_____ **[3]**

**[Total: 3]**

**13** A car has a maximum driving force of 2000 N.

It has a top speed of 140 km/h.

Look at the diagram.

140 km/h

2000 N driving force

2000 N drag force

A roof box is placed on top of the car. Look at the diagram.

2000 N driving force
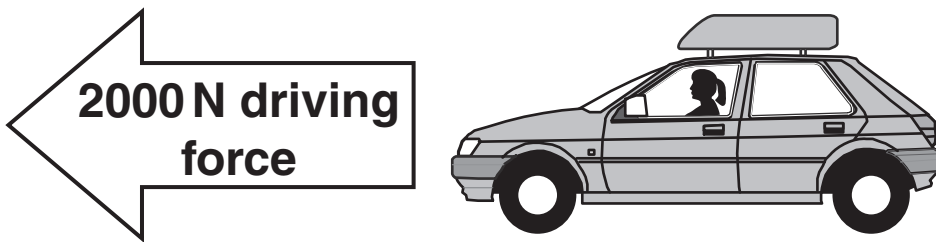
Explain why the roof box affects the drag force.

_____

_____

Explain why the top speed is lower with the roof box.

_____

_____

_____ **[2]**

**[Total: 2]**

**END OF QUESTION PAPER**

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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<br>**He**<br>helium<br>2 |
| 7<br>**Li**<br>lithium<br>3 | 9<br>**Be**<br>beryllium<br>4 | | | | | | | | | | | 11<br>**B**<br>boron<br>5 | 12<br>**C**<br>carbon<br>6 | 14<br>**N**<br>nitrogen<br>7 | 16<br>**O**<br>oxygen<br>8 | 19<br>**F**<br>fluorine<br>9 | 20<br>**Ne**<br>neon<br>10 |
| 23<br>**Na**<br>sodium<br>11 | 24<br>**Mg**<br>magnesium<br>12 | | | | | | | | | | | 27<br>**Al**<br>aluminium<br>13 | 28<br>**Si**<br>silicon<br>14 | 31<br>**P**<br>phosphorus<br>15 | 32<br>**S**<br>sulfur<br>16 | 35.5<br>**Cl**<br>chlorine<br>17 | 40<br>**Ar**<br>argon<br>18 |
| 39<br>**K**<br>potassium<br>19 | 40<br>**Ca**<br>calcium<br>20 | 45<br>**Sc**<br>scandium<br>21 | 48<br>**Ti**<br>titanium<br>22 | 51<br>**V**<br>vanadium<br>23 | 52<br>**Cr**<br>chromium<br>24 | 55<br>**Mn**<br>manganese<br>25 | 56<br>**Fe**<br>iron<br>26 | 59<br>**Co**<br>cobalt<br>27 | 59<br>**Ni**<br>nickel<br>28 | 63.5<br>**Cu**<br>copper<br>29 | 65<br>**Zn**<br>zinc<br>30 | 70<br>**Ga**<br>gallium<br>31 | 73<br>**Ge**<br>germanium<br>32 | 75<br>**As**<br>arsenic<br>33 | 79<br>**Se**<br>selenium<br>34 | 80<br>**Br**<br>bromine<br>35 | 84<br>**Kr**<br>krypton<br>36 |
| 85<br>**Rb**<br>rubidium<br>37 | 88<br>**Sr**<br>strontium<br>38 | 89<br>**Y**<br>yttrium<br>39 | 91<br>**Zr**<br>zirconium<br>40 | 93<br>**Nb**<br>niobium<br>41 | 96<br>**Mo**<br>molybdenum<br>42 | [98]<br>**Tc**<br>technetium<br>43 | 101<br>**Ru**<br>ruthenium<br>44 | 103<br>**Rh**<br>rhodium<br>45 | 106<br>**Pd**<br>palladium<br>46 | 108<br>**Ag**<br>silver<br>47 | 112<br>**Cd**<br>cadmium<br>48 | 115<br>**In**<br>indium<br>49 | 119<br>**Sn**<br>tin<br>50 | 122<br>**Sb**<br>antimony<br>51 | 128<br>**Te**<br>tellurium<br>52 | 127<br>**I**<br>iodine<br>53 | 131<br>**Xe**<br>xenon<br>54 |
| 133<br>**Cs**<br>caesium<br>55 | 137<br>**Ba**<br>barium<br>56 | 139<br>**La***<br>lanthanum<br>57 | 178<br>**Hf**<br>hafnium<br>72 | 181<br>**Ta**<br>tantalum<br>73 | 184<br>**W**<br>tungsten<br>74 | 186<br>**Re**<br>rhenium<br>75 | 190<br>**Os**<br>osmium<br>76 | 192<br>**Ir**<br>iridium<br>77 | 195<br>**Pt**<br>platinum<br>78 | 197<br>**Au**<br>gold<br>79 | 201<br>**Hg**<br>mercury<br>80 | 204<br>**Tl**<br>thallium<br>81 | 207<br>**Pb**<br>lead<br>82 | 209<br>**Bi**<br>bismuth<br>83 | [209]<br>**Po**<br>polonium<br>84 | [210]<br>**At**<br>astatine<br>85 | [222]<br>**Rn**<br>radon<br>86 |
| [223]<br>**Fr**<br>francium<br>87 | [226]<br>**Ra**<br>radium<br>88 | [227]<br>**Ac***<br>actinium<br>89 | [261]<br>**Rf**<br>rutherfordium<br>104 | [262]<br>**Db**<br>dubnium<br>105 | [266]<br>**Sg**<br>seaborgium<br>106 | [264]<br>**Bh**<br>bohrium<br>107 | [277]<br>**Hs**<br>hassium<br>108 | [268]<br>**Mt**<br>meitnerium<br>109 | [271]<br>**Ds**<br>darmstadtium<br>110 | [272]<br>**Rg**<br>roentgenium<br>111 | | | | | | | |

1<br>**H**<br>hydrogen<br>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.

**32**