OCR
Oxford Cambridge and RSA

H

Friday 3 November 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

* B 7 1 1 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 **75**.
- This document consists of **24** 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 B1

1 Sharon needs to wear glasses to see into the distance clearly.

(a) **(i)** What causes the problem Sharon has with her eyes?

.....

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

(ii) Sharon's sight can be corrected using lenses.

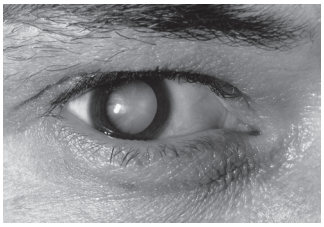
Explain how these lenses help Sharon to see distant objects more clearly.

.....

.....

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

(b) Sharon's grandfather has a problem with his right eye.



The lens in the right eye has become cloudy.

This condition is called a cataract.

Suggest and explain how the cataract will affect the sight in his right eye.

.....

.....

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

2 Malaria is a disease that can be caught in some countries of the world.

(a) Describe how malaria passes from one person to another.

.....

.....

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

(b) The spread of malaria can be prevented by sleeping under a net and draining stagnant pools of water.

Explain how **each** of these methods work.

.....

.....

.....

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

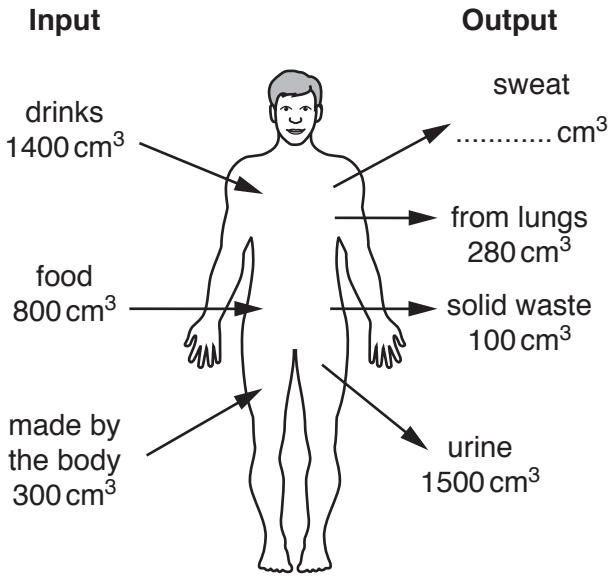
(c) Drugs to prevent malaria are tested before they can be used.

Some drugs are tested on animals and humans.

Describe **one other** way drugs are tested.

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

3 Look at the diagram. It shows how much water one person takes in and loses in one day.



(a) Water balance in the body involves **homeostasis**.

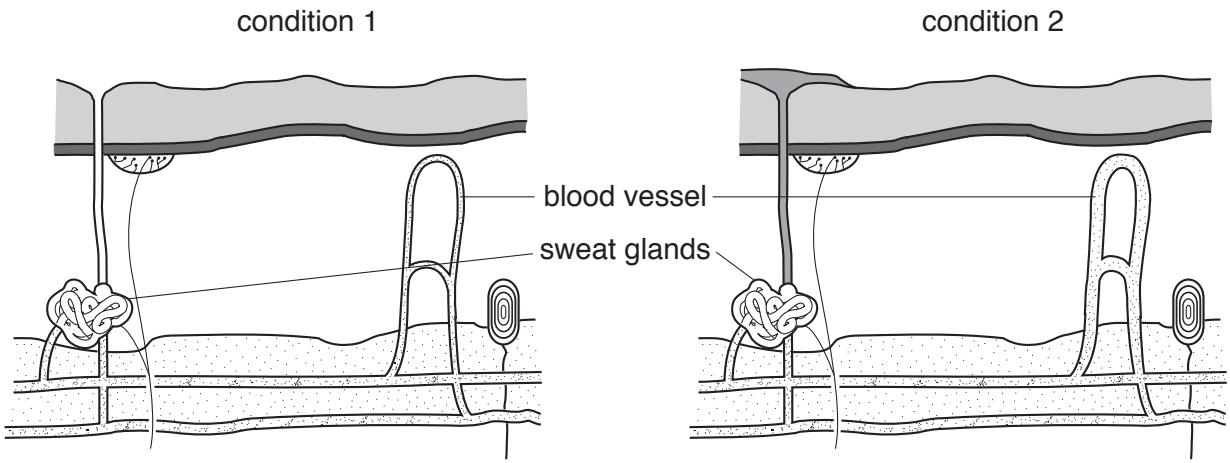
(i) Calculate the amount of water output by sweat.

..... cm^3 **[1]**

(ii) What **percentage** of water output does sweating account for?

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

(b) Look at the diagram. It shows skin in two different conditions.



Which condition would be the **hottest**?

Use the diagrams and your scientific knowledge to explain your answer.

.....

.....

.....

.....

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

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

4 John and Janet investigate their fitness.

They try out three different fitness tests.

This table shows each test and their results.

Fitness measure	Fitness test	John's result	Janet's result
endurance and strength	number of push-ups in a minute	46	24
cardiovascular efficiency	time to walk one mile in minutes	13	14
cardiovascular efficiency	pulse rate after doing 3 minutes of step-ups in beats per minute	89	92

This table shows the ratings for each test.

Rating	Number of push-ups in a minute		Time to walk one mile in minutes		Pulse rate in beats per minute after doing three minutes of step-ups	
	Males	Females	Males	Females	Males	Females
Good	45 to 54	34 to 48	11 to 12	13 to 14	79 to 87	85 to 93
Average	35 to 44	17 to 33	>12	>14	88 to 100	94 to 110

John makes this statement about their results.

> I am stronger, faster and generally fitter than Janet.

(a) Write down **one** reason why John's statement might be correct.

.....

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

(b) Evaluate their investigation and explain **two** reasons why John's statement may **not** be correct.

.....

.....

.....

.....

.....

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

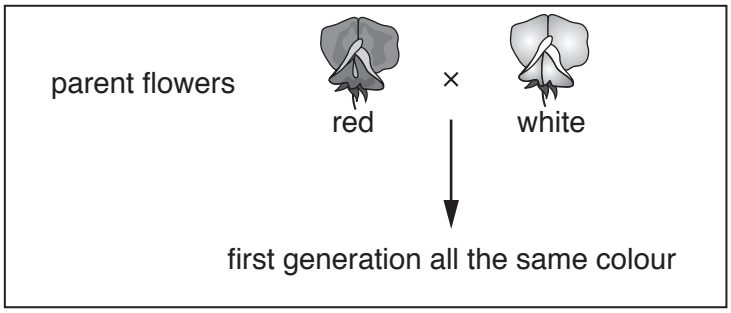
5 Jack grows red and white flowers.

He decides to cross-breed his flowers.

Jack uses pollen from the white flowers to fertilise the red flowers.

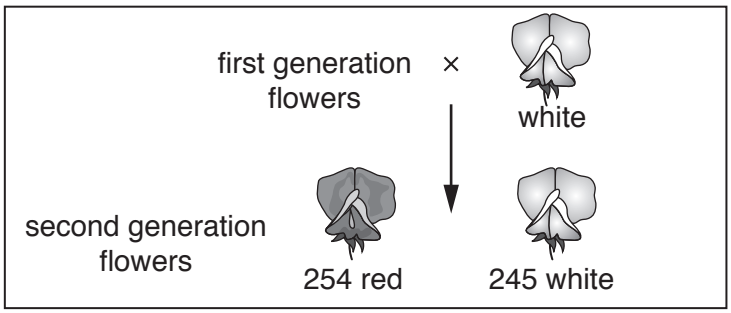
He then grows the seeds.

All offspring in this **first generation** are the same colour.



Jack then fertilises these flowers with pollen from the original white flowers.

He grows the seeds and gets 254 red and 245 white flowers in the **second generation**.



Identify the **phenotype** and **genotype** (use the letters R and r) of the offspring from the **first generation**.

Use genetic diagrams and ideas about dominance to explain the results of both the first and second generations.

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

.....

.....

.....

.....

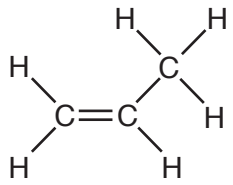
.....

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

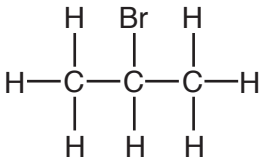
SECTION B – Module C1

6 This question is about carbon compounds.

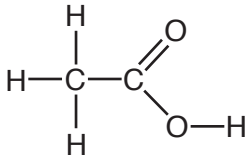
Look at the displayed formulas of some compounds.



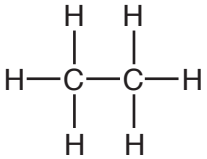
compound **A**



compound **B**



compound **C**



compound **D**

(a) Compound **B** has the **molecular formula** C_3H_7Br.

Write down the molecular formula for compound **C**.

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

(b) Which compound is an **unsaturated** compound?

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

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

(c) Compound **A** is propene.

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

(i) Write down the **conditions** needed to make poly(propene).

.....

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

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

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

7 Trevor drives a car with a diesel engine.

Julie drives a car with a petrol engine.

Look at the table.

It gives information about the two different engines.

	Carbon dioxide made in g/km	Carbon monoxide made in g/km	Oxides of nitrogen made in g/km
Petrol engine	148	265	8
Diesel engine	94	172	139

(a) Trevor says that his **diesel** engine causes less pollution than Julie's petrol engine.

Is he correct?

Explain your answer. Use information from the table.

.....

.....

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

(b) Petrol contains butane, C_4H_{10}.

In a car engine the butane reacts with oxygen, O_2. Carbon dioxide and water are made.

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

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

(c) Explain how **oxides of nitrogen** are made in a car engine.

.....

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

8 Mary is making her lunch.

She cooks eggs and chips.

(a) Eggs contain **protein** molecules.

Describe what happens to the protein molecules when Mary cooks the eggs.

.....

.....

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

(b) Potato is **easier to digest** if it is cooked.

Explain why.

.....

.....

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

(c) Mary also has a slice of bread and margarine with her lunch.

Margarine contains an **emulsifier** molecule that helps to stop oil and water from separating.

Complete the labels on the diagram of an emulsifier molecule.

[1]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

9 Crude oil is a mixture of hydrocarbons.

Fractional distillation separates crude oil into useful products (fractions).

Look at the table.

It gives information about some of the different fractions made from crude oil.

Fraction	Number of carbon atoms in a hydrocarbon molecule	Percentage found in North Sea crude oil (supply)	Percentage required for use (demand)
LPG	1 – 5	2	4
petrol	5 – 10	8	22
naphtha	8 – 12	10	5
kerosene	16 – 24	14	8
fuel oil	20 – 27	21	23
residue	45	45	38

(a) (i) Which fraction has the **lowest** boiling point?

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

(ii) Which fraction 'exits' at the **bottom** of the fractionating column?

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

(b) Crude oil contains too much of some fractions and not enough of others.

An oil refinery uses **cracking** to convert large hydrocarbon molecules into smaller ones that are more useful.

Explain how cracking of a hydrocarbon such as $C_{11}H_{24}$ helps an oil refinery to match supply with demand.

Use information in the table to explain which fractions should be cracked.

Include an equation for cracking.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

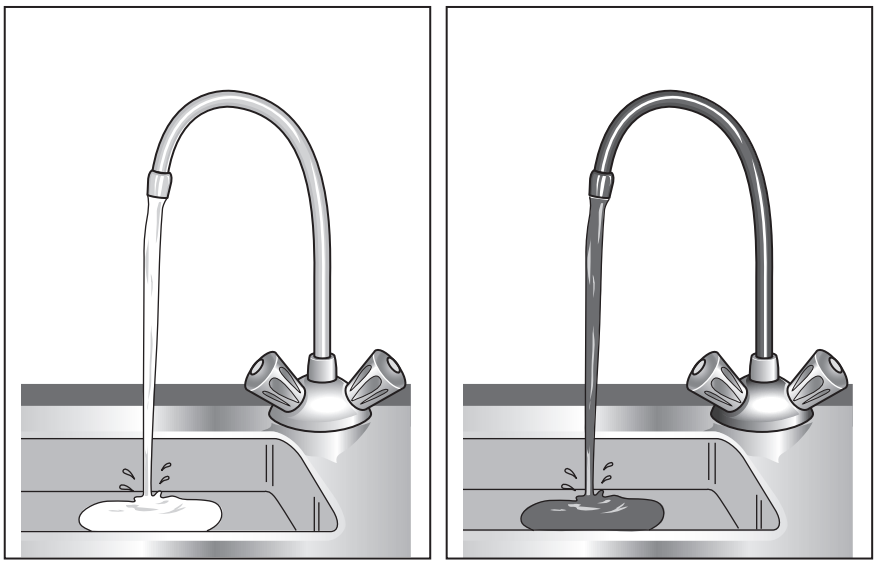
.....

.....

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

SECTION C – Module P1

10 Nina uses a thermal camera to take pictures of the sink and tap in her kitchen.



A **B**

(a) The water from the tap in picture **A** is at a different temperature to the water in picture **B**.

Which picture shows water with particles at a **lower** average kinetic energy?

.....

Explain your answer.

.....

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

(b) The water hits the bottom of the sink.

Energy is transferred when the water hits the sink.

Look at picture **A**. In which direction is energy transferred and what happens to the temperature of the sink as a result?

.....

.....

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

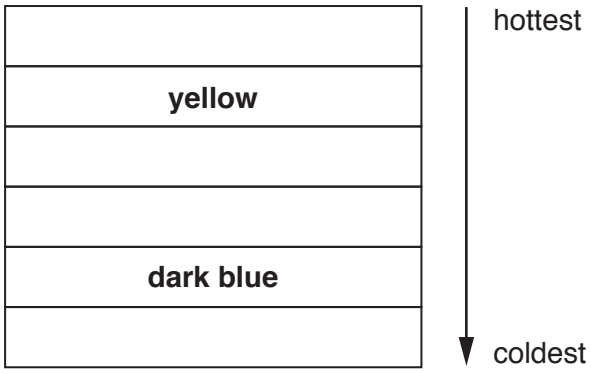
(c) Nina's pictures are in shades of black, white and grey.

Thermograms usually have the colours listed below.

black **dark blue** **purple** **red** **white** **yellow**

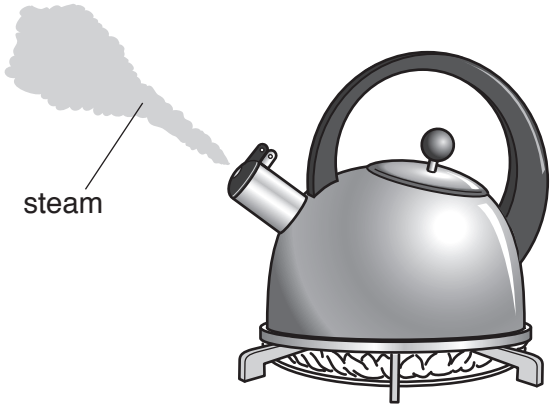
Put these thermogram colours in order of hottest to coldest.

Two have been done for you.



[1]

(d) Nina boils some water in her kettle.



The temperature of the boiling water is 100 °C.

Energy is still being transferred to the boiling water from the kettle.

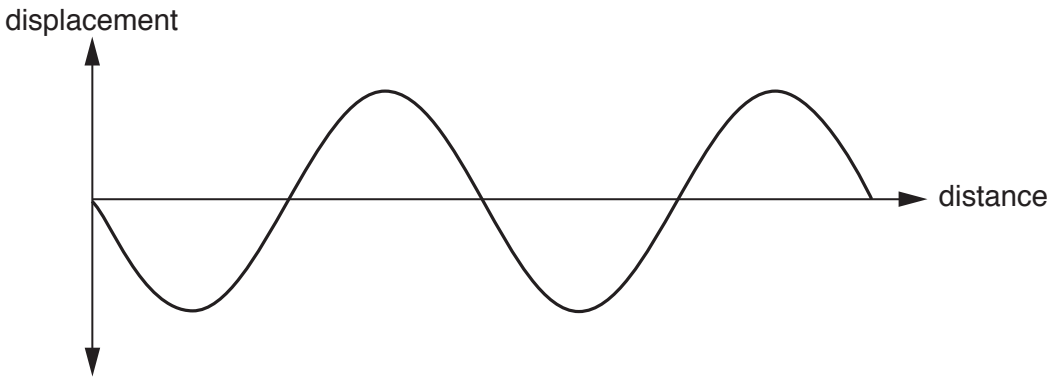
Describe what happens to the temperature of the boiling water.

.....

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

11 The electromagnetic spectrum is made up of transverse waves.

Look at the diagram of a transverse wave.



(a) Use the diagram to describe a **wavelength**.

You may label the diagram to help your description.

.....

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

(b) Microwaves are part of the electromagnetic spectrum.

(i) A microwave has a wavelength of 0.5 m.

It has a frequency of 6×10^8 Hz.

Calculate the wave speed.

.....

.....

answer ..... unit of speed ..... **[2]**

(ii) What happens to the frequency of the microwave if the wavelength is **doubled**?

.....

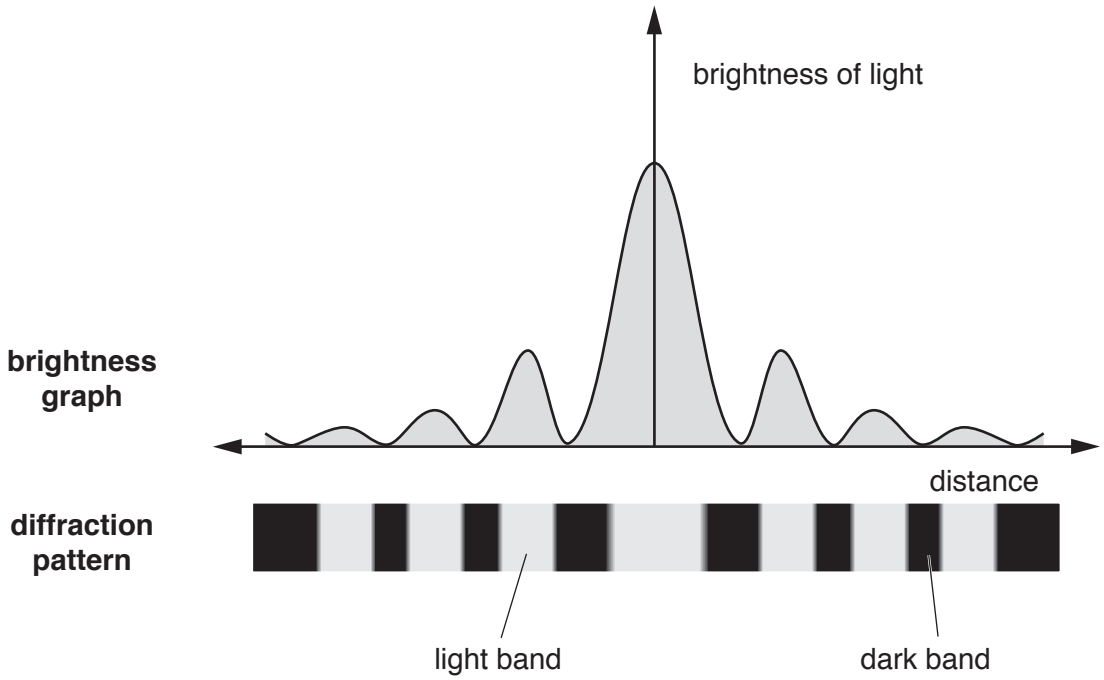
..... **[1]**

(c) Electromagnetic waves can be diffracted.

Light of a single wavelength is diffracted when it passes through a narrow slit.

(i) The diagram shows

- a graph of the brightness of light in each band
- the diffraction pattern seen.



Describe the main features of the diffraction pattern using the band sizes and brightness of light.

.....

.....

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

(ii) Diffraction reduces the quality of images seen using microscopes and telescopes.

Explain why the images are not sharp.

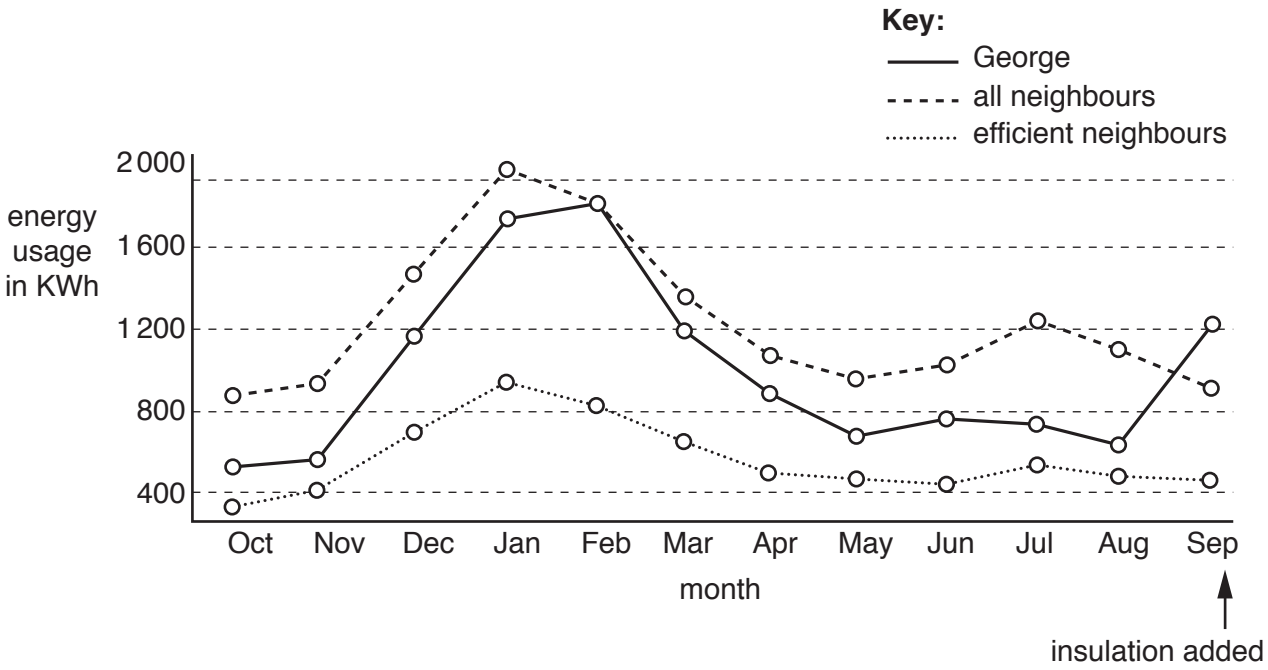
.....

.....

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

12 George has an energy report for his home.

(a) Part of the energy report is a graph which compares his energy usage with the energy usage of his neighbours.



George adds insulation to his house at the end of September (Sep).

Compare George's pattern of energy use with **all** his neighbours and his **efficient** neighbours.

Explain how and why his energy use will change during the year **after** the insulation is added.

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

.....

.....

.....

.....

.....

.....

.....

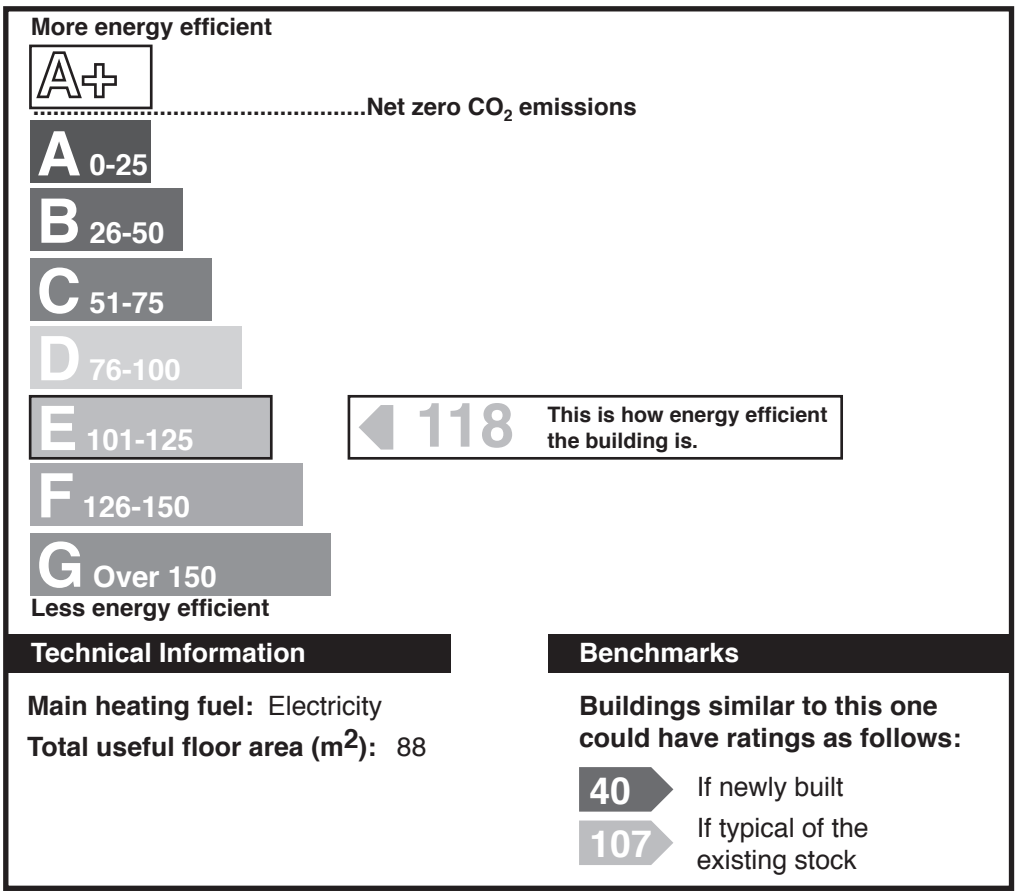
.....

.....

.....

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

(b) Energy performance certificates contain different information.



Parts of the certificate are **claims** and parts are **scientific evidence**.

Write down one example of a claim in the certificate and suggest one way the claim could be made more reliable.

.....

.....

.....

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

13 Light has different uses.

(a) **(i)** Explain how light can be used to send messages over long distances.

.....

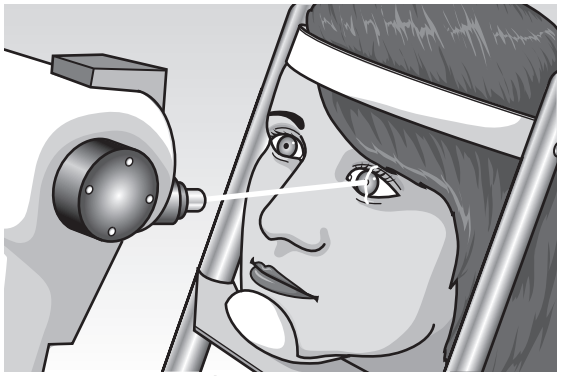
..... **[1]**

(ii) Write down one **advantage** of using light for communication rather than radio waves.

.....

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

(b) The properties of light produced by lasers allow it to be used for eye surgery.



carrying out surgery

Describe one property of light needed for accurate eye surgery.

Explain why the light from lasers has this property.

.....

.....

..... **[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.