OCR
Oxford Cambridge and RSA

H

Wednesday 21 June 2017 – 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

* B 7 6 2 0 2 *

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$GPE = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

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

$$V_pI_p = V_sI_s$$

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Question 1 begins on page 4

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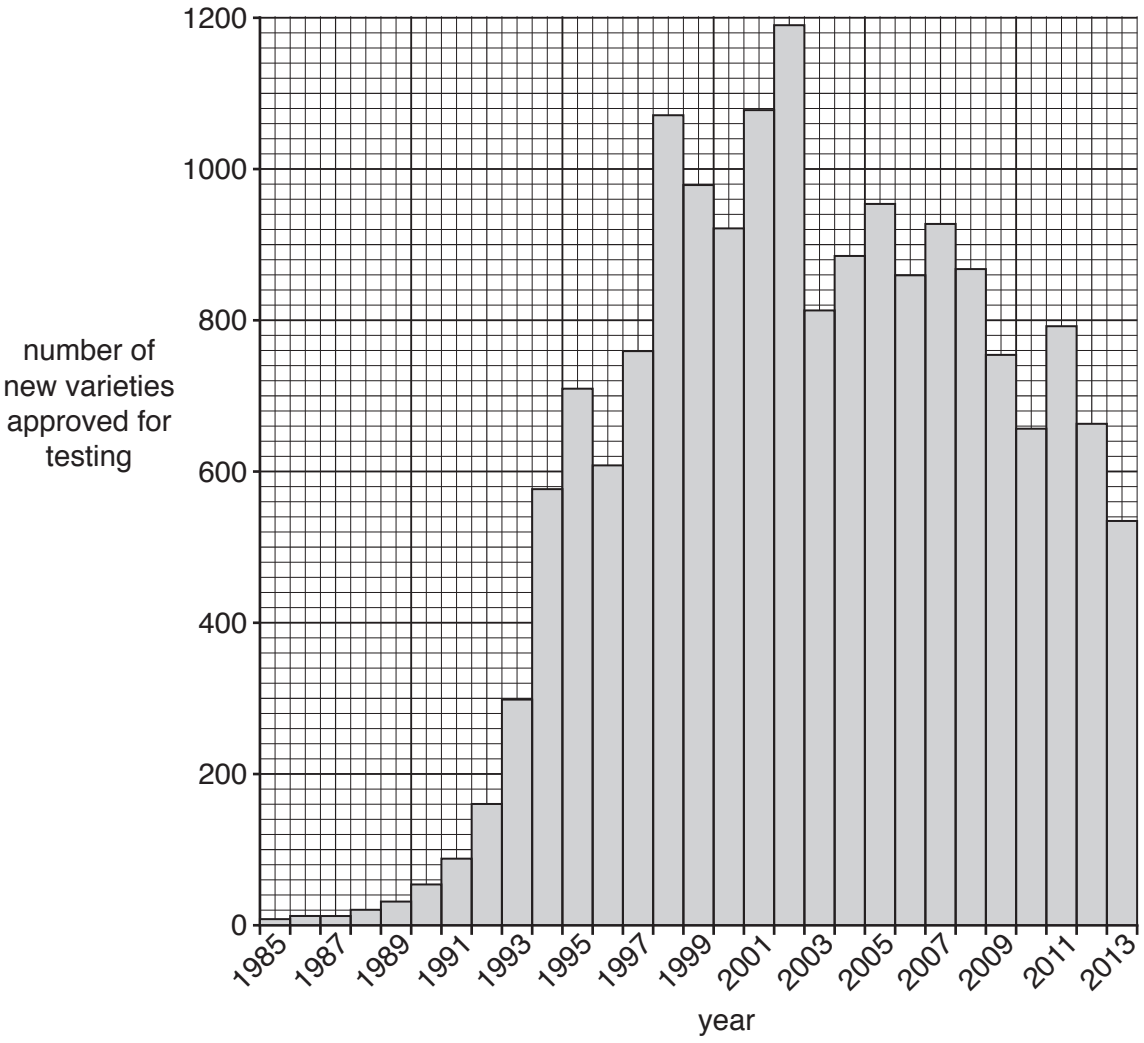
Answer **all** the questions.

SECTION A – Module B6

1 New varieties of genetically engineered crops are tested by growing them outside.

The graph shows the number of new varieties approved for testing by the US government.



(a) Describe the trends shown by the graph.

Include data from the graph in your answer.

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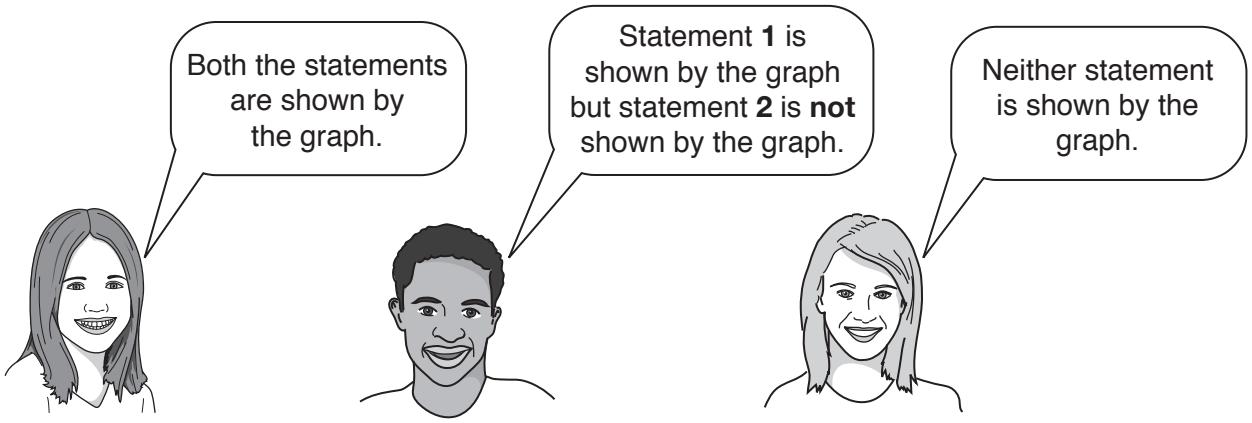
..... **[2]**

(b) Look at two statements about genetically engineered crops.

Statement 1	Statement 2
The graph shows that the number of genetically engineered crops grown has been recently decreasing.	The graph shows that genetically engineered crops are now becoming less popular with consumers.

Some students are discussing these statements.



Which student is correct?

Explain your answer.

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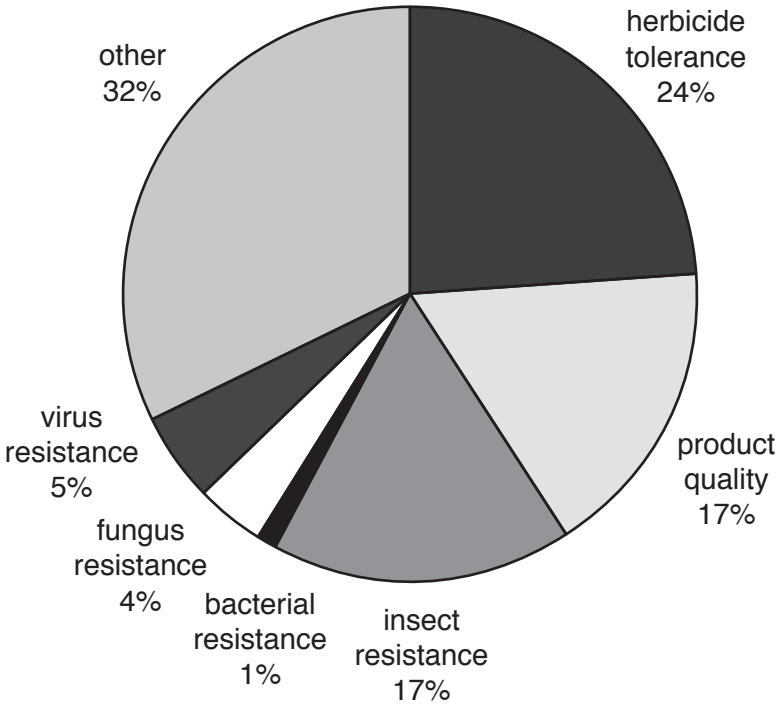
..... **[2]**

(c) The pie chart shows what characteristics the new varieties were tested for.



(i) Which characteristic is being tested for the most?

Put a (ring) around the correct answer.

herbicide tolerance

product quality

resistance to pests and infections

[1]

(ii) Explain your answer to part **(c)(i)**.

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

(d) The table describes the stages of genetic engineering.

They are **not** in the correct order.

Put the stages in the correct order by writing numbers **1**, **2**, **3**, **4** and **5** in the boxes.

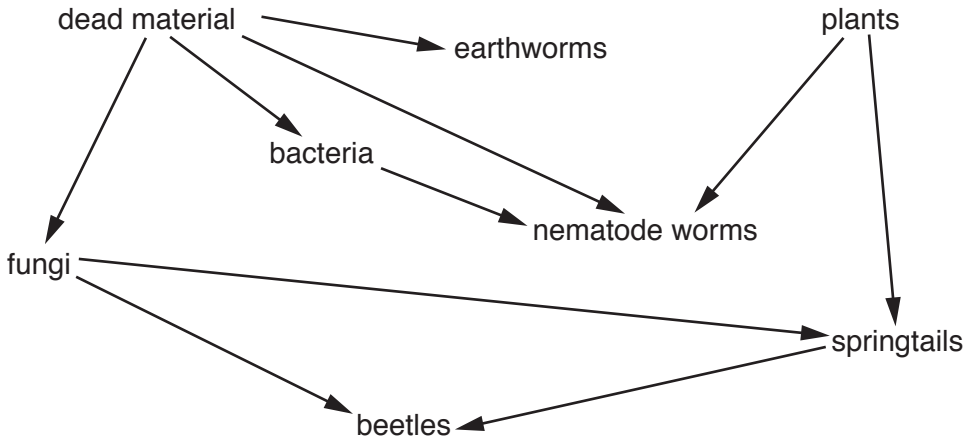
Two stages have been done for you.

stages	description
	cut open the DNA of a new plant
1	identify the desired gene in a plant
	insert the desired gene into the DNA
	remove the desired gene from the DNA
5	the desired gene works in the new plant

[1]

Question 2 begins on page 8

2 The diagram shows part of a soil food web in a garden.



(a) A disease kills all the beetles in a garden.

What effect will this have on the size of the population of springtails?

Explain your answer.

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

(b) As well as living on the dead material, bacteria live in a very wide range of habitats throughout the world.

Explain why bacteria are able to live in so many different places.

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

(c) Read the newspaper article.

Charles Darwin's best-selling book

Today, Charles Darwin is most famous for his book **On the Origin of Species**, published in 1859. But in his lifetime, his best-selling book was a book all about earthworms, called **The Formation of Vegetable Mould through the Action of Worms**. This was his last scientific book, published in 1881.

(i) Suggest why Darwin's book on earthworms was his best-selling book.

.....

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

(ii) Darwin's book made people realise just how important earthworms are, both for farmers and for the natural environment.

This is because of the effect they have on soil structure and fertility.

Explain why earthworms are so important.

In your answer:

- describe what earthworms do to the soil
- explain why these actions are so important.

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

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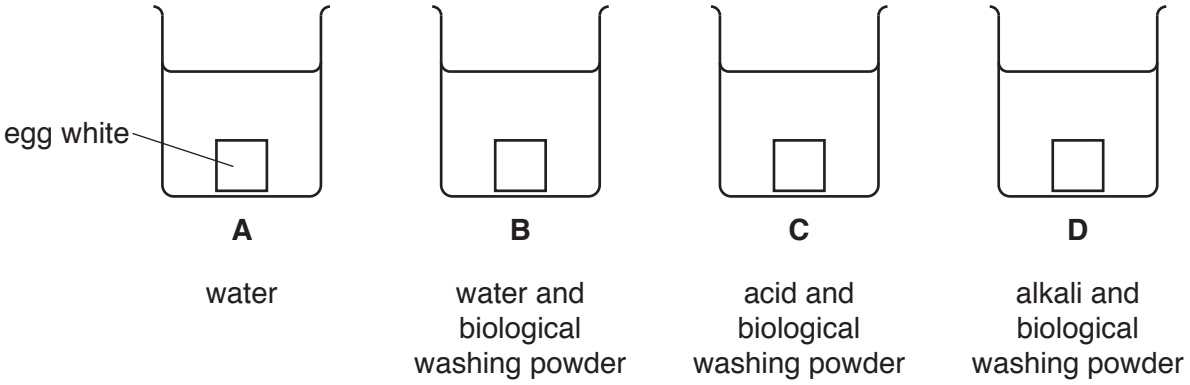
..... **[6]**

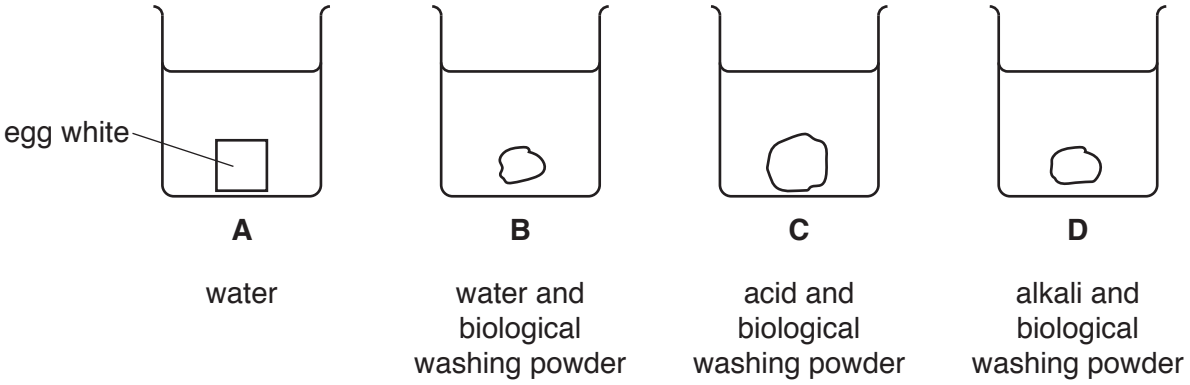
3 Erin is investigating biological washing powder.

She places four identical cubes of cooked egg white in four different solutions, **A**, **B**, **C** and **D**.

Egg white is made of protein.



These are the results after two days.



Explain the results of the experiment.

Use information from the question, as well as your own knowledge, to help you answer.

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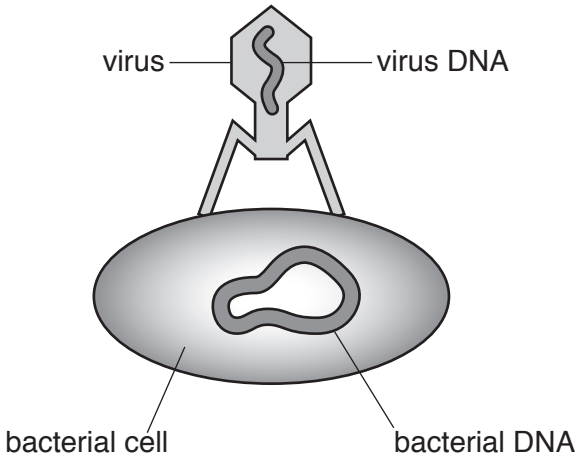
..... **[4]**

4 The diagram shows a virus attacking a bacterial cell.



(a) Explain how the virus reproduces inside the bacterial cell.

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

(b) Bacteria can be killed by antibiotics.

Doctors do **not** always prescribe antibiotics for bacterial infections.

Explain why.

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

SECTION B – Module C6

5 This question is about fuel cells.

(a) In a hydrogen-oxygen fuel cell, hydrogen, H_2, reacts with oxygen, O_2.

Water, H_2O, is made.

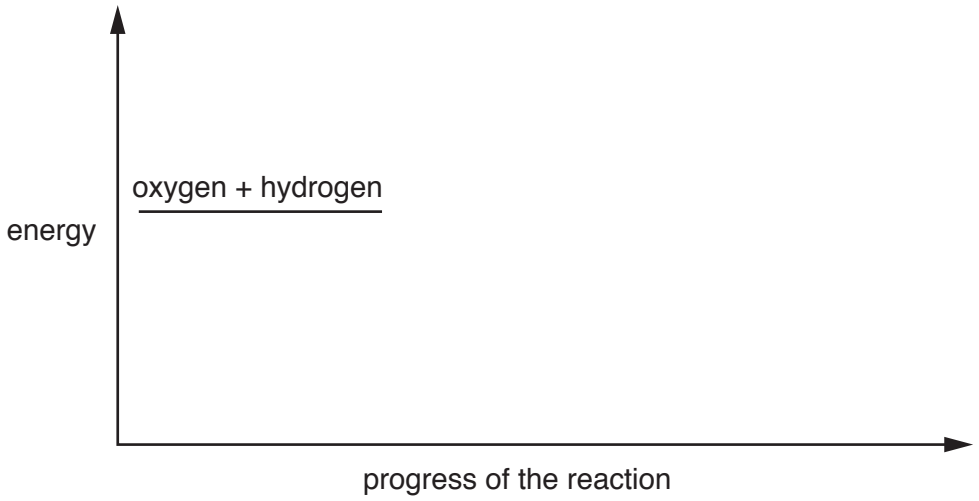
Write a **balanced symbol** equation for this reaction.

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

(b) Look at the information about the reaction between hydrogen and oxygen in a fuel cell.

- **the reaction between hydrogen and oxygen is exothermic**
- **energy must be put in to start the reaction**

Complete the energy level diagram for the reaction between hydrogen and oxygen.



[2]

(c) Hydrogen-oxygen fuel cells make water as a waste product.

Water is not a pollutant.

Hydrogen-oxygen fuel cells still produce pollution.

Explain how.

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

6 A detergent company is making new detergents.

Tim is researching these detergents.

Look at the table. It shows if the new detergents remove different stains at low temperatures.

Detergent	Is stain removed?				Does it damage the clothes?
	Oil	Egg	Blood	Paint	
A	no	yes	yes	no	yes
B	yes	no	no	no	no
C	no	no	no	yes	no
D	yes	no	no	yes	yes
E	yes	yes	yes	no	no

(a) Which detergent should Tim use to remove paint from his clothes?

.....

Explain your answer.

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

(b) Two of the detergents contain an enzyme.

Which two?

..... and .....

Explain your answer.

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

(c) Tim also has a jacket.

The jacket must be **dry cleaned**.

What is meant by dry cleaning?

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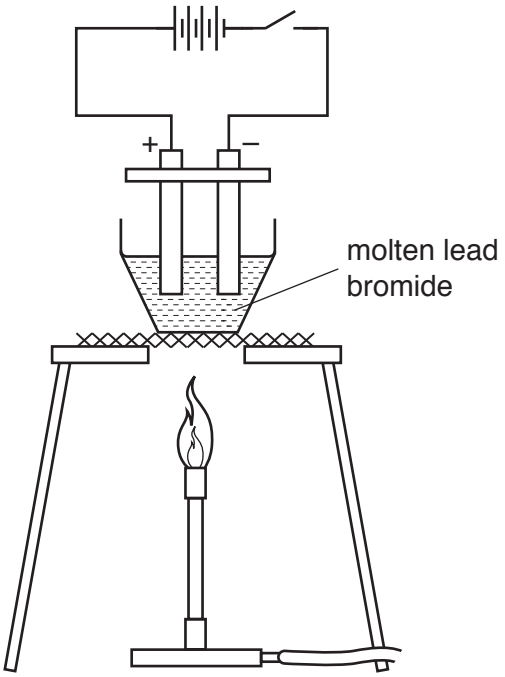
..... **[2]**

7 Jane is investigating electrolysis.

She electrolyses molten (liquid) lead bromide.



(a) Jane finds that solid lead bromide does not conduct electricity.

She finds that molten (liquid) lead bromide does conduct electricity.

Explain these **two** observations.

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

(b) Jane then electrolyses dilute sulfuric acid. Hydrogen is made at the cathode.

Write a **half equation** for the reaction of hydrogen ions, H^+, to make hydrogen gas, H_2.

Use e^- to represent an electron.

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

(c) Jane then electrolyses sodium sulfate solution.

Sodium sulfate solution contains these ions.

H^+ Na^+ OH^- SO_4^{2-}

The electrolysis of sodium sulfate solution makes hydrogen, H_2, rather than sodium, Na, at the cathode.

Explain why.

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

8 This question is about fats and oils.

(a) Natural fats and oils can be split up using hot sodium hydroxide solution.

What is the name of this process?

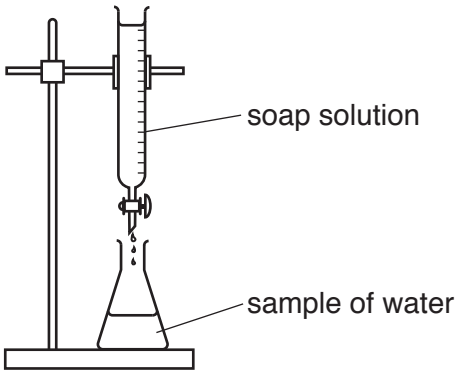
..... **[1]**

(b) Complete the word equation for the process.

fat + sodium hydroxide ⟶ ..... + ... **[1]**

9 Abigail and Alfie investigate four samples of water, **A**, **B**, **C** and **D**.

Look at the diagram. It shows the apparatus they use.



They add soap solution to samples of water and shake them.

They keep adding more soap solution until a lather remains.

Look at the table. It shows their results.

Sample		Volume of soap solution added in cm^3
distilled water		3.0
sample **A**	before boiling	10.0
	after boiling	3.0
sample **B**	before boiling	15.0
	after boiling	9.0
sample **C**	before boiling	12.0
	after boiling	12.0
sample **D**	before boiling	6.0
	after boiling	3.0

Identify, with reasons, the types of hardness in each of the samples **A**, **B**, **C** and **D**.

Temporary hard water contains dissolved calcium hydrogencarbonate, $Ca(HCO_3)_2$.

Write a **balanced symbol** equation for the thermal decomposition of calcium hydrogencarbonate.

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

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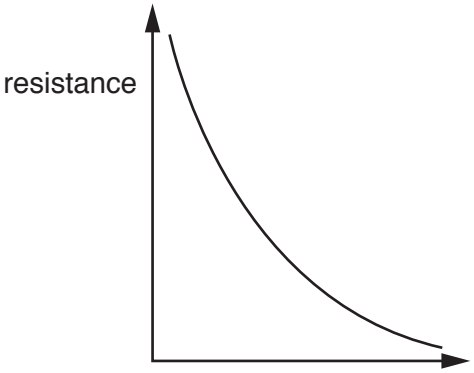
..... **[6]**

SECTION C – Module P6

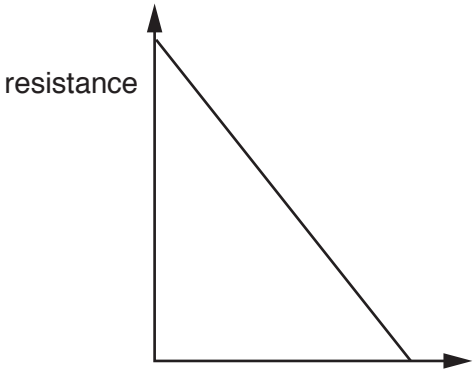
10 Samir investigates the resistance of some components.

Look at the graphs **A**, **B**, **C** and **D**.

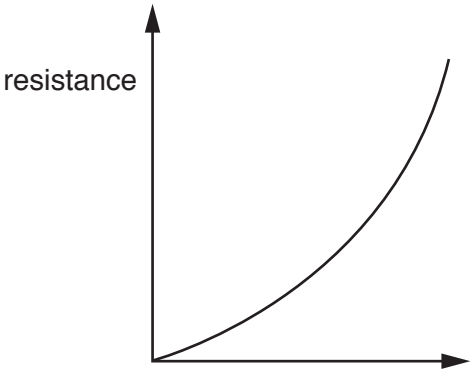
A



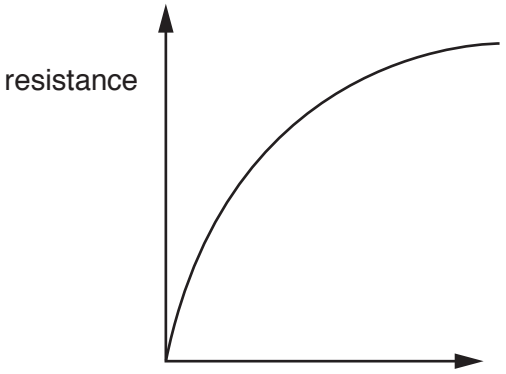
B



C



D



(a) Look at the graphs.

(i) The resistance of an LDR varies with increasing light level. Which graph shows this?

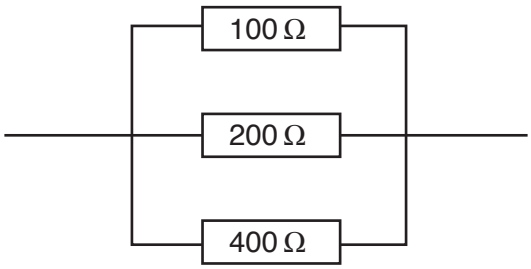
Choose from: **A**, **B**, **C** or **D** ..... **[1]**

(ii) The resistance of a thermistor varies with increasing temperature. Which graph shows this?

Choose from: **A**, **B**, **C** or **D** ..... **[1]**

(b) Samir connects three resistors in parallel.

Look at the diagram.



Calculate the **total** resistance of the three resistors in parallel.

answer ..... Ω **[2]**

11 Ron investigates the rotation of an electromagnet inside a coil.

He thinks that doubling the speed of rotation of the coils will double the voltage generated.

He also thinks that doubling the number of turns will double the voltage generated.

Look at the table.

attempt	speed of rotation in rotations per minute	number of turns
1	100	100
2	200	200
3	300	200
4	300	100
5	400	100

If attempt 1 generates 10 V, explain which **two** attempts will produce 40 V.

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

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Question 12 begins on page 22

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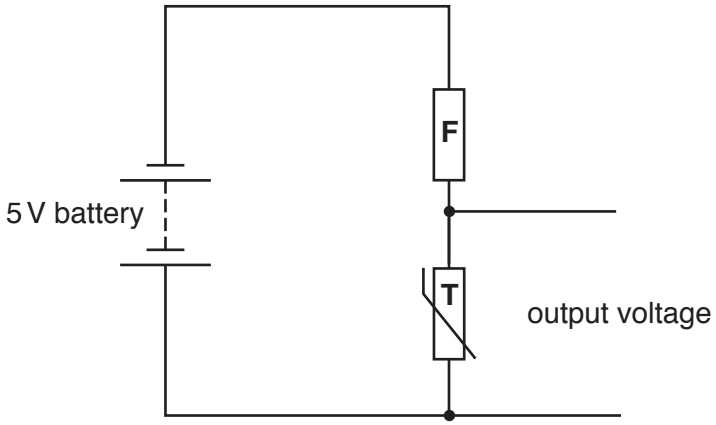
12 Jane investigates a potential divider circuit.

She places a thermistor, **T**, in series with a fixed resistor, **F**.

The resistance of the thermistor can vary.

Its resistance can vary from less to more than that of a fixed resistor.

Look at the circuit Jane builds.



(a) The output of this circuit can provide a signal to a logic gate which depends on temperature.

Explain how.

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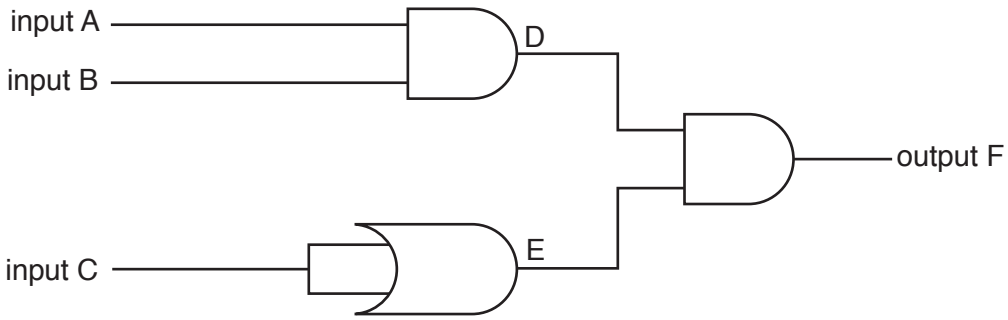
..... **[4]**

(b) Jane connects the output to a series of logic gates.

Look at the diagram.



Inputs			Outputs		
A	**B**	**C**	**D**	**E**	**F**
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

Complete the truth table for this series of logic gates. **[3]**

13 Liz investigates power loss in electrical cables.

She measures the current and the resistance in two cables.

Look at her results.

Current in amps	Resistance in ohms	Power loss in watts
20	1.2	.....
2	1.2	.....

(a) Calculate the power loss for each cable and use your answers to explain why power is transmitted at high voltages.

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

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

(b) Explain what causes resistance in metallic conductors and how this changes with temperature.

Use ideas about kinetic theory in your answer.

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

14 **(a)** When a capacitor is fully charged the voltage across it is 10 V.

Describe how the current **and** voltage change when a conductor is connected across it.

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

(b) What job does a capacitor do in an electrical circuit?

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

SECTION D

15 James finds this headline in a newspaper.

> **Butter or margarine: which is really healthier?**

James thinks that margarine is healthier as it contains less saturated fat.

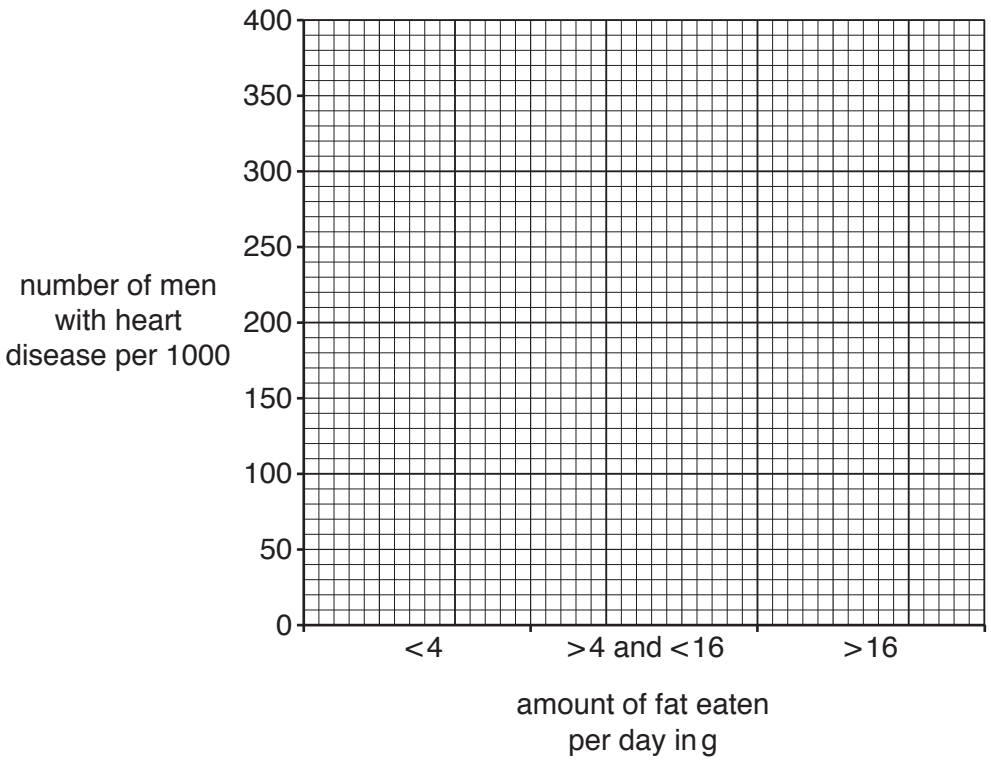
He decides to do some research about butter and margarine.

(a) James finds this table of data on the internet.

The data shows the average amount of fat eaten as butter or margarine each day and how many men have heart disease.

Amount of fat eaten per day in g	Number of men with heart disease per 1000	
	Eat butter	Eat margarine
< 4	340	295
> 4 and < 16	320	330
> 16	300	400

(i) Complete the chart to show the data for both butter and margarine. **[1]**



(ii) James eats an average of 18 g of margarine a day.

He uses the data to predict he has a 40% probability of getting heart disease.

Calculate the probability of getting heart disease if he ate **less than** 4 g of margarine each day.

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

(iii) Does the **data** answer the question in the headline? .....

Write down **two** reasons for your answer.

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

(iv) The number of men with heart disease per 1000 is an estimate.

The estimate is based on a study involving 832 men aged 45–64.

At the start of the study none of the men had heart disease.

Their intake of fat and health were monitored for 20 years.

At the end of the study the proportion of men in the study with heart disease was recorded.

This value was used to estimate how many men per 1000 are likely to have heart disease based on their intake of fats.

Suggest **three** reasons why the final estimate may not be valid for all men.

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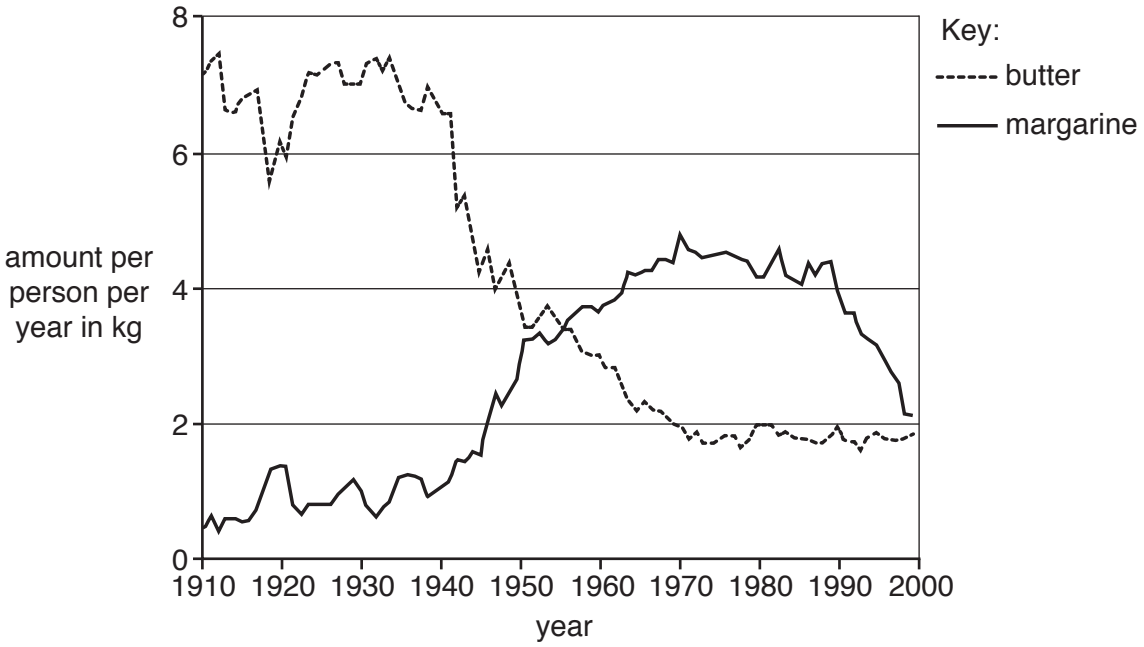
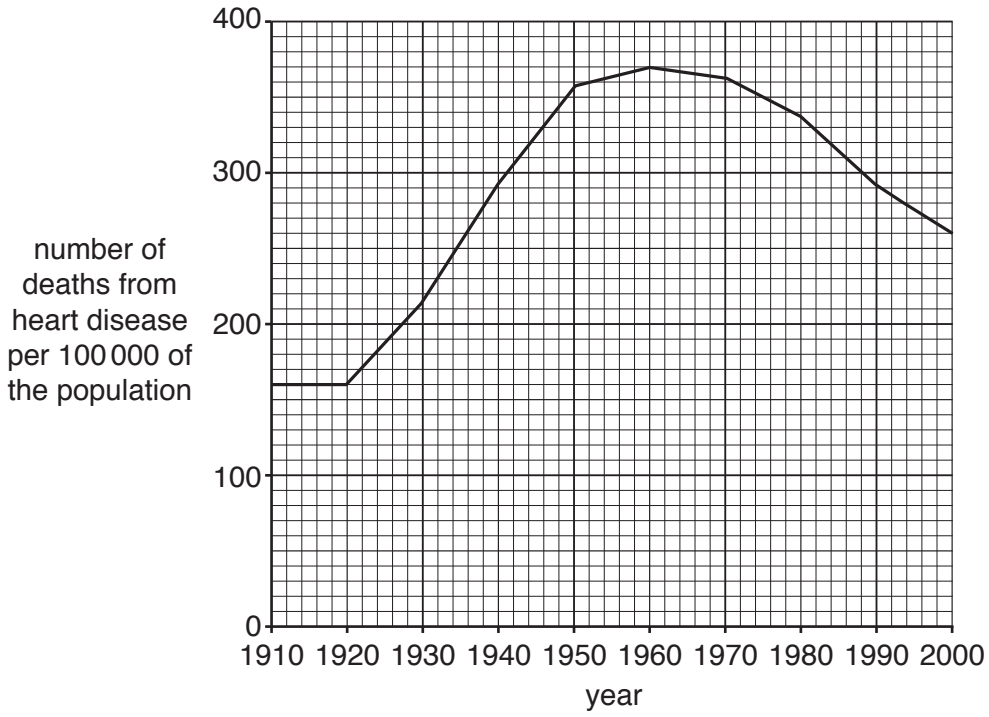
..... **[3]**

(b) James finds this graph.
It shows the amount of butter and margarine eaten in a year by people living in America.



Look at the graph. It shows the number of deaths from heart disease in America.



Together, the graphs in part **(b)**, **seem** to show a surprising link between eating margarine and heart disease.

Write about this link between eating margarine and heart disease.

Use evidence from **both** graphs in part **(b)** in your answer.

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

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.