OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

ADDITIONAL SCIENCE B

B623/02

Unit 1 Modules B3 C3 P3 (Higher 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)

Wednesday 26 May 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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

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.

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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Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

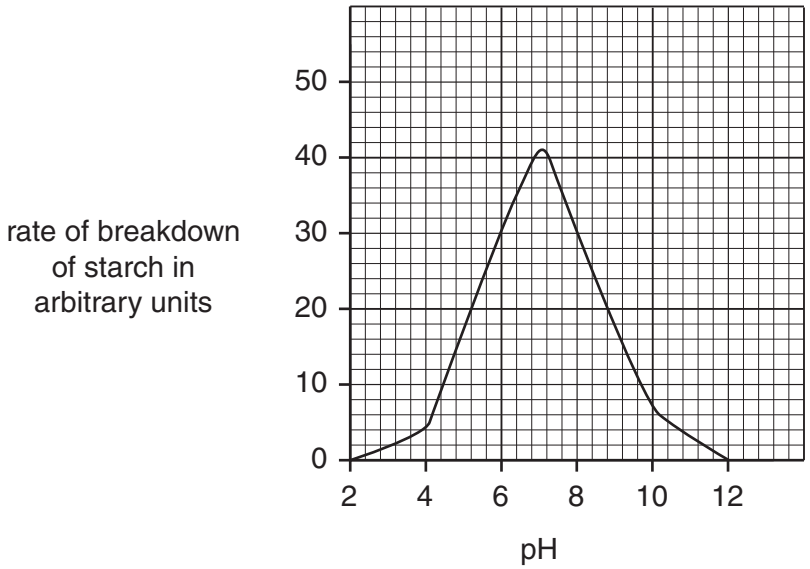
Answer **all** the questions.

Section A – Module B3

1 In the digestive system, the carbohydrate starch is broken down into sugar.

This begins in the mouth and uses the enzyme amylase.

(a) The graph shows how the rate of breakdown of starch by amylase changes as the pH increases.



Look at the graph.

(i) Describe how the rate of breakdown of starch changes as the pH increases.

.....

.....

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

(ii) Write down the optimum pH of amylase.

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

(iii) Food passes from the mouth to the stomach and then to the small intestine.

The table shows the pH at these different parts of the digestive system.

part of the digestive system	typical pH
mouth	7
stomach	2
small intestine	6

Some amylase is made in the mouth.

Amylase is also made in the pancreas and passed into the small intestine.

Suggest why more amylase has to be made in the pancreas.

.....

.....

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

(b) Sugar is absorbed from the small intestine into the blood.

(i) Write down the name of this absorption process.

.....

What causes sugar to be absorbed by this process?

.....

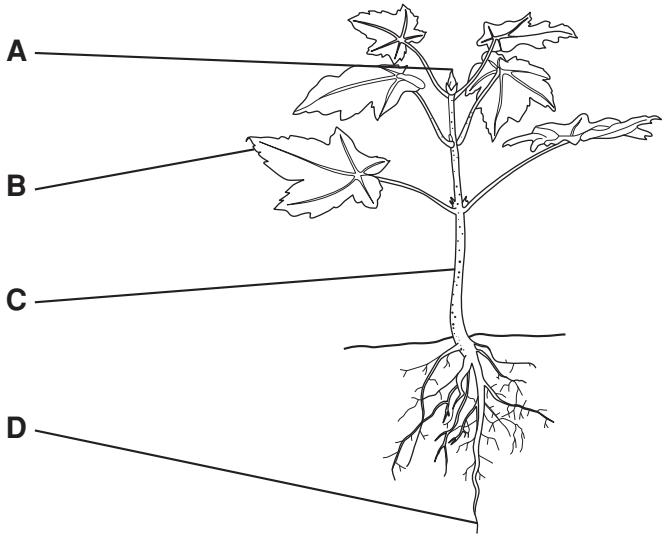
..... **[2]**

(ii) Which part of the blood transports sugar?

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

[Total: 8]

2 The diagram shows a growing geranium plant.



(a) (i) One way in which plants grow is by **cell division**.

In which two parts of a plant does **most** cell division occur?

Look at the diagram.

Choose **two** from **A**, **B**, **C** and **D**.

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

(ii) Write down the name of this type of cell division.

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

(b) The shoot and root of a plant grow differently in response to light and gravity.

Put **four** ticks (✓) in the table to show the responses shown by a shoot and a root.

	positive geotropism	negative geotropism	positive phototropism	negative phototropism
shoot				
root				

[2]

(c) Paul wants to grow more geranium plants by tissue culture.

He uses very small pieces of the shoot to grow into new plants.

(i) New plants can be grown by tissue culture.

Animals like sheep **cannot** be grown by tissue culture.

Explain why sheep cannot be grown by tissue culture.

.....

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

(ii) Paul can also grow new geranium plants from seeds.

Write down **one advantage** of growing new geranium plants by tissue culture rather than by using seeds.

.....

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

[Total: 6]

3 Liz has diabetes.

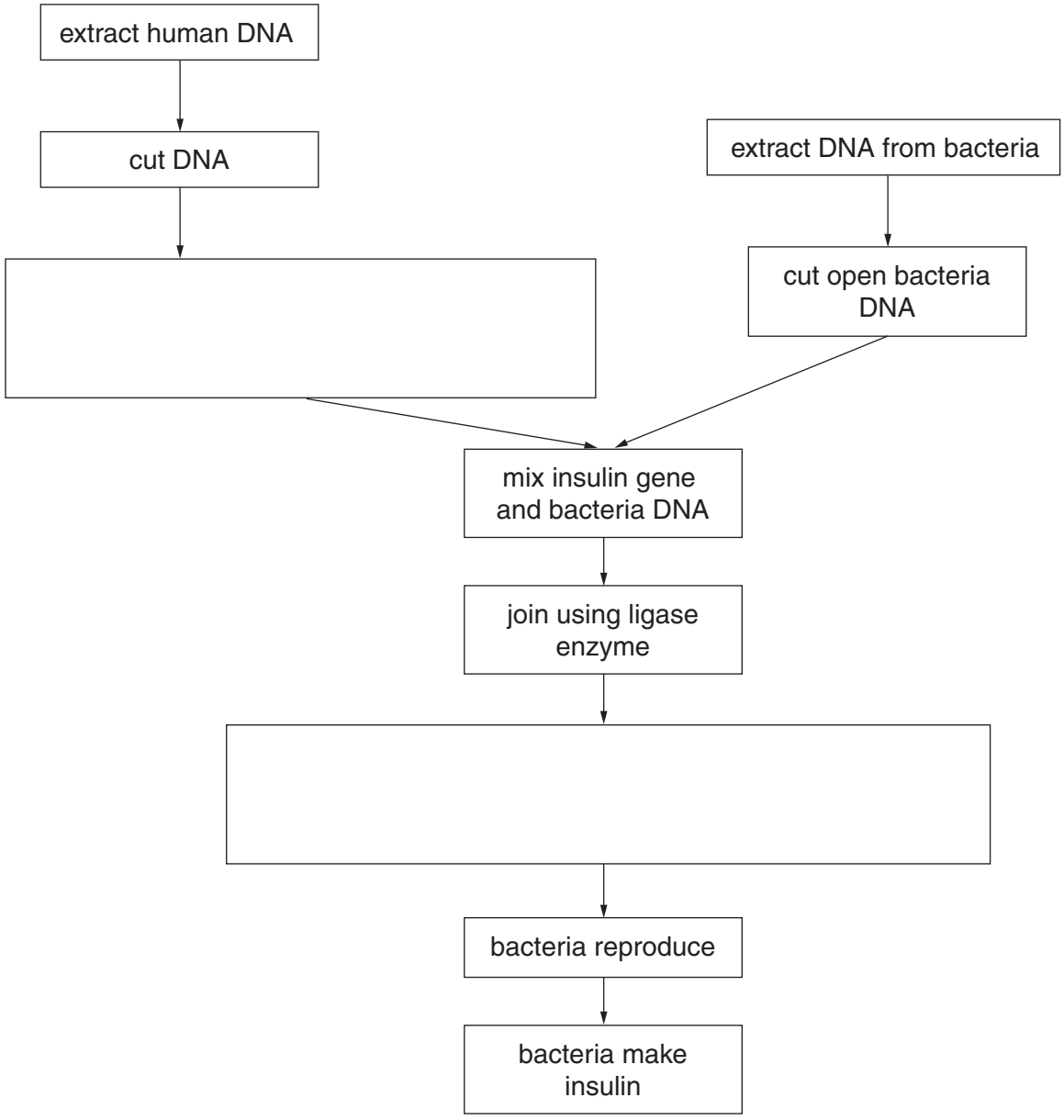
The cells in her pancreas do **not** make the hormone insulin.

She has to inject herself regularly with insulin.

She uses insulin from genetically engineered bacteria.

(a) The flow chart shows how bacteria are genetically engineered to make insulin.

(i) Complete the flow chart by writing in the **two** boxes.



[2]

(ii) The insulin that the bacteria make is identical to the insulin that humans make.

Explain why.

.....

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

(iii) Some people object to genetic engineering.

Write down **one** reason why.

.....

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

(b) When bacteria cells grow to a certain size, they divide into smaller cells.

This is because if they get too big they **cannot** survive.

Explain why cells that are too big cannot survive.

.....

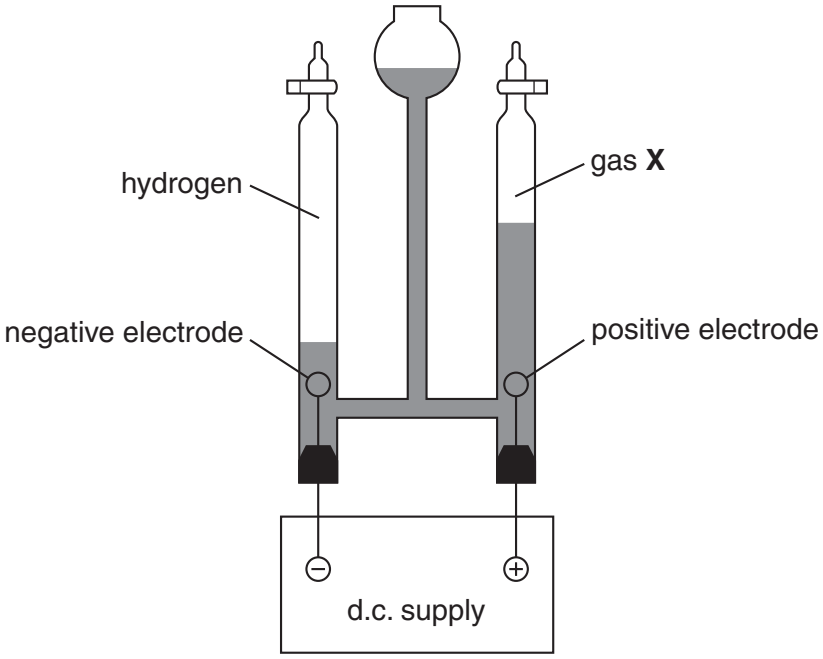
.....

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

[Total: 6]

Section B – Module C3

4 Look at the diagram. It shows the apparatus used to electrolyse dilute sulfuric acid.



(a) Gas **X** is made at the positive electrode.

(i) Write down the name of gas **X**.

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

(ii) Hydrogen is made at the negative electrode.

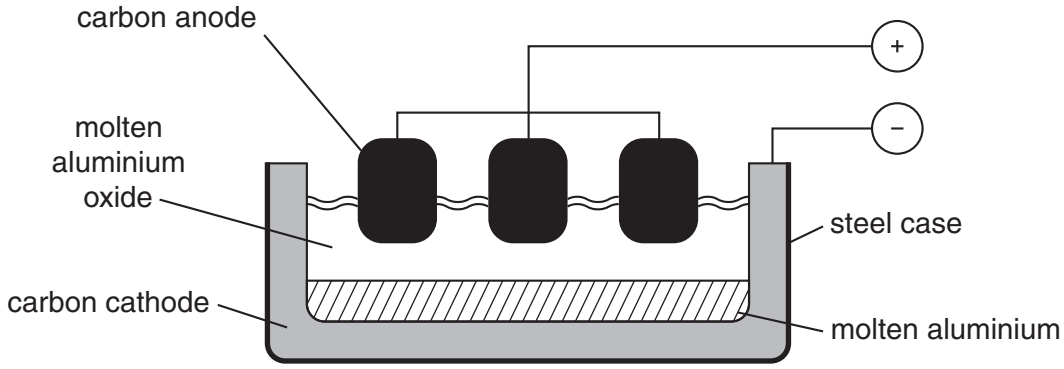
Hydrogen ions, H^+, gain electrons, e^-, to make a hydrogen molecule, H_2.

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

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

(b) Electrolysis is also used to make aluminium.

Look at the diagram. It shows the equipment that is used.



(i) Aluminium is made at one of the electrodes.

Which one?

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

(ii) The electrolyte is aluminium oxide mixed with cryolite.

Why is cryolite mixed with the aluminium oxide?

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

(iii) Aluminium is a very expensive metal to make.

Explain why.

.....

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

[Total: 6]

5 Alice and Jamie investigate some reactions of the Group 7 elements.

Chlorine and bromine are Group 7 elements.

(a) Look at the table.

It shows what is made when Group 7 elements react with Group 1 elements.

Complete the table.

	name of compound made in reaction with	
	chlorine	bromine
sodium	sodium chloride	.....
potassium	.....	potassium bromide

[2]

(b) Write a **word** equation for the reaction of sodium with chlorine.

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

(c) The Group 7 elements have 7 electrons in their outer shell.

Chlorine is more reactive than bromine.

Explain why. Use ideas about the gain of electrons.

.....

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

(d) Bromine reacts to make bromide ions.

$$Br_2 + 2e^- \rightarrow 2Br^-$$

This process is called **reduction**.

Explain why.

.....

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

[Total: 5]

6 This question is about transition elements.

(a) The compounds of transition elements are often coloured.

Draw a straight line to match each **compound** to its **colour**.

compound	colour
iron(III) sulfate	orange / brown
copper sulfate	pale green
iron(II) sulfate	blue

[2]

(b) Mercury is a transition element.

At very low temperatures, mercury is a **superconductor**.

Superconductors are materials that conduct electricity with little or no resistance.

Write about the **benefits** and **drawbacks** of using superconductors.

.....

.....

.....

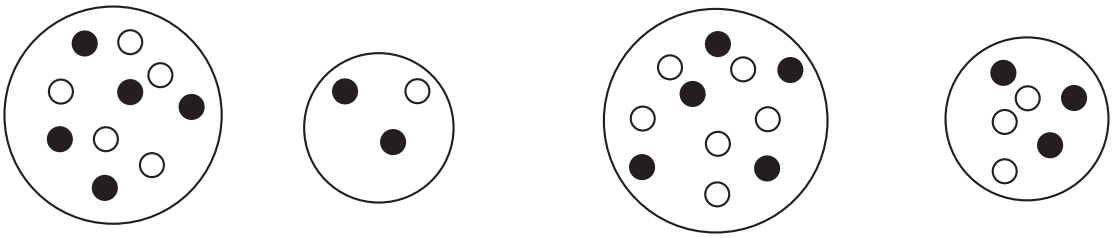
.....

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

[Total: 5]

7 This question is about atomic structure and bonding.

(a) Look at the diagrams. Each diagram shows the nucleus of a different atom.



A **B** **C** **D**

● = proton
○ = neutron

(i) Which nucleus has a mass number of 3?

Choose from **A**, **B**, **C** and **D**.

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

(ii) Which are isotopes of the same element?

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

(b) Oxygen atoms have the electronic structure 2. 6.

Hydrogen atoms have the electronic structure 1.

Draw a dot and cross diagram to show the covalent bonding in a water molecule, H_2O.

[2]

[Total: 4]

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Question 8 begins on page 16.

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Section C – Module P3

8 Ibrahim is the fastest runner in his class.

He runs a 100 metre race.

(a) Other pupils in his class are going to calculate his speed during the race.

They measure the **distance** he runs and the **time** he takes for the race.

The results are:

distance = 100 metres (m)

time = 12 seconds (s)

Calculate Ibrahim's **average** speed for the race.

The equations on page 2 may help you.

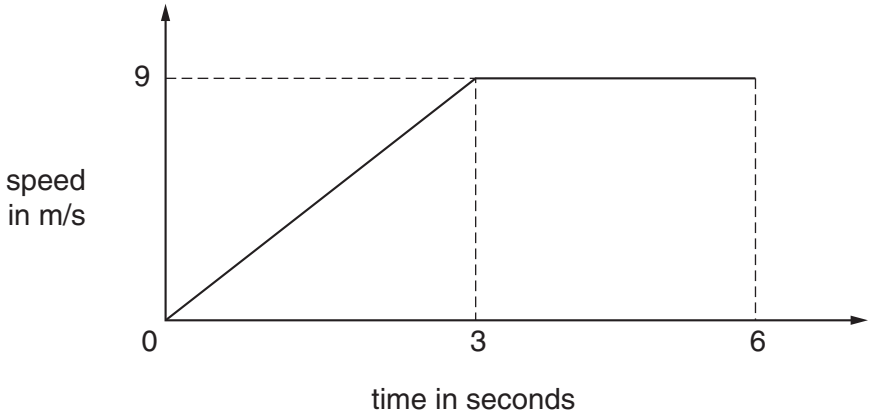
.....

.....

.....

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

(b) Look at the graph of part of Ibrahim's race.



(i) After 3 seconds Ibrahim's speed is 9 metres per second (m/s).

Calculate his acceleration during the first 3 seconds.

The equations on page 2 may help you.

.....

.....

.....

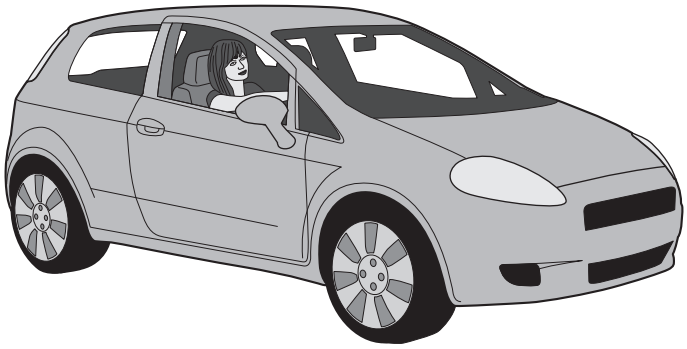
answer ..... m/s^2 **[2]**

(ii) What can be calculated from the **area** under the line of the speed-time graph?

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

[Total: 5]

9 Julie is driving her car.



Julie approaches some traffic lights.

The lights change to red (stop). She stops the car quickly.

(a) When Julie applies the brakes work is done.

While the brakes are applied

- the car travels 15 m
- the braking force is 4000 N.

Calculate the work done by the brakes.

The equations on page 2 may help you.

.....

.....

.....

.....

answer ..... joules **[2]**

(b) The traffic lights turn green. Julie pulls away from the lights.

She now drives the car at a higher speed.

Higher speed increases her braking distance. It also increases her thinking distance.

Write about **other** factors that could **increase**

- the braking distance
- the thinking distance.

.....

.....

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

(c) Look at the table about braking distances.

speed in m/s	**braking distance in m**
14	15
28	60
42	135

The braking distance increases as the speed increases.

Look at the table.

Explain in **detail** what happens to braking distance when the speed increases.

Use ideas about kinetic energy.

The equations on page 2 may help you.

.....

.....

.....

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

[Total: 6]

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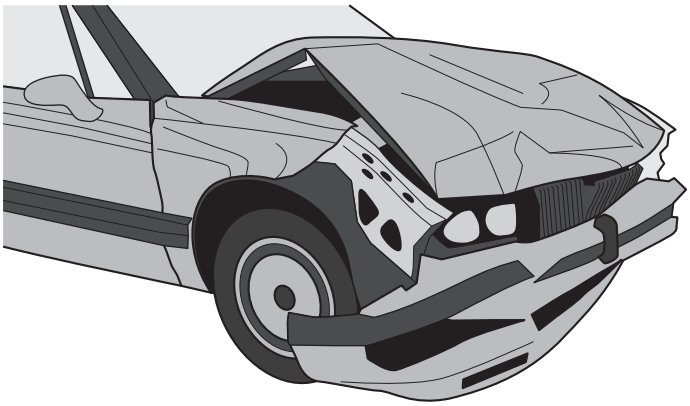
10 Modern cars have safety features that absorb energy in a crash.

This reduces the forces on the driver.

One example of this is a crumple zone.



(a) Crumple zones reduce the force on the driver in a crash.

Write down **two** reasons why.

1 .....

.....

2 .....

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

(b) Crumple zones are a **passive** safety feature in a car.

ABS brakes are an example of an active safety feature.

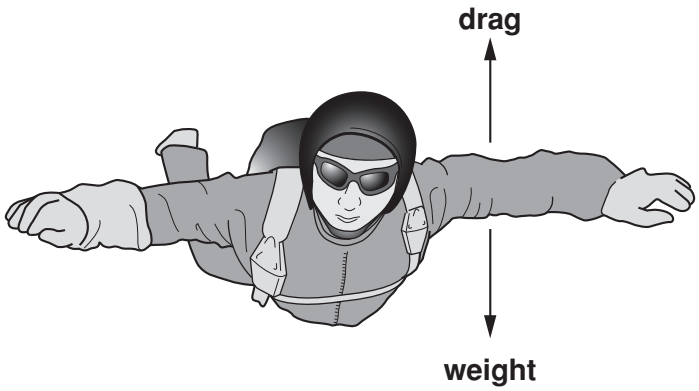
How do **active** safety features make driving safer?

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

[Total: 3]

11 Liz is a free-fall parachutist. Look at the drawing.

It shows the forces acting on Liz at the start of her free-fall.



Her weight is greater than the drag so she falls.

(a) What happens to the acceleration of free-fall (g) acting on Liz as she falls?

Choose from

decreases

increases

stays the same

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

(b) **(i)** As Liz falls, her drag force increases.

Explain why.

.....

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

(ii) She spreads her body out flat. This increases the drag force.

Explain why.

.....

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

(iii) As she falls, Liz reaches a **terminal speed**.

There is a relationship between the forces acting on her.

What is the relationship between these forces at terminal speed?

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

(c) Liz falls at terminal speed.

(i) What happens to Liz's kinetic energy (KE) as she falls at terminal speed?

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

(ii) At terminal speed her potential energy (PE) decreases as she falls.

What happens to this energy?

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

[Total: 6]

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.