

Wednesday 24 May 2017 – Afternoon

**GCSE GATEWAY SCIENCE
SCIENCE B**

B711/02 Science modules B1, C1, P1 (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 15 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

2 EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

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

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

BLANK PAGE

Question 1 begins on page 2

PLEASE DO NOT WRITE ON THIS PAGE

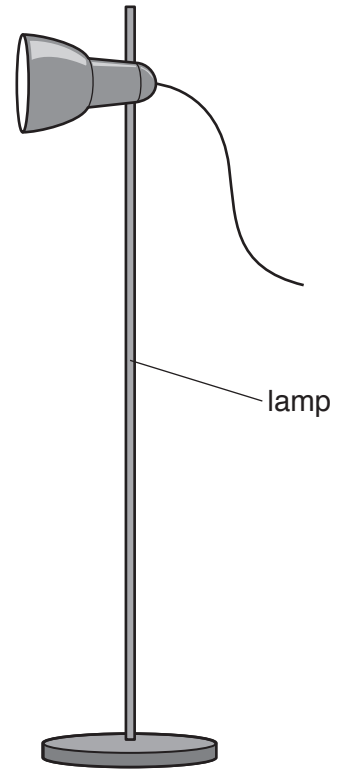
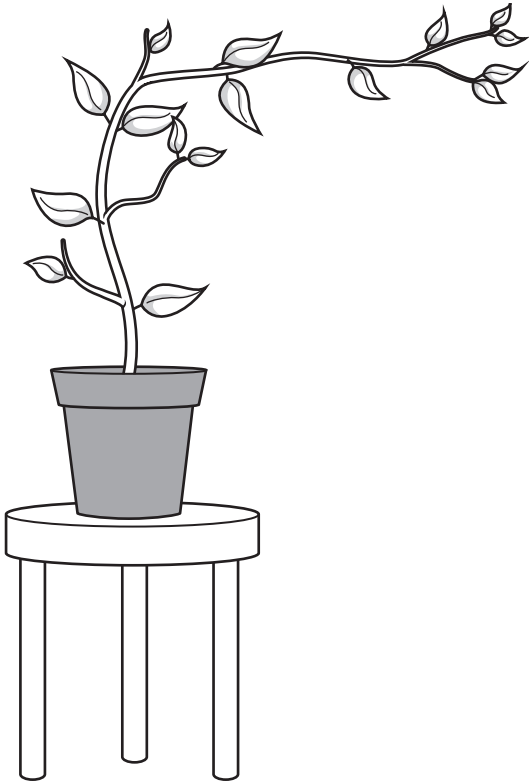
Answer **all** the questions.

SECTION A – Module B1

1 (a) The picture shows a plant shoot growing towards a lamp.

The lamp is on all the time.

The lamp is the only light source.



(i) Plants respond to light.

Describe the type of response to light shown by this plant shoot.

..... [2]

(ii) Auxin causes this shoot to bend.

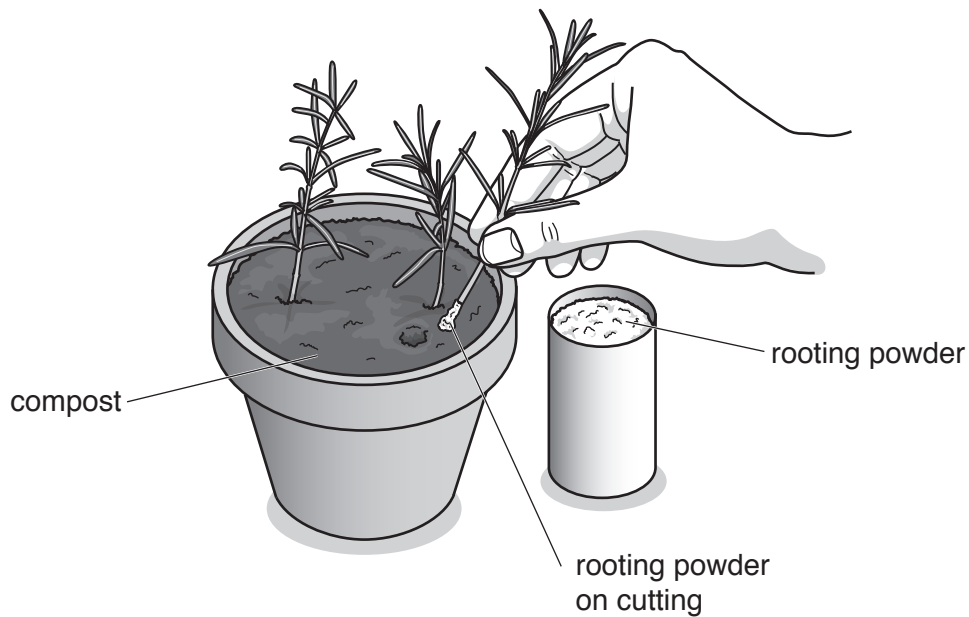
If the plant pot was slowly rotated, the shoot would then grow straight up.

Explain why.

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

(b) Jill takes cuttings from a plant.

She puts rooting powder on the cuttings.



Jill then puts the cuttings into compost.

Jill uses 'Start-Root' rooting powder because she thinks it is the best.

Look at the table.

It shows the effects of different rooting powders on cuttings.

Rooting powder used	Mean number of roots per cutting after ten days	Mean root length after ten days in mm
none	7.6	22.1
Rootz-It	8.9	30.3
Roo-Ting	12.5	32.4
Start-Root	12.8	28.3

Is 'Start-Root' the best rooting powder?

Give reasons for your answer.

Use data from the table to support your answer.

.....

.....

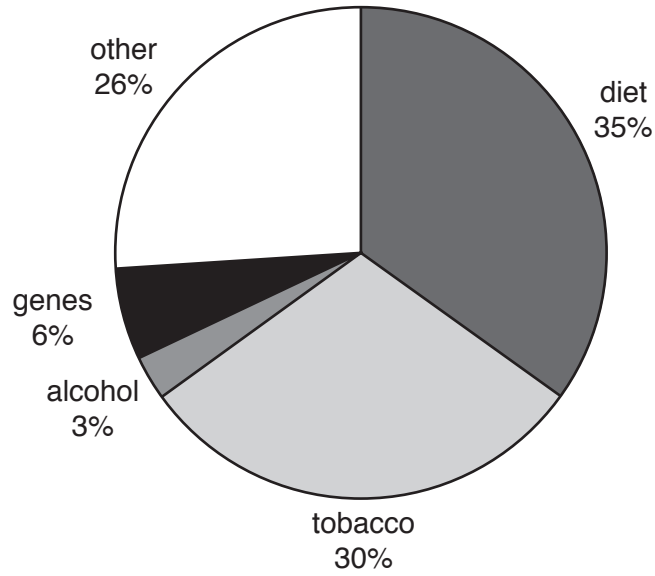
.....

..... [2]

PLEASE DO NOT WRITE ON THIS PAGE

2 (a) Look at the chart.

It shows the factors that cause cancer.



Write down **two** changes to a person's lifestyle that would **best** reduce their risk of getting cancer.

1

.....

2

.....

[2]

(b) Scientists have developed a drug to treat cancer.

The drug works by attaching to a specific protein found only on the cancer cells.

The white blood cells recognise the cancer cells more easily and attack them.

(i) Which part of the immune system works in a similar way to this drug?

..... [1]

(ii) A side effect of this drug is low blood pressure.

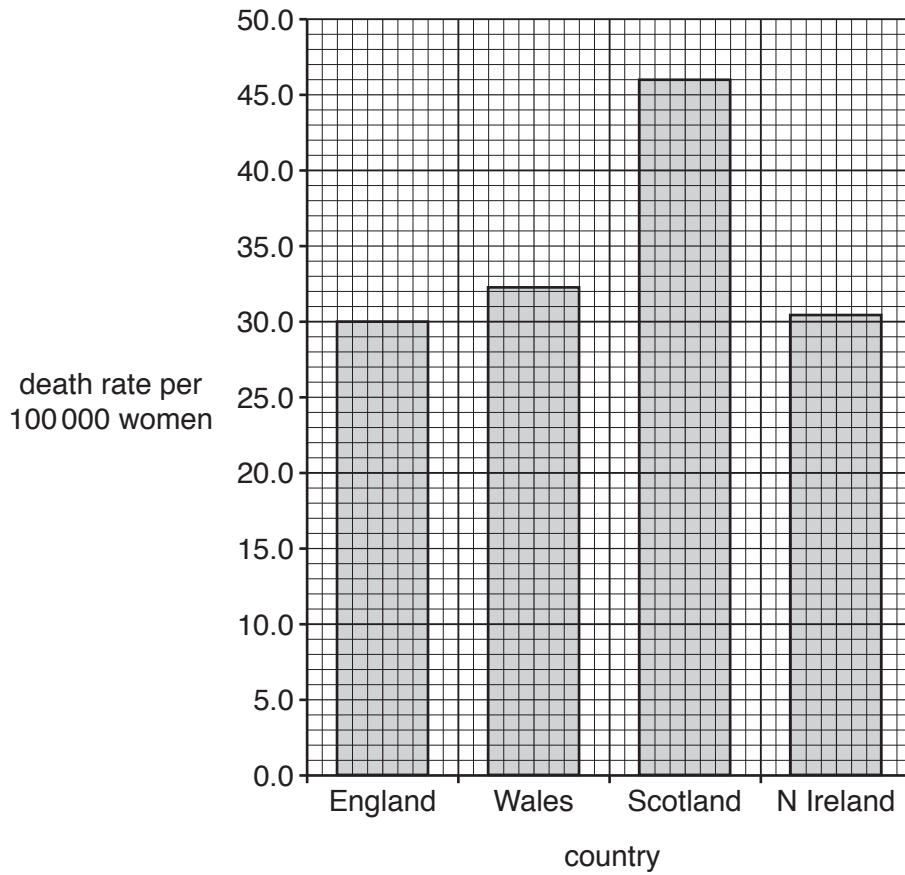
Explain why this side effect would need careful monitoring.

.....

..... [1]

(c) Look at the graph.

It shows the death rate for lung cancer between 2007 and 2009 in four different countries per 100 000 women.



(i) What is the difference between the death rate per 100 000 women in England and the death rate per 100 000 women in Scotland?

.....

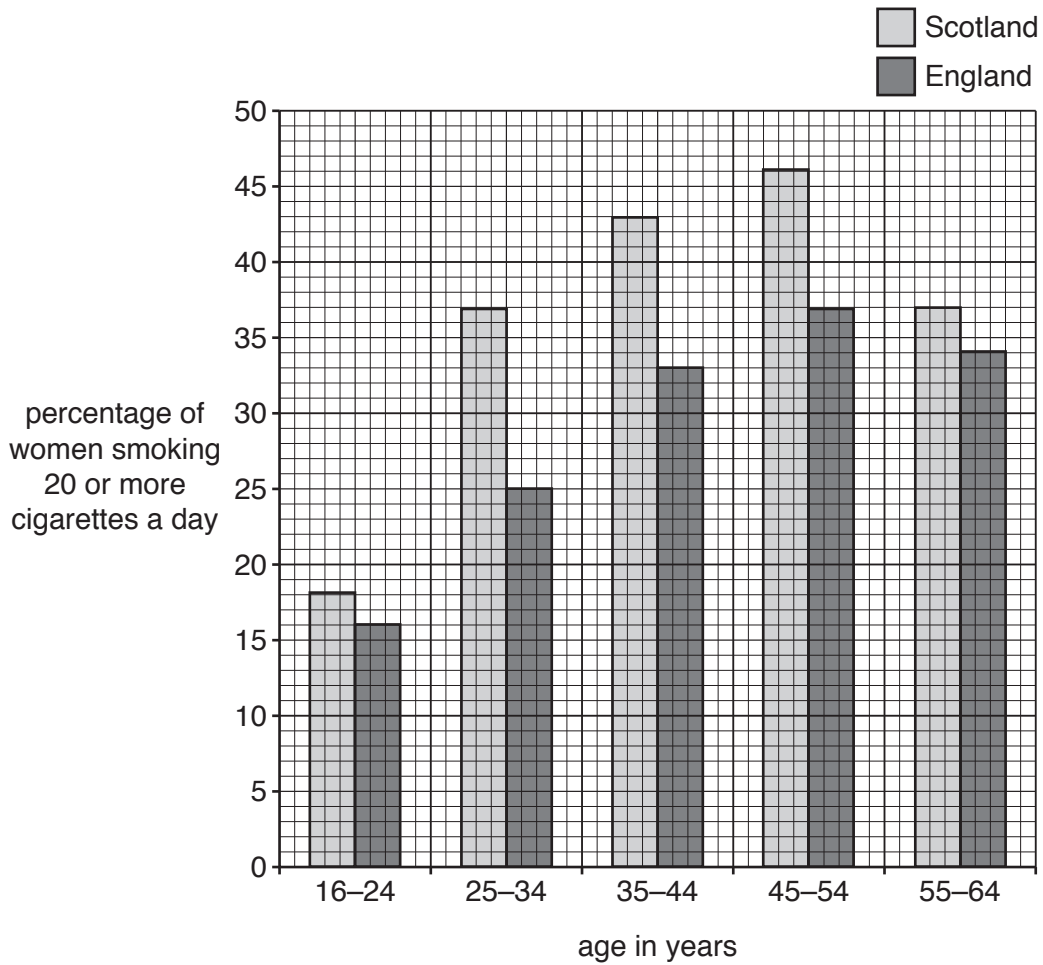
What is this figure as a percentage of the death rate per 100 000 women in England?

.....%

[2]

(ii) Look at the graph below.

It shows the percentage of women in Scotland and England smoking 20 or more cigarettes a day.



The percentage of women in Scotland dying from lung cancer is greater than the percentage of women dying from lung cancer in England.

Suggest why. Use the evidence from the graph to support your answer.

.....

..... [1]

4 Some substances are depressants.

(a) Which substance is a depressant?

Put a tick (✓) in the box next to the correct answer.

- anabolic steroid
- aspirin
- ecstasy
- solvent

[1]

(b) Alcohol is a depressant.

Drinking large amounts of alcohol daily can damage the liver.

Describe how.

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

(c) Parkinson’s disease is caused when some nerve cells in the brain cannot make enough dopamine.

Dopamine is a transmitter substance released at synapses in the brain.

Chlorpromazine is a drug used to treat anxiety.

It works in a similar way to depressants by acting on dopamine receptors in the brain.

Some side effects of chlorpromazine are similar to the symptoms of Parkinson’s disease.

Use your understanding of how depressants work to explain this similarity.

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..... [2]

SECTION B – Module C1

5 (a) Nick is painting his kitchen.



Nick uses **emulsion paint**.

Describe how emulsion paint dries.

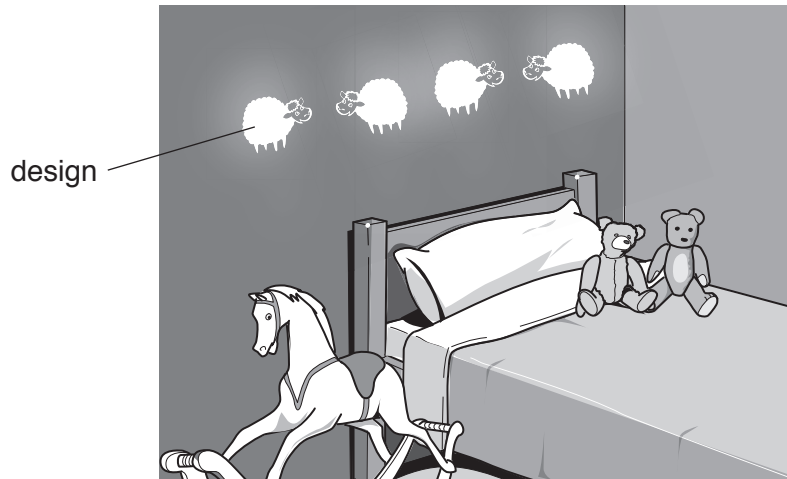
..... [1]

(b) Paint is a **colloid**.

Explain what is meant by a colloid.

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

(c) Nick also paints his granddaughter's bedroom.



He wants a design to appear on the walls when it is dark.

Look at the table. It gives some information about pigments.

Pigment	Colour at 20°C	Colour at 100°C	Effect of light
A	blue	red	no change
B	blue	blue	colour fades
C	green	green	gives off light in the dark
D	yellow	yellow	no change

Which pigment should Nick choose to paint the design in his granddaughter's bedroom?

.....

Explain your choice.

.....

 [2]

6 Look at the information about four different fuels.

Fuel	Cost per litre in pence	Volume to heat a house for 1 year in litres	Relative energy content per litre	Relative mass of carbon dioxide made per kJ
Gas oil	47.66	900	10.40	0.341
Paraffin	30.98	1000	9.80	0.300
LPG	37.50	3000	6.66	0.244
Propane	74.24	1800	7.07	0.244

(a) Liz thinks that **paraffin** would be the best fuel to heat her house.

Is she correct?

Use information from the table to explain your answer.

.....

 [2]

(b) Gas oil, paraffin, LPG and propane are all found in crude oil.

A mixture of gas oil, paraffin, LPG and propane can be separated by **fractional distillation**.

Explain why. Use ideas about molecular size and intermolecular forces.

.....

 [2]

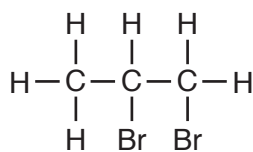
(c) Propane, C_3H_8 , burns in oxygen, O_2 .

Carbon dioxide and water are made.

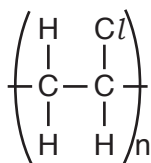
Write a **balanced symbol** equation for this reaction.

..... [2]

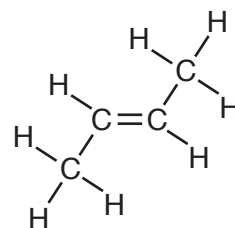
7 Look at the displayed formulas of some carbon compounds.



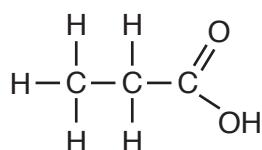
compound **A**



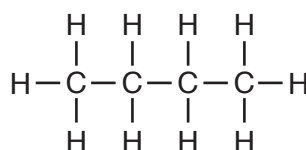
compound **B**



compound **C**



compound **D**



compound **E**

(a) Which compound is an **unsaturated** hydrocarbon?

Choose from **A**, **B**, **C**, **D** or **E**.

.....

[1]

(b) Compound **A** is formed in the reaction between propene with bromine.

What type of reaction is this?

..... [1]

(c) Compound **C** is butene.

Many butene molecules react together to make the **polymer** poly(butene).

Write a **balanced symbol** equation for the reaction of butene to make poly(butene).

[2]

8 Chemicals called **esters** can be used to make perfumes or used as solvents.



(a) Perfumes need to have certain properties.

Perfumes must **evaporate easily** and must **not react with water**.

Explain why a perfume needs to have each of these properties.

evaporates easily

.....

not react with water

..... [2]

(b) Perfumes must be thoroughly tested before they can be sold.

In the past, perfumes were tested on animals.

Testing on animals is now banned in the EU.

Explain why people have different opinions about whether the testing of cosmetics on animals is ever justified.

.....

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.....

..... [2]

- (c) Helen investigates five different solvents.

She wants to find the best solvent for removing her nail varnish.

Solvent	How easily does it evaporate? (10 = good, 1 = poor)	How effective is it at dissolving nail varnish? (10 = good, 1 = poor)	Is it toxic?	Is it flammable?
A	8.0	1.6	✓	✓
B	5.6	4.5	✓	✓
C	7.8	4.2	✗	✓
D	10.0	4.5	✗	✗
E	6.8	5.1	✓	✓

Explain, using information from the table, which solvent would be best for removing Helen's nail varnish.

Explain why water will not dissolve Helen's nail varnish.



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

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[6]

Section C – Module P1

9 There are seven types of electromagnetic wave.

radio waves	microwave	infrared	visible light	ultraviolet	X-rays	gamma rays
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(a) Which **type** of wave has the **longest** wavelength?

..... [1]

(b) Visible light can travel along optical fibres.

Optical fibres have a glass-air boundary.

It is important that the angle of the incident light on the boundary is greater than the critical angle.

Explain why.

.....
 [1]

(c) An electromagnetic wave travels in space.

It has a frequency of 3×10^6 Hz.

It has a wavelength of 100 m.

(i) Calculate the speed of this wave.

.....

 answer m/s. [2]

(ii) Another electromagnetic wave is travelling in space.

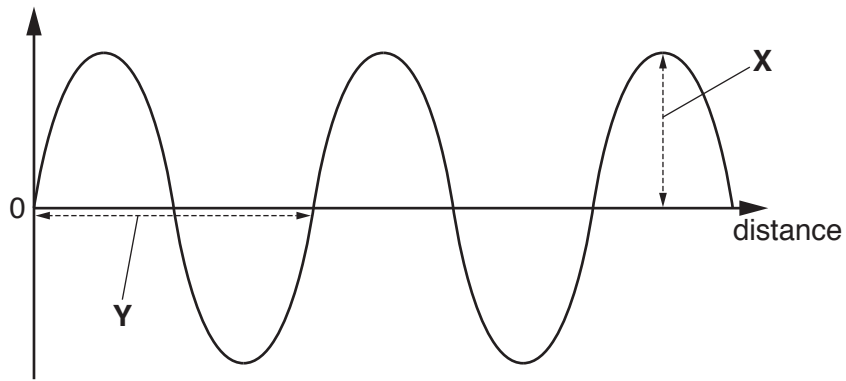
It has a frequency of 3×10^8 Hz.

Complete the sentences about this wave.

The speed of this wave is m/s.

The wavelength of this wave is m. [1]

(d) Two features, **X** and **Y**, of an electromagnetic wave are shown in a diagram.



Use the letters **X** and **Y** to name and describe these features.

.....

.....

.....

..... [2]

10 Paloma wants to insulate her house.

She finds information about different types of insulation.

Type of insulation	Cost to fit in £	Money saved each year in £	Payback time in years
Double glazing	3000	20
Cavity wall insulation	600	100	6
Draught-proofing	25	50	0.5
Loft insulation	200	100

(a) (i) Calculate the money saved each year for double glazing.
 answer £ [1]

(ii) Calculate the payback time for loft insulation.
 answer years [1]

(b) Paloma has up to £600 to spend on insulation.

She has two options.

Option 1 Fit only cavity wall insulation.

Option 2 Fit draught proofing **and** loft insulation.

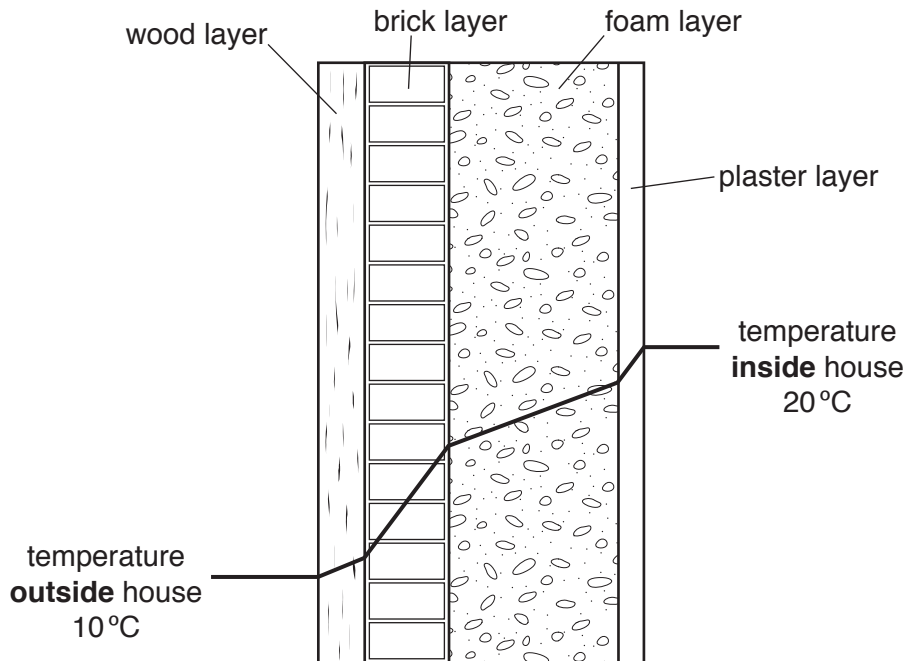
Use the information in the table to suggest which option is best.

.....

 [2]

(c) One of the outside walls of Paloma’s house **cannot** have cavity wall insulation.

The wall is made of four layers of material.



The diagram shows how the temperature changes across each layer.

There are different energy losses across each layer.

(i) Explain why there are different energy losses across each layer.

Use ideas about conduction and convection in your answer.

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..... [3]

(ii) Suggest what Paloma could do to reduce the **total** energy loss through this wall.

.....

..... [1]

12 Microwaves are used for heating food and for communicating.

(a) Explain how microwaves heat food in a microwave oven.

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

(b) Lily is worried about the heating effect of the microwaves from her mobile phone.

Oscar is worried about a mobile phone mast near his house.

They collect information to compare the mobile phone mast and a microwave oven.

	Mobile phone mast	Microwave oven
Height from ground	52.5 m	1.5 m
Frequency of microwaves	1 800 000 KHz	2 450 000 KHz
Transmitter power	1 000 W	0.7 W

(i) This mobile phone mast may reduce the risk of using microwaves for communication.

Use the information in the table to explain how.

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..... [1]

(ii) Why do many people still use mobile phones when there is evidence that microwaves may cause harm to humans?

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..... [1]

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).

A large area of lined paper for writing. It features a vertical margin line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dotted lines, providing space for writing answers. The lines are evenly spaced and extend across the width of the page.

A blank sheet of handwriting practice paper. It features a vertical solid line on the left side, creating a margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height and placement. There are 25 horizontal dashed lines in total, evenly spaced across the page.

A large grid of dotted lines for handwriting practice. The grid consists of 26 horizontal rows, each starting with a vertical margin line on the left. The lines are evenly spaced and extend across the width of the page.

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines extending across the page, providing a space for writing answers.



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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
		9 Be beryllium 4						20 Ne neon 10
	7 Li lithium 3	23 Na sodium 11	24 Mg magnesium 12				19 F fluorine 9	35.5 Cl chlorine 17
							16 O oxygen 8	40 Ar argon 18
							14 N nitrogen 7	
							12 C carbon 6	
							11 B boron 5	
							27 Al aluminium 13	
							31 P phosphorus 15	
							32 S sulfur 16	
							75 As arsenic 33	
							79 Se selenium 34	
							80 Br bromine 35	
							115 In indium 49	131 Xe xenon 54
							119 Sn tin 50	
							122 Sb antimony 51	
							128 Te tellurium 52	
							204 Tl thallium 81	[222] Rn radon 86
							207 Pb lead 82	[210] At astatine 85
							209 Bi bismuth 83	
							209 Po polonium 84	
							201 Hg mercury 80	
							197 Au gold 79	
							195 Pt platinum 78	
							192 Ir iridium 77	
							190 Os osmium 76	
							186 Re rhenium 75	
							184 W tungsten 74	
							181 Ta tantalum 73	
							178 Hf hafnium 72	
							178 Ti titanium 22	
							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	
							106 Ni nickel 28	
							59 Co cobalt 27	
							59 Fe iron 26	
							56 Mn manganese 25	
							55 Cr chromium 24	
							55 V vanadium 23	
							52 Ti titanium 22	
							48 Sc scandium 21	
							45 Ca calcium 20	
							89 Y yttrium 39	
							88 Sr strontium 38	
							85 Rb rubidium 37	
							137 Ba barium 56	
							139 La* lanthanum 57	
							133 Cs caesium 55	
							227 Ac* actinium 89	
							226 Ra radium 88	
							[223] Fr francium 87	
							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	
							209 Po polonium 84	
							209 Bi bismuth 83	
							207 Pb lead 82	
							204 Tl thallium 81	
							115 In indium 49	
							119 Sn tin 50	
							122 Sb antimony 51	
							128 Te tellurium 52	
							127 I iodine 53	
							80 Br bromine 35	
							79 Se selenium 34	
							75 As arsenic 33	
							73 Ge germanium 32	
							70 Ga gallium 31	
							65 Zn zinc 30	
							63.5 Cu copper 29	
							108 Ag silver 47	
							112 Cd cadmium 48	

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.