OCR
Oxford Cambridge and RSA

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Wednesday 17 June 2015 – Morning

GCSE GATEWAY SCIENCE
FURTHER ADDITIONAL SCIENCE B

B762/02 Further Additional Science modules B6, C6, P6 (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)

Duration: 1 hour 30 minutes

B762/02

4858754802

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

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

$$\text{energy} = \text{mass} \times \begin{matrix}\text{specific}\\ \text{heat}\\ \text{capacity}\end{matrix} \times \begin{matrix}\text{temperature}\\ \text{change}\end{matrix}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output } (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

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

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

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

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

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

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

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

$$\text{power} = \text{force} \times \text{speed}$$

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$GPE = mgh$$

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

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\begin{matrix}\text{voltage across}\\ \text{primary coil}\end{matrix}}{\begin{matrix}\text{voltage across}\\ \text{secondary coil}\end{matrix}} = \frac{\begin{matrix}\text{number of}\\ \text{primary turns}\end{matrix}}{\begin{matrix}\text{number of}\\ \text{secondary turns}\end{matrix}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_pI_p = V_sI_s$$

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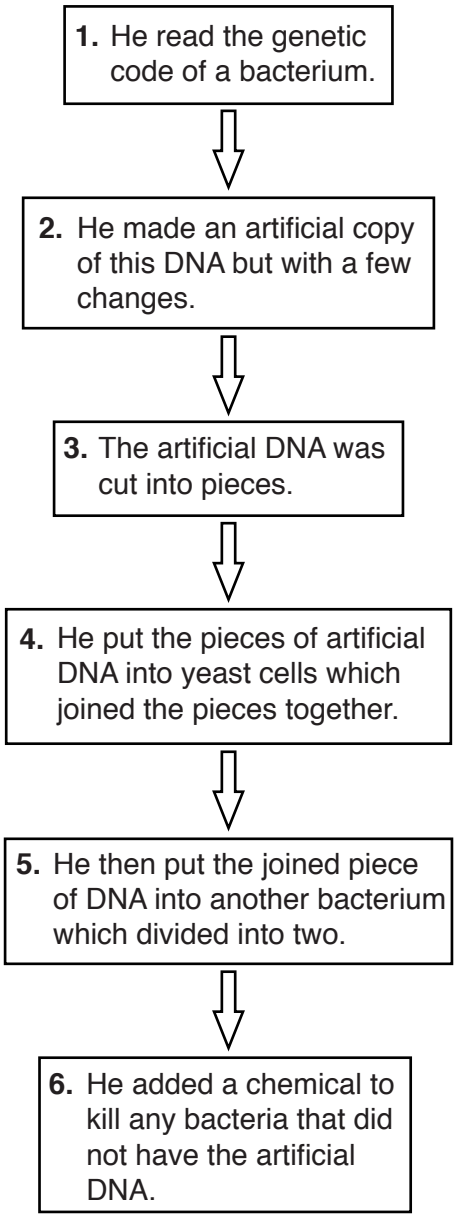
Answer **all** the questions.

SECTION A – Module B6

1 A scientist called Craig Venter has claimed to have made the first artificial life form.

The diagram shows six main stages in his method.



(a) The table shows some statements about Venter's method.

Write in the table the number of the stage that each statement refers to.

	Number of stage
This stage involves ligase enzymes.	
This stage involves restriction enzymes.	
Binary fission occurs in this stage.	

[3]

(b) After Venter made his claim, he published his work in a scientific journal.

Why is it important for scientists to publish their work?

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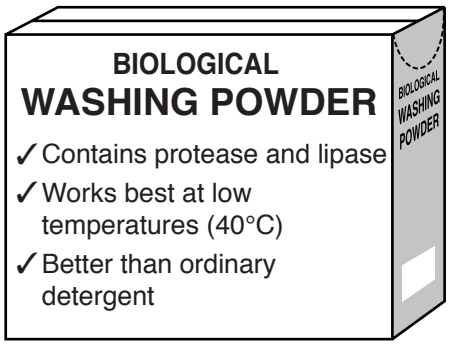
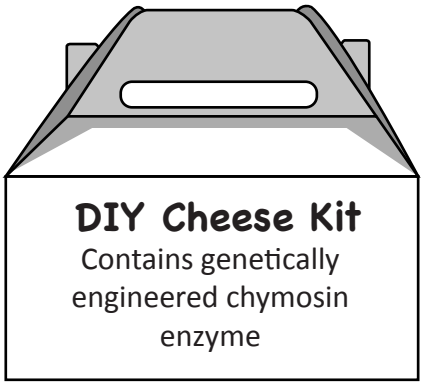
..... **[1]**

2 Gary is shopping.

Look at two items from his shopping basket.





(a) The two enzymes in the washing powder help the powder to remove stains from clothes.

Explain how they do this.

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

(b) The DIY Cheese Kit contains an enzyme called chymosin.

Chymosin used to be extracted from the stomach lining of young cows.

Chymosin can now be made by removing the gene for chymosin from cows and inserting this gene into bacteria.

(i) The gene makes identical chymosin if it is in a cow or if it is in a bacterium.
Explain why.

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

(ii) Some people do not want to eat cheese made with chymosin from cows' stomachs. Other people are concerned about the new method of making chymosin.

Suggest why these two groups of people have these different views about chymosin.

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

3 In Vietnam there are many small farms.

The farmers keep cows, goats and rabbits.

These animals produce a lot of manure.

The farmers can use manure in three different ways.

(a) (i) The first method is to use manure to make biogas in a digester.

Biogas is produced in anaerobic conditions.

Rabbit and goat manure float on the top of the liquid in the digester.

Suggest and explain the effect this may have on the quantity of biogas made.

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

(ii) Put a tick (✓) next to the combination of gases that would make up a safe, usable biogas mixture.

70% methane / 25% carbon dioxide / 5% hydrogen	
70% carbon dioxide / 25% methane / 5% hydrogen	
70% hydrogen / 25% carbon dioxide / 5% methane	

[1]

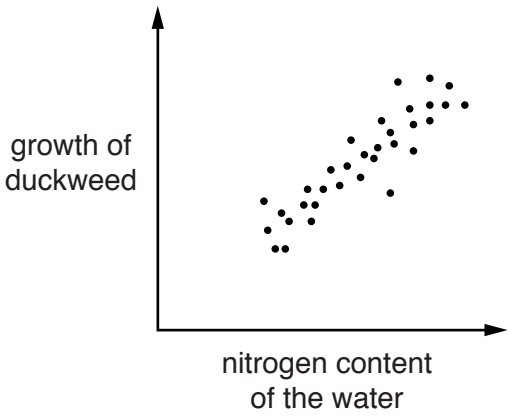
(b) The second method is to put the manure into ponds.

A plant called duckweed grows in the ponds.

Farmers can feed this plant to their animals.

The nitrogen content of the water affects the growth of duckweed.

Look at the graph and the table.



Animal	Percentage of nitrogen in manure
cow	0.6
goat	1.1
rabbit	2.0

The farmers do **not** put the manure from cows into the ponds.

Use the table and graph to explain why.

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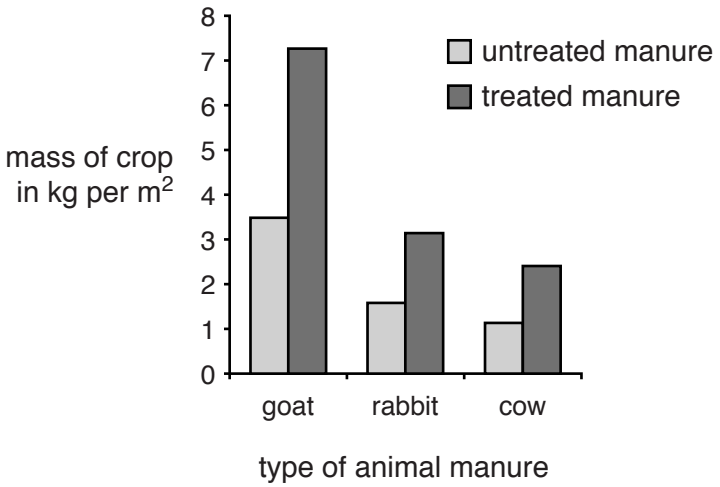
..... **[2]**

(c) The third method is to dig manure into fields where crops will be grown.

It can be dug straight into the soil (untreated) or treated first with earthworms.

The graph shows the effect of untreated manure and treated manure on crop growth.



The crop growth is different when the manure has been first treated with earthworms.

Suggest reasons for this difference.

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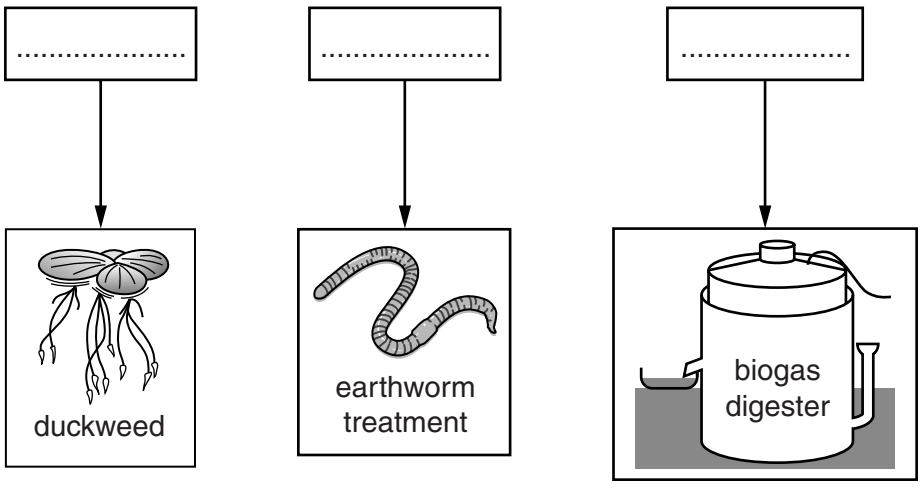
..... **[2]**

(d) The diagram shows which method the farmers use to dispose of manure from each type of animal.

Write **cow**, **goat** or **rabbit** in each of the boxes.

Use information from each part of this question to decide on your answer.



[1]

4 The disease cholera is spread by contaminated water.

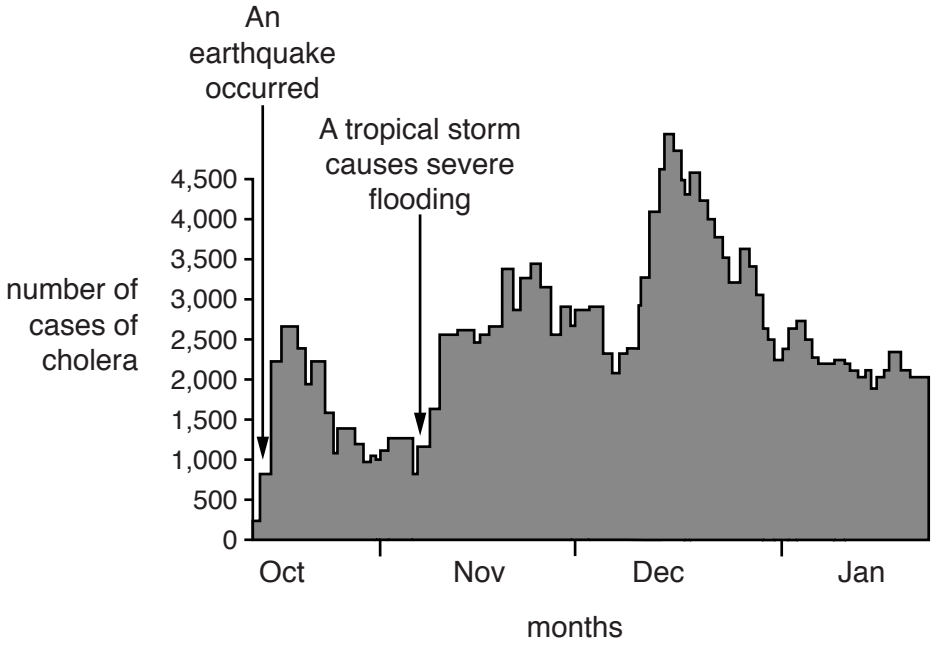
In 2010 there was a series of events on the island of Haiti.

Firstly, in October, there was an earthquake.

Sometime later, there was a tropical storm.

After several weeks this was followed by riots that made it unsafe for people to travel about.

The graph shows the number of cases of cholera in Haiti.



There is a health service on Haiti that tried to treat people who developed cholera.

Explain why the number of cholera cases on Haiti changed during the months shown on the graph.

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

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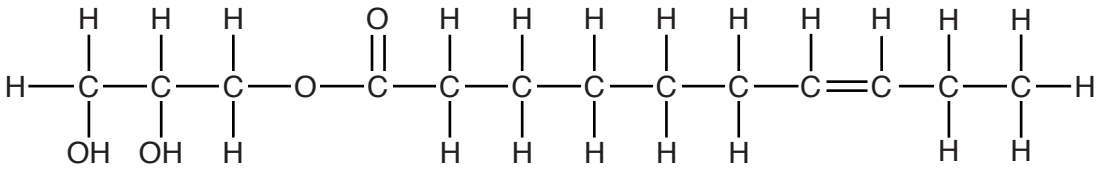
..... **[6]**

SECTION B – Module C6

5 The diagram shows part of the displayed formula of an oil.



(a) The oil is unsaturated.

How can you tell from the displayed formula?

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

(b) Orange bromine water is shaken with some of this oil.

What colour change do you see?

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

(c) Explain why this colour change happens.

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

6 Magnesium, Mg, reacts with zinc chloride solution, $ZnCl_2$.
Magnesium chloride and zinc are made.

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

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

(b) Look at the ionic equation for this reaction.

$$Mg + Zn^{2+} \longrightarrow Mg^{2+} + Zn$$

Explain why this is a **redox** reaction. Use ideas about **electrons** in your answer.

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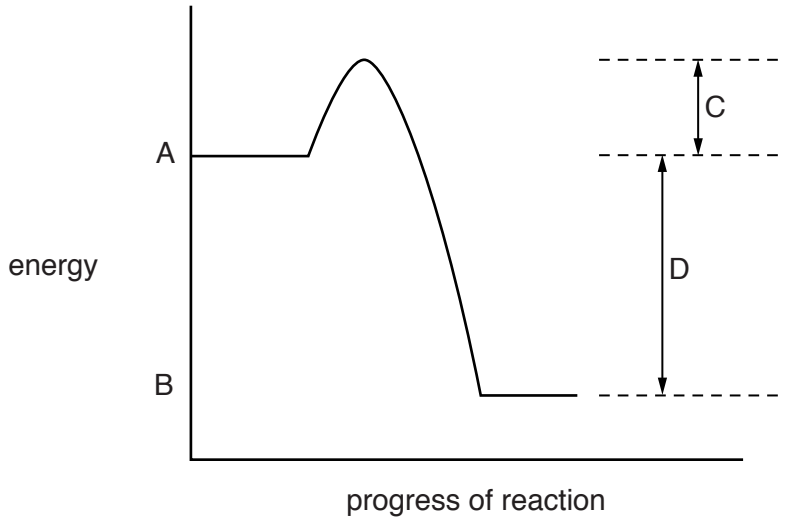
..... **[4]**

7 The reaction between hydrogen and oxygen is used in a fuel cell to make electricity.

Look at the energy diagram for the reaction between **hydrogen** and **oxygen**.



(a) Which letter on the diagram corresponds to the energy **released** in the reaction?

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

(b) In a fuel cell hydrogen, H_2, reacts with oxygen, O_2.
Water, H_2O, is made.

Write down the **balanced symbol** equation for this reaction.

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

(c) The waste product of the reaction in the fuel cell is water.

The water is **not** a pollutant.

Explain **one** reason why the use of hydrogen-oxygen fuel cells may still produce pollution.

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

(d) The car industry is developing engines powered by fuel cells instead of petrol.

Write down **two** reasons why.

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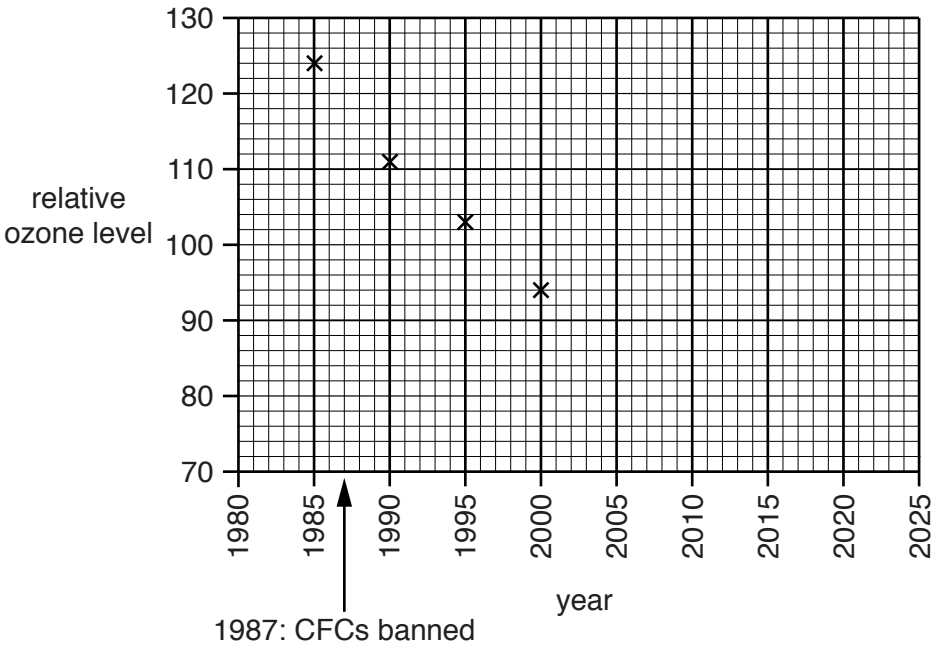
..... **[2]**

8 The table shows the level of ozone in part of the atmosphere from 1985 to 2015.

Year	Relative ozone level
1985	124
1990	111
1995	103
2000	94
2005	89
2010	96
2015	110

Variation in relative ozone level between 1985 and 2015



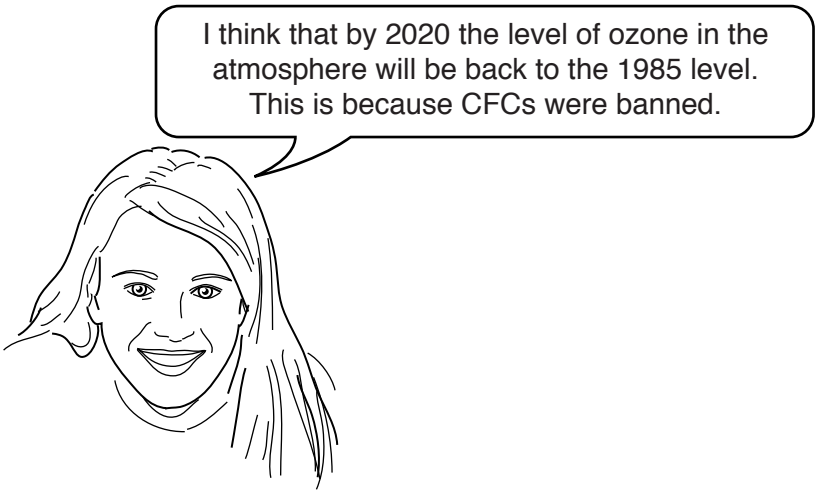
(a) Finish the graph by plotting the points for **2005** to **2015** and draw a curve of **best fit**. **[2]**

(b) CFCs reduce the amount of ozone in the atmosphere.

CFCs stay in the atmosphere for a long time.

In 1987 it was agreed to ban the use of CFCs.

Louise is a scientist. She looks at the data.



Evaluate this claim by explaining the change from 1985 to 2005 and the change from 2005 to 2025.

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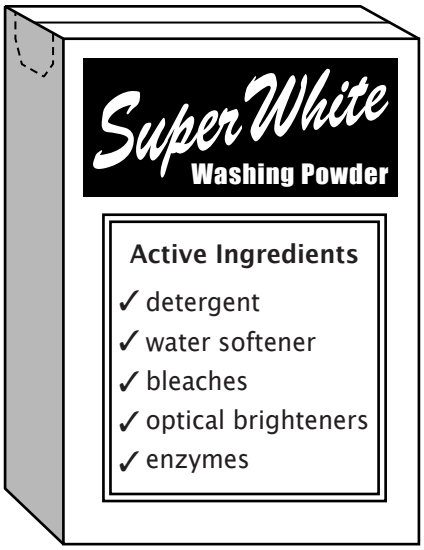
..... **[3]**

9 The picture below shows a packet of washing powder.



Julie has a grease mark on her shirt.

The label on her shirt says “wash at a low temperature”.

Suggest reasons why the shirt should be washed at low temperature and explain how the detergent removes the grease stain.

You may wish to draw diagrams.

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

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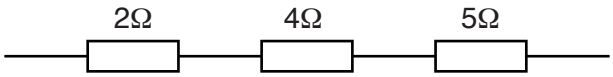
..... **[6]**

SECTION C – Module P6

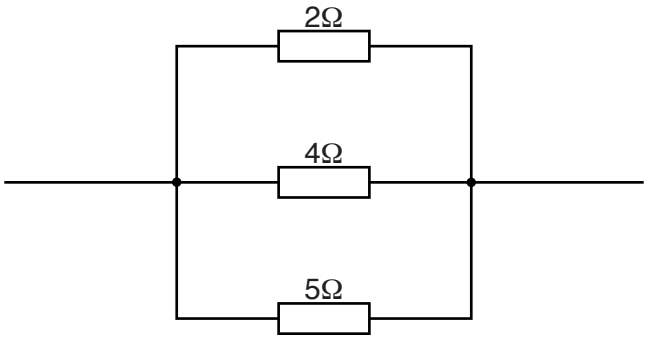
10 Sylvia builds circuits using some resistors.

(a) She arranges the resistors in series.



She calculates the total resistance of the resistors in series to be 11 Ω.

Sylvia arranges the resistors in parallel.



(i) How does this parallel arrangement affect the **total** resistance compared with the series arrangement?

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

(ii) Calculate the **total** resistance of this parallel arrangement.

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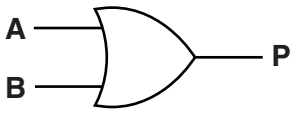
answer ..... Ω **[2]**

(b) Sylvia uses logic gates in her circuits.

She has two gates: **OR** and an **AND** gate.

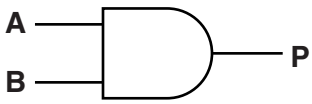
Complete the truth tables for the two gates.

OR gate



Input A	Input B	Output P
0	0	
0	1	
1	0	
1	1	

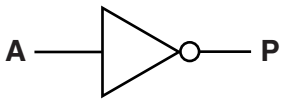
AND gate



Input A	Input B	Output P
0	0	0
0		0
1	0	0
		1

[2]

(c) Sylvia also has a **NOT** gate.



She can use the **NOT** gate with another gate to produce a **NAND** gate.

(i) Draw a diagram to show how Sylvia connects the gates to produce a **NAND** gate.

[1]

(ii) Complete the truth table for a **NAND** gate.

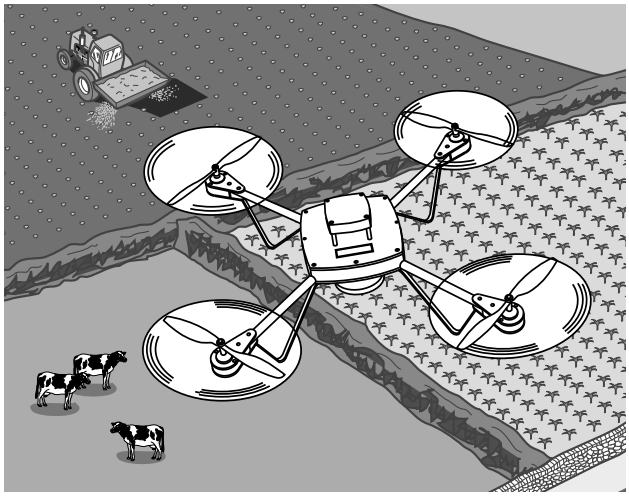
Input A	Input B	Output P
0		
0		
1		

[1]

11 Modern electronic components allow robots to be small enough to fly.

These robots can be used to help farmers make observations and do tasks. For example taking photographs or spraying crops.

Look at the diagram.



Using these flying robots can have an impact on local people and the environment.

Suggest arguments for and against the use of flying robots on farms.

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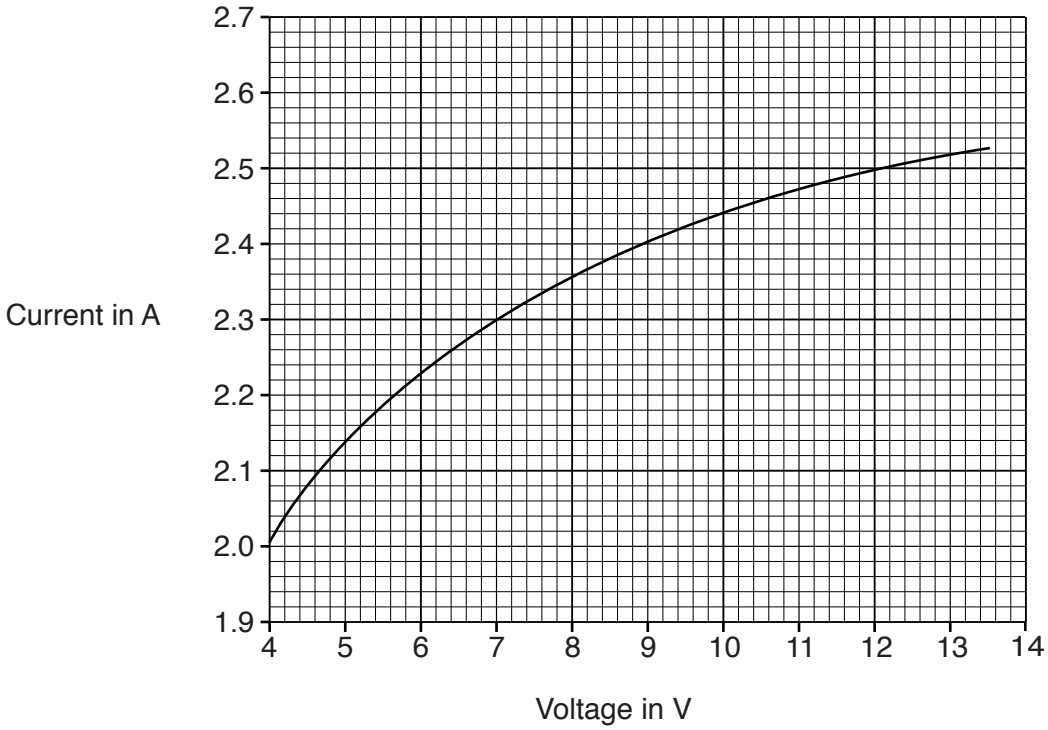
..... **[2]**

12 Sammy investigates the resistance of a wire.

He measures the voltage across the wire and the current in the wire.

Sammy changes the voltage and takes a range of results.

Look at the results he collects.



(a) Sammy wants the range of resistance values to be less than 2.5Ω for voltages between 4V and 12V.

Use the graph to calculate values of resistance to find out if the wire has a suitable **range**.

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Does the wire have a suitable range of resistance? ..... **[4]**

(b) Current is a flow of charge carriers called electrons.

The electrons collide with ions in the wire.

Explain the shape of Sammy's graph, and use kinetic theory to explain why the resistance changes.

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

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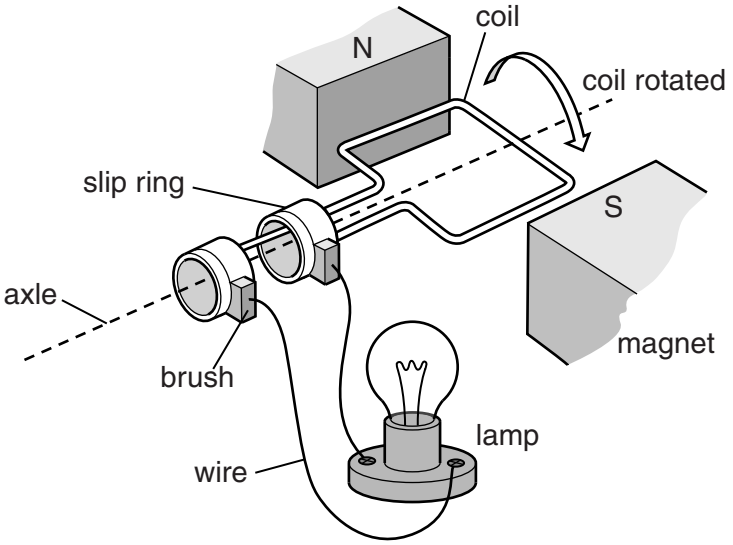
13 Look at the diagram of a generator.



(a) The coil is rotated.

Explain how the generator works and why slip rings are used.

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

(b) The coil is rotated **faster**.

Describe and explain what happens to the output voltage.

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

SECTION D

14 This question is about organ donation.

Some people donate their organs when they die.

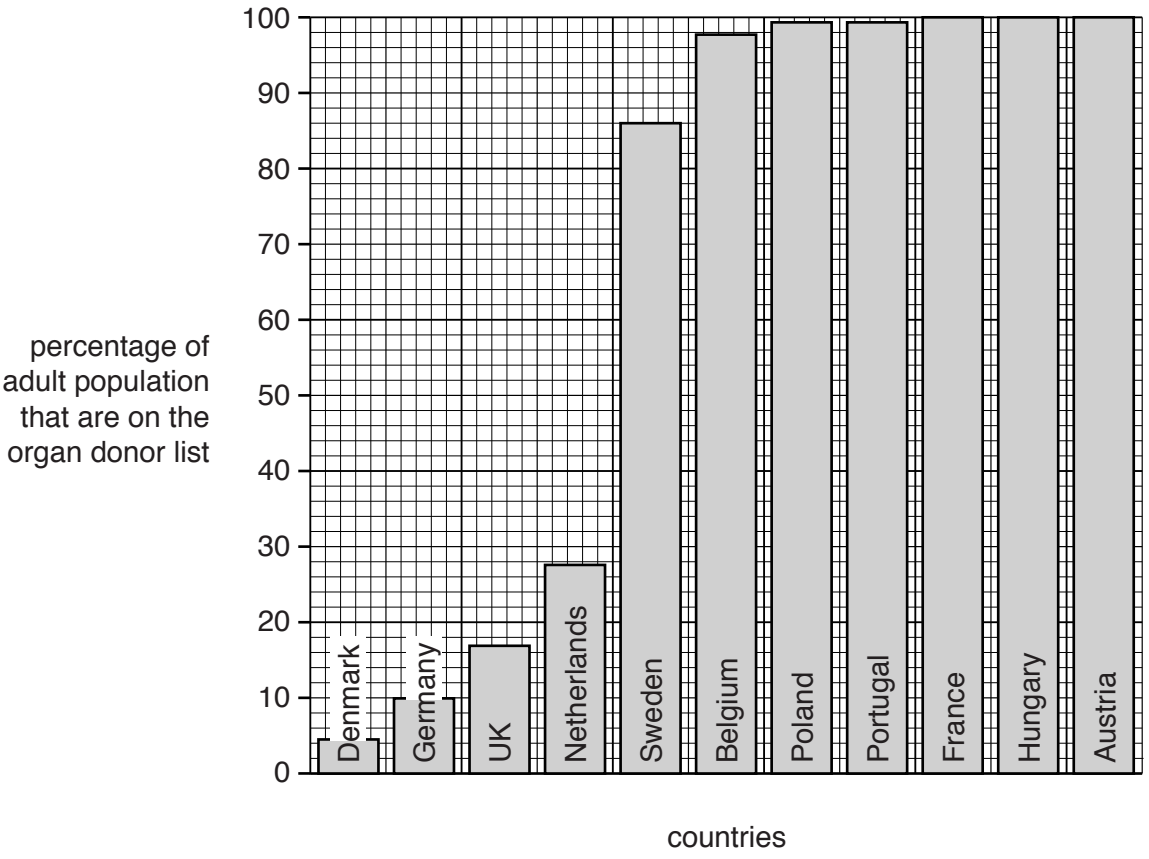
(a) There are two different organ donor systems.

System 1 – people who want to donate their organs register their names on an organ donor list.

System 2 – everyone is on the organ donor list unless they 'opt out'.

The bar chart shows the percentage of the adult population in different countries that are on the organ donor list.

The information is from 2003.



Which countries use **system 1**?

Explain your answer.

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

(b) The number of organs that have been transplanted has changed.

The table shows the number of transplants in the UK during 2008 and 2013.

Organ	Number of transplants in 2008	Number of transplants in 2013	Percentage change in number of transplants
cornea	2489	3622	46
lung	115	187	63
liver	623	774	24
pancreas	58	38	34
kidney	1249	1749	
heart	127	147	16

(i) Calculate the **percentage change** for kidney transplants between 2008 and 2013.

Show your working.

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

(ii) Two conclusions are made from the data.

- Not all organ transplants are increasing.
- Lung transplants have the largest increase in actual numbers.

Do you agree with these conclusions?

Use the data to explain your answer.

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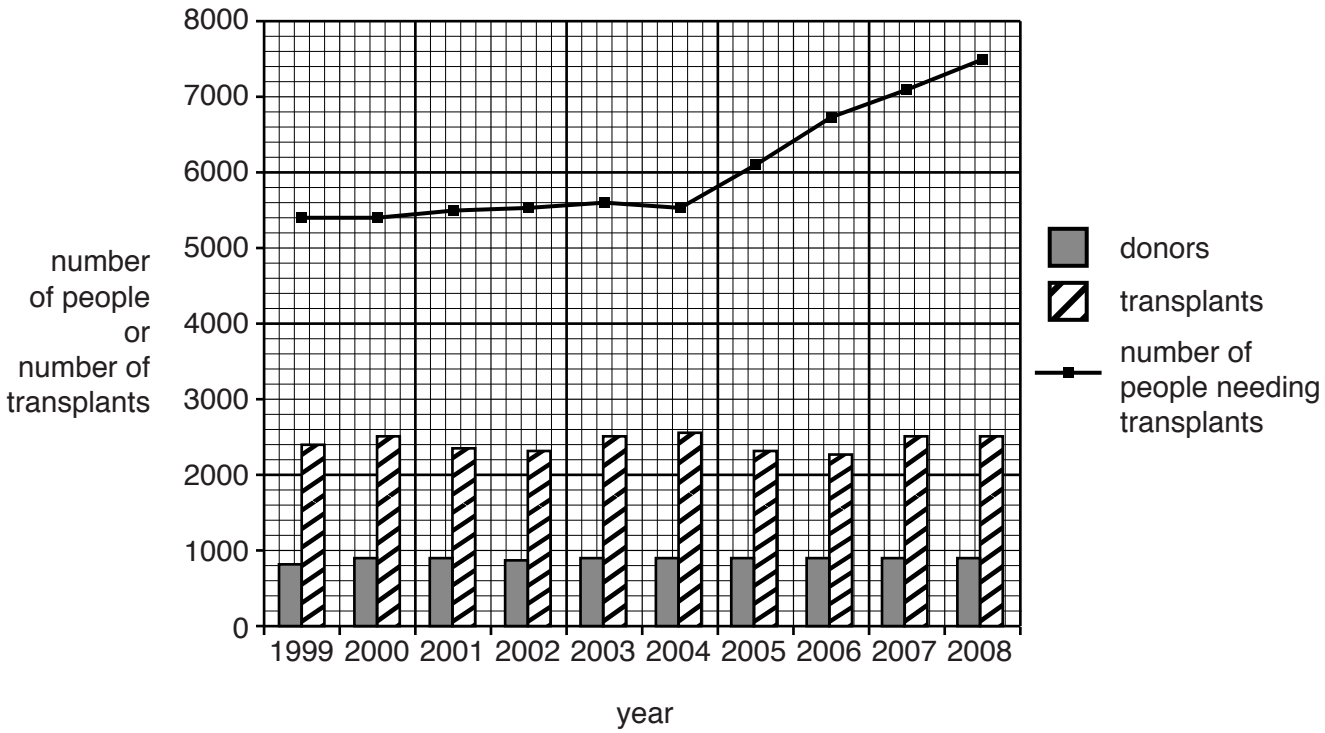
..... **[3]**

(c) Look at the graph.
It shows how organ donation and the number of people needing a transplant have changed in the UK between 1999 and 2008.



(i) The number of transplants is much greater than the number of donors.

Suggest why.

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

(ii) In 2015 Wales changed so that everyone is on the organ donor list unless they 'opt out' (system **2**).

Some people think that the whole of the UK should change to system **2**.

How does the data in parts **(a)** and **(c)** support the idea for changing?

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

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.