OCR
Oxford Cambridge and RSA

F

Wednesday 8 November 2017 – Afternoon

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B722/01 Additional Science modules B4, C4, P4 (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 30 minutes

B722/01

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 **85**.
- This document consists of **32** 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

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

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

Answer **all** the questions.

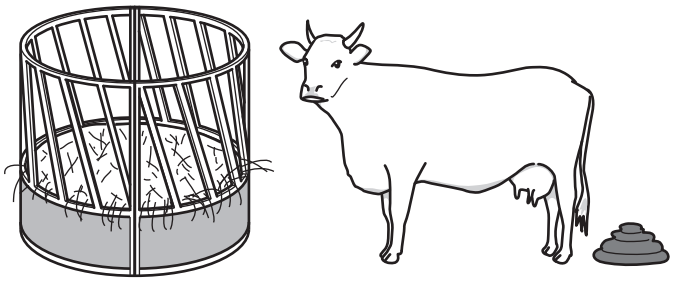
SECTION A – Module B4

1 A farmer keeps cows in a field.

A container in the middle of the field has food for the cows.

The cows spend a lot of time around the food container.

This means they drop lots of manure on the ground.



(a) The cow manure is broken down by decomposers.

(i) Write down **one type** of organism which is a decomposer.

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

(ii) Decomposers release minerals from the manure that can then be used by plants.

Write about how plants take up these minerals.

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

(b) Some students measure the percentage of the ground that is covered in plants.

They do this at different distances away from the food container.

(i) Put a tick (✓) next to the equipment they use to sample the plants.

net and tape measure	
pitfall trap and pooter	
pooter and quadrat	
transect line and quadrat	

[1]

(ii) They also measure the nitrates in the soil at different distances from the food container.

The table below shows their results.

Distance from food container in metres	1	2	3	4	5	6
Percentage cover by plants	90	85	75	65	55	50
Nitrate content in mg per kg	12	10	9	7	6	4

The percentage cover by plants changed as the students moved further away from the food container.

Explain this change.

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

2 A student writes two sentences about diffusion and osmosis.

Each sentence contains **one** mistake.

- **Diffusion** is the movement of a substance from a low concentration to a high concentration.
- ***Osmosis*** can happen in plant cells and involves the movement of different gases.

Rewrite each sentence correcting the mistake.

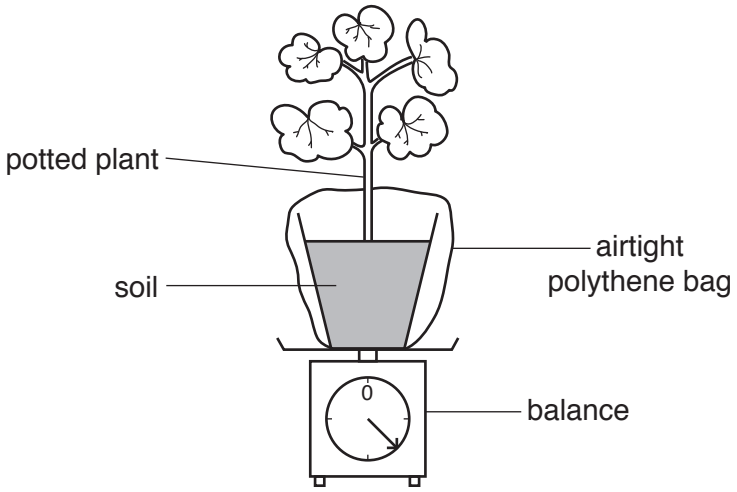
Diffusion .....

.....

Osmosis .....

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

3 Jemima sets up an experiment with a potted plant.



(a) After one day, the reading on the balance has gone down.

Explain why.

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

(b) Jemima changes the conditions in the room.

She wants to see if this causes more or less mass to be lost.

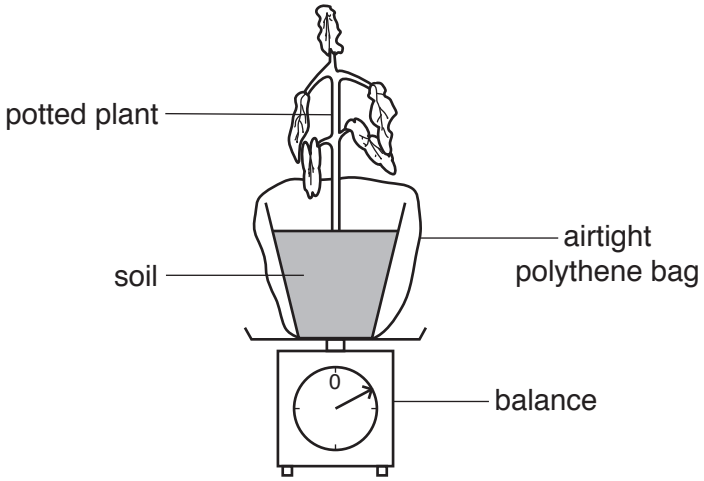
Write **more** or **less** in the table below to show what would happen to the loss of mass.

Change to conditions	**Is the change in mass more or less than in normal conditions?**
a bright light shines at the plant	
the air in the room is more humid	
the room is colder	
a fan is pointed at the plant	

[2]

(c) Jemima leaves the potted plant on the balance.

When she looks at the plant after a week she notices that the leaves have drooped.



Explain why the leaves have drooped.

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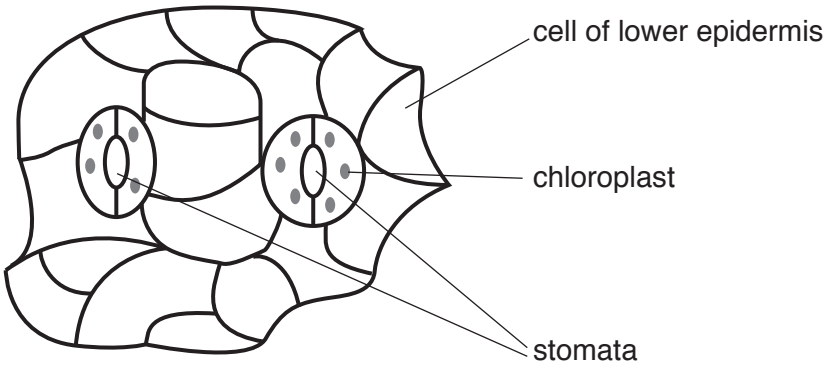
..... **[2]**

4 Tim is using a microscope to look at the lower surface of a leaf.

He draws a labelled diagram of what he sees.



(a) Chloroplasts contain a green chemical called chlorophyll.

What is the job of chlorophyll in a leaf?

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

(b) The stomatal index of a leaf gives a measurement of how many stomata are present.

It can be calculated using this formula:

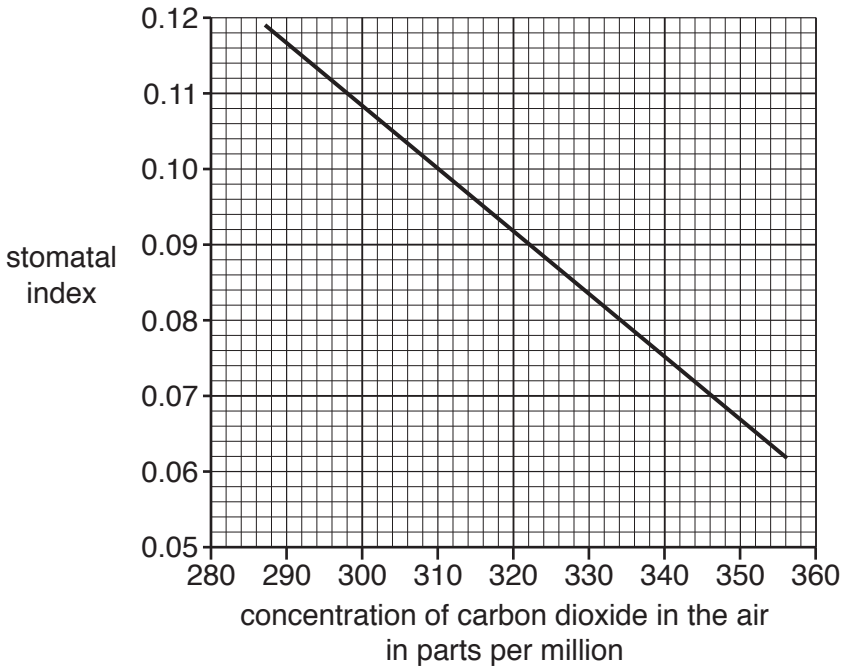
$$\textbf{stomatal index} = \frac{\text{number of stomata}}{\text{number of lower epidermis cells + number of stomata}}$$

Work out the stomatal index for Tim's leaf.

stomatal index = ... **[2]**

(c) The stomatal index of a plant may depend on the level of carbon dioxide in the air around the plant.

Look at the graph.



(i) Use the graph to estimate the carbon dioxide concentration in the air where Tim's plant grew.

answer = ... parts per million **[1]**

(ii) Write about the job of stomata in leaves.

Suggest an explanation for the shape of the graph.

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

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

SECTION B – Module C4

5 This question is about elements in the Periodic Table.

Look at the list of elements.

chlorine, C*l*

copper, Cu

hydrogen, H

iron, Fe

neon, Ne

nitrogen, N

nickel, Ni

oxygen, O

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 answer some of the questions.

(a) Which element has the **highest** atomic number?

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

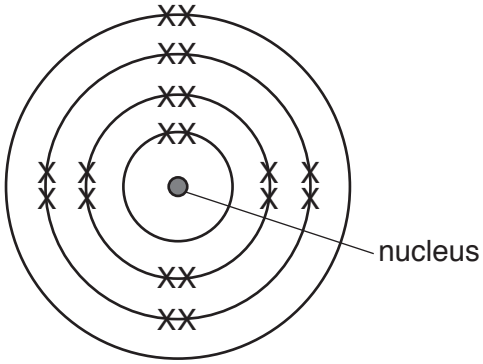
(b) Which element is in the same **group** as helium?

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

(c) Which element has some **compounds** that are orange/brown in colour?

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

6 Look at the electronic structure of an atom of an element.



(a) What is the electrical charge on the nucleus?

Choose from

negative

neutral

positive

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

(b) How many **protons** are in the nucleus of this atom?

Explain your answer.

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.....

.....

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

(c) Scientists often use models when developing atomic theories.

(i) Write down **two** reasons why scientists often use models when developing atomic theories.

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.....

.....

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

(ii) Write down the name of the scientist who discovered the electron.

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

(iii) Write down the name of the scientist who suggested that atoms have a nucleus.

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

7 Kevin and Ann test a solution.

They use two chemical tests.

- Test 1 – they add sodium hydroxide solution
- Test 2 – they add barium chloride solution

Look at their results.

Test	Result
1	grey/green solid is made
2	white solid is made

Kevin and Ann conclude that the solution contains copper ions, Cu^{2+}, and sulfate ions, SO_4^{2-}.

Do the results support this conclusion?

Explain your answer.

Refer to **both** tests in your answer.

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

8 Sodium chloride, NaC*l*, is an ionic compound.

It contains sodium ions, Na^+, and chloride ions, Cl^-.

Solid sodium chloride gives a yellow flame in the flame test because it contains sodium ions.

Sodium chloride dissolves in water to give a colourless solution.

Describe and explain two **other** properties of sodium chloride.

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

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

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9 Metals have lots of useful properties.

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

Metal	Melting point in °C	Boiling point in °C	Thermal conductivity (1 = low and 10 = high)	Electrical conductivity (1 = low and 10 = high)
A	1005	2020	7	5
B	700	1300	10	10
C	450	1200	4	8
D	45	490	5	6

(a) Metal **B** is used to make the base of a saucepan.

Write down **two** reasons why.

Use information from the table.

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

(b) Look at the melting point of metal **D**.

Explain why metal **D** cannot be used as a container to boil water.

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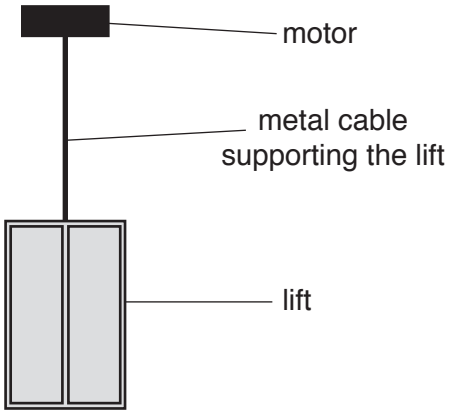
..... **[1]**

(c) Metal **A** is used to make the cables that support lifts in buildings.



Suggest **two** properties that the metal needs to be suitable for this use.

Do **not** use properties that are given in the table.

.....

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

10 Water is an extremely useful resource for many chemical processes.

Some processes use water as a reactant.

Write down **two other** reasons why water is an important resource for many chemical processes.

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

SECTION C – Module P4

11 Mekhola writes about wiring a plug for her science homework.

Wiring a Plug

A plug can have three connecting wires.

These are called the earth wire, the neutral wire and the live wire.

The earth wire is brown, the live wire is yellow and the neutral wire is blue.

An earthed conductor cannot become live.

Mekhola asks her friend Joe to check her homework.

Joe notices two mistakes.

(a) Write down the **two** mistakes Joe found.

Write down the correct information.

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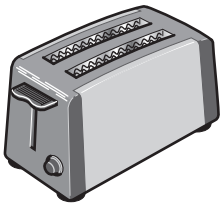
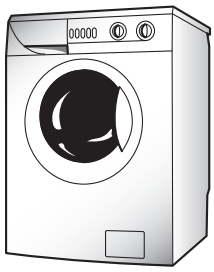
..... **[2]**

(b) Three appliances are connected to the mains electricity supply.

Look at the diagrams below.



toaster



washing machine

hairdryer

Which of these appliances does **not** need an earth wire connection?

Explain why.

Appliance .....

Explanation .....

.....

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

(c) These three appliances use mains electricity.

Look at the table below.

Appliance	Voltage used in volts	Current used in amps	Power used in watts
toaster	230	10	……..
washing machine	……..	8	1840
hairdryer	230	5	1150

Calculate the missing values.

Write your answers in the table.

[2]

12 Radiation can be useful.

The table below contains some information about six radioactive sources.

Look at the table.

Source	Type of radiation emitted	Half-life
A	alpha	432 years
B	alpha	45 minutes
C	beta	14 days
D	beta	12 years
E	gamma	6 hours
F	gamma	30 years

Explain which one of the sources could be used in a smoke alarm and which one of the sources could be used as a medical tracer.

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

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

13 **(a)** Nuclear fusion is the joining together of nuclei to release energy.

One group of scientists **claims** to have successfully achieved cold fusion.

Cold fusion is when this process takes place close to room temperature.

Other groups of scientists do not believe this claim.

Describe what would make other scientists **accept** this claim.

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

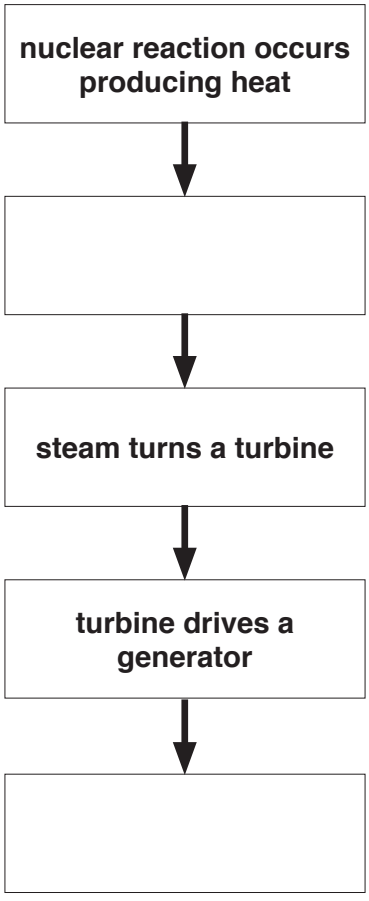
(b) Nuclear fission is the splitting of nuclei to release energy.

(i) Name a fuel used in nuclear fission power stations.

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

(ii) Power production in a nuclear power station has a number of stages.

Complete the flow chart.



[2]

(iii) Explain **one** disadvantage of using nuclear fission to produce power.

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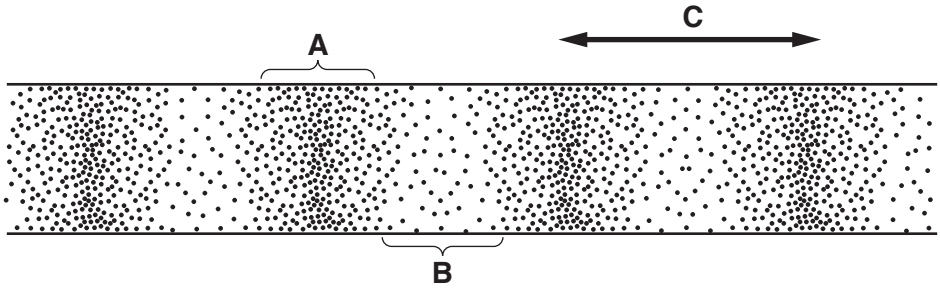
..... **[2]**

14 Ultrasound is a longitudinal wave.

Look at the diagram below of a longitudinal wave.



Three features of the wave have been labelled **A, B** and **C.**

(a) Draw a straight line from each **label** below to the correct name of the **feature.**

label	feature
A	rarefaction
B	compression
C	wavelength

[2]

(b) Describe how ultrasound is different to sound.

.....

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

15 This question is about electrostatics.

(a) At a party Rajesh is given a balloon. He rubs the balloon against his jumper.

The balloon is attracted to his jumper.

Explain why.

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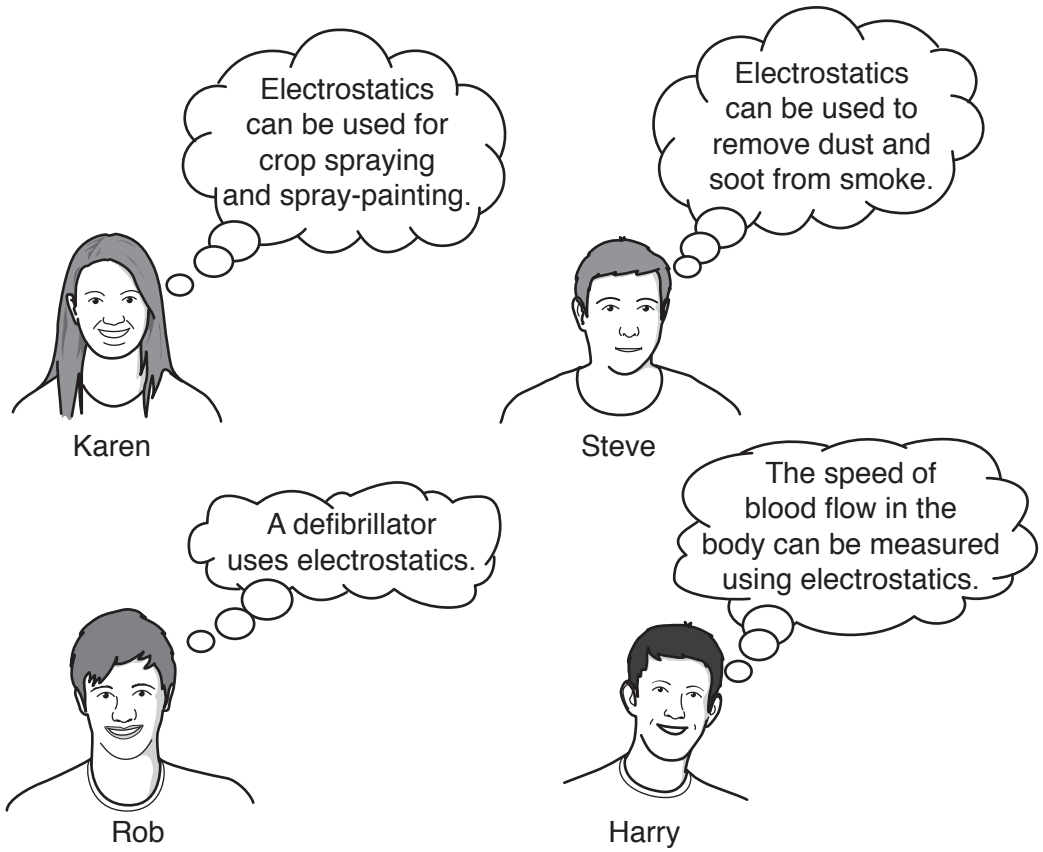
.....

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

(b) Four students are discussing uses of electrostatics.

Look at their ideas.



Who does **not** have a correct idea about a use of electrostatics?

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

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SECTION D

16 Vitamin A is an important chemical needed in the body.

A low level of vitamin A can cause conditions such as night blindness.

(a) People in three African countries were sampled for the vitamin A level in their blood.

The percentage of people with night blindness was also recorded.

Country	Percentage of people with a low level of vitamin A	Percentage of people with night blindness
Burundi	28	2
Ethiopia	46	5
Gabon	17	1

What is the link between low levels of vitamin A and night blindness shown in the data?

.....

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

(b) This table gives some information about the number of people sampled.

Country	Population of the country	Number of people sampled
Burundi	8 200 000	100
Ethiopia	82 000 000	1100
Gabon	1 000 000	200

(i) The samples are going to be used to make estimates for the whole population.

For which country is the estimate likely to be the **least** reliable?

Explain your answer.

country .....

explanation .....

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

(ii) What percentage of the total population in Gabon was sampled?

answer = ... % **[2]**

(c) Vitamin A can be made in the body from a chemical called carotene.

Carotene is found in many foods.

The table below shows the amount of carotene in different foods and a conversion factor.

The conversion factor shows how easily carotene can be converted into vitamin A in the body.

The conversion factor is calculated using this formula:

$$\textbf{conversion factor} = \frac{\text{vitamin A made in the body in mg}}{\text{carotene content of food in mg}}$$

Food	Carotene content in mg per 100 g of food	Conversion factor
spinach	3.8	0.20
carrots (cooked)	7.6	0.15
carrots (raw)	7.6	0.13
sweet potato	4.0	

(i) A person eats 100 g of sweet potato.

0.48 mg of vitamin A is made in the body.

What is the conversion factor for sweet potato?

answer = ... **[2]**

(ii) Carotene is **not** easily destroyed by cooking.

How can you tell this from the table?

.....

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

(iii) Scientists have produced a new type of rice called golden rice.

It has been made by genetic engineering.

The scientists found that

- 100 g of golden rice contained 3.5 mg of carotene
- the vitamin A in the golden rice had a conversion factor of 0.3.

Write about how useful golden rice might be in preventing night blindness compared with the foods shown in the table.

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

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.