OCR
Oxford Cambridge and RSA

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Wednesday 20 May 2015 – 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	

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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

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

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

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Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

SECTION A – Module B1

1 Jake wants to find out how much protein he should eat each day.

He finds information from two different sources.

Source 1

The table shows the amount of protein people of different ages should eat each day.

Age group	**Amount of protein in g**
Infants	10
Teenage males	52
Teenage females	46
Adult males	56
Adult females	46

Source 2

Your estimated average daily intake of protein can be calculated using the formula.

EAR in g = 0.6 × body mass in kg

(EAR) Estimated Average Requirement

(a) Jake is a teenage male. He has a mass of 70 kg.

The amounts of protein recommended by Source 1 and Source 2 are different.

(i) Calculate Jake's EAR.

Use your calculation to decide which source recommends that Jake eats the **most** protein.

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

(ii) Suggest **two** reasons why the recommended amounts of protein are different.

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

(b) Jake's mum has the same mass as Jake.

This means they have the same EAR.

Jake needs to eat more protein each day than his mum to stay healthy.

Explain why their daily intake of protein should be different even though the EAR is the same.

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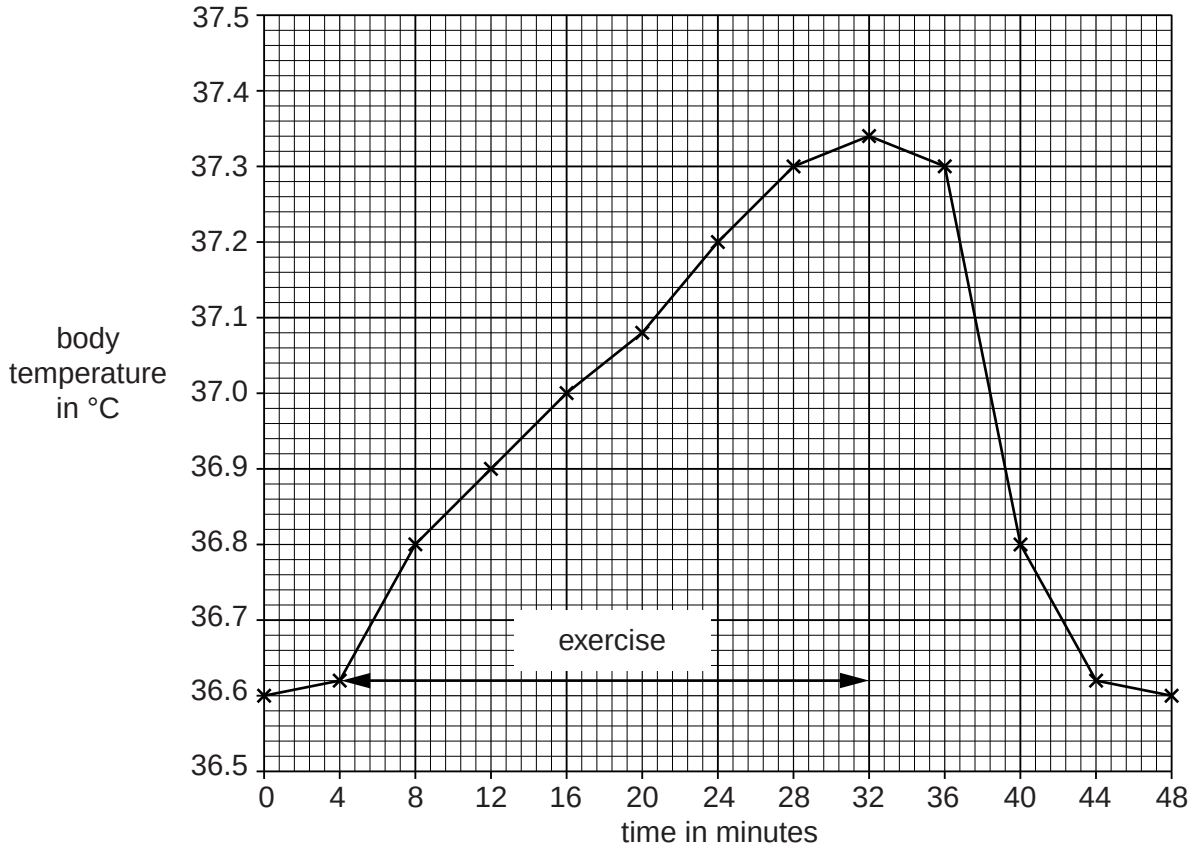
..... **[2]**

2 Jess and Neil investigate the effect of exercise on body temperature.

Jess measures Neil's body temperature every four minutes for 48 minutes.

Neil exercises for 28 minutes of this time.

The graph shows the change in Neil's body temperature.



(a) Explain how **sweating** and **negative feedback** mechanisms cause the changes shown in the graph.

Use data from the graph in your answer.

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

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(b) People who don't exercise enough sometimes develop high blood pressure.

Write down **one other** factor that could **increase** blood pressure.

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

(c) Energy is needed for exercise.

Fats are one type of food that can provide energy for the body.

(i) Which **two** molecules are fats made up of?

Put a (ring) around each correct answer.

amino acid

fatty acids

glucose

glycerol

starch

[1]

(ii) Where and how are fats stored in the body?

.....

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

3 Read this information about multiple sclerosis and cannabis.

People with a medical condition called multiple sclerosis (MS) often have very painful symptoms.

A study of more than 600 MS patients has shown that taking cannabis can relieve some of the symptoms.

A scientist working on the trial says that the study has made NHS prescribing of cannabis-based drugs more likely.

In some countries, MS patients smoke cannabis mixed with tobacco. It is also possible to take cannabis without mixing it with tobacco. In other countries the possession of cannabis is illegal.

(a) Smoking cannabis mixed with tobacco has many risks.

The risks to MS patients smoking cannabis can be reduced by making cannabis a prescription drug.

Use the information to help you describe and explain one **other** way the risks can be reduced.

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

(b) To make the study more reliable a **blind trial** was used.

Describe how a blind trial would be done for this study.

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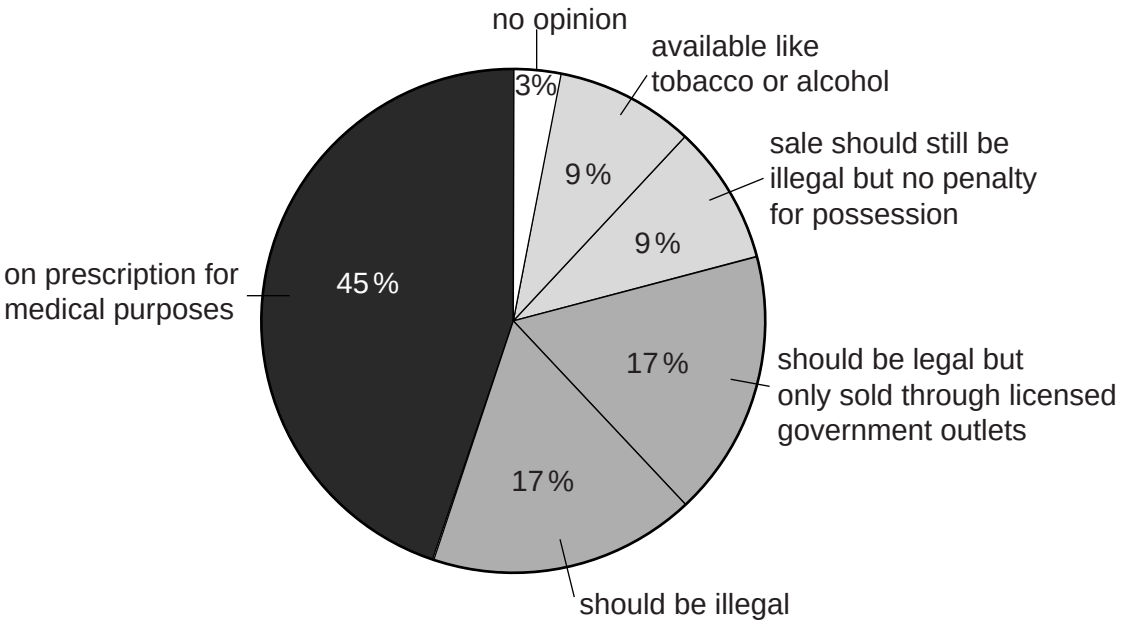
..... **[2]**

(c) Some people think cannabis should be made legal in the United Kingdom.

Look at the chart. It shows the results of an opinion poll about making cannabis legal.



Read these conclusions about the data.

Put a tick (✓) next to the **two** conclusions that match the data.

35% think you should be able to get cannabis on prescription. ☐

26% think you should be able to buy cannabis without a prescription. ☐

9% think you should be able to buy cannabis without a prescription from a licensed outlet. ☐

26% think that the sale of cannabis should be illegal. ☐

Less than 50% think cannabis should be made legal either with or without a prescription. ☐

[2]

4 This question is about genetics.

A scientist called Mendel studied the inheritance of characteristics in peas.

(a) Nalshed and Jill copy some of Mendel's experiments.

The table shows their experiments and some of their results.

Experiment	Description of experiment	Number of offspring	Offspring type
1	crossed tall plants with short plants	282	all tall
2	crossed the offspring from experiment 1 with each other	280	210 tall 70 short
3	crossed offspring from experiment 1 with short plants	260	

There were 260 offspring from **experiment 3**.

Predict how many of these offspring from experiment 3 will be tall and how many will be short.

Use the letters **T** and **t** and a diagram to help you.

Number of tall offspring .....

Number of short offspring ..... **[2]**

(b) Mendel's work on inheritance was not recognised until after his death.

Scientists used papers Mendel had written to help them explain their own investigations.

Use these ideas to explain why it is important that Mendel published his work.

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

SECTION B – Module C1

5 This question is about carbon compounds.

compound **A** compound **B**

(a) Look at the displayed formula of compound **A**.

(i) Compound **A** is **not** a hydrocarbon.

Explain why.

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

(ii) Write down the **molecular formula** for compound **A**.

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

(b) Compound **A** is changed into compound **B** in a process called polymerisation.

Describe, including the conditions needed, the process of polymerisation.

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

(c) What type of compound is compound **B**?

Choose from the list.

alkane

alkene

dibromo

saturated

unsaturated

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

6 Louise buys a new bottle of perfume.

(a) The perfume contains a chemical called an **ester**.

Complete the **word equation** for the reaction used to make an ester.

..... + alcohol → ester + water

[1]

(b) Louise buys some nail varnish remover.

Her nail varnish remover contains an ester.

The ester is a solvent.

Louise's nail varnish remover dissolves nail varnish.

Water does not dissolve nail varnish.

Explain, using ideas about particles, why water will not dissolve nail varnish.

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

7 Duncan investigates the combustion of four different fuels.

He burns the same volume of fuel in each experiment.

Look at his results.

Fuel	Is carbon dioxide made?	Is carbon monoxide made?	Is soot made?	Energy given out in J	Cost per litre in £
A	✓	✗	✗	4200	6.00
B	✓	✓	✗	2900	4.00
C	✗	✓	✓	1100	1.30
D	✓	✗	✗	3800	3.00

(a) Which fuel would be best for Duncan to use to heat his house?

Use information from the table to explain your answer.

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

(b) Fuel **A** is ethanol.

Look at this equation. It shows the complete combustion of ethanol.

$$C_2H_5OH + \mathbf{x}O_2 \longrightarrow \mathbf{y}CO_2 + \mathbf{z}H_2O$$

What are the numbers **x**, **y** and **z** that balance this equation?

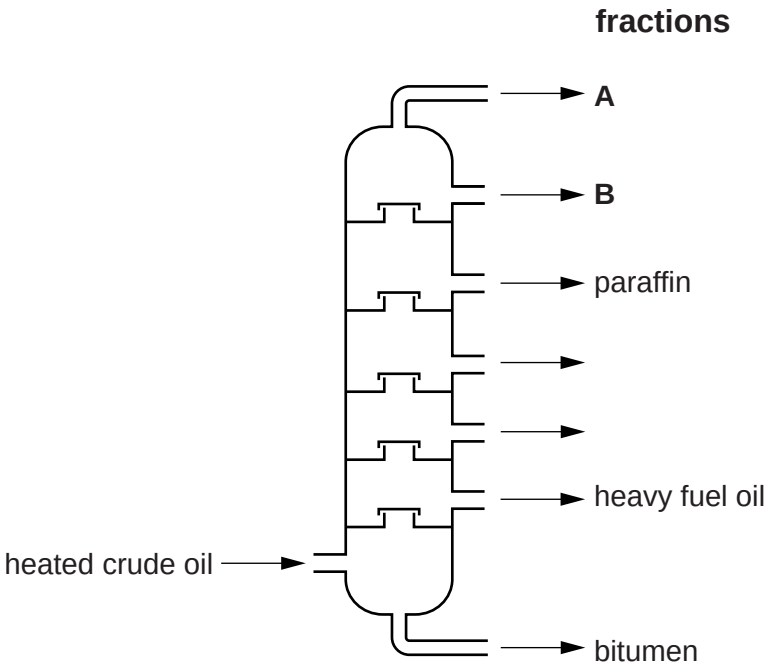
x = ...

y = ...

z = ... **[1]**

8 This question is about crude oil.

Crude oil can be separated into useful substances called fractions.



(a) What are the names of the missing fractions **A** and **B**?

Choose your answers from the list.

diesel

heating oil

LPG

methane

petrol

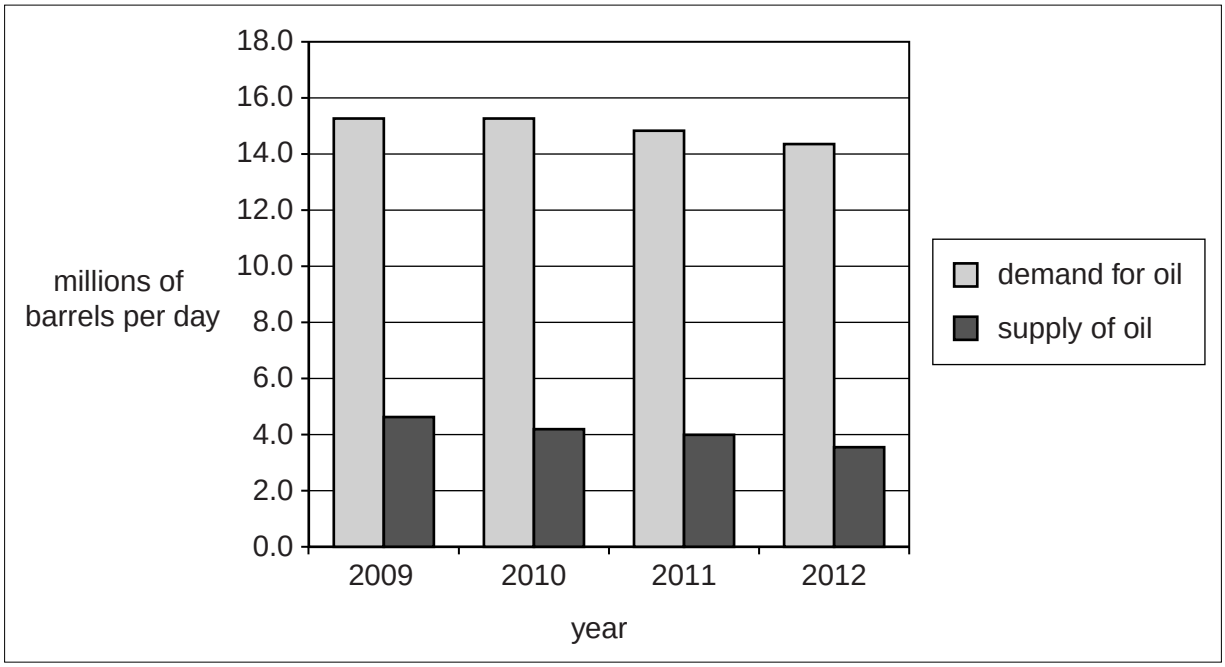
Fraction **A** is .....

Fraction **B** is ..... **[1]**

(b) Look at the graph.

The graph shows the **production** of oil in Europe from 2009 to 2012.

It also shows the **demand** for oil in Europe in the same period.



What trends can you deduce about the supply and demand of crude oil from 2009 to 2012?

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

(c) Look at the information about two substances found in crude oil.

Molecular formula	C_2H_6	→	C_8H_{18}
Boiling point	.....	→	.....
Intermolecular forces	.....	→	.....

Complete the boxes to show how the **boiling points** and **intermolecular forces** compare for these two substances.

Choose words from the list.

covalent **high** **ionic**

low **strong** **weak** **[2]**

(d) Distillation of C_8H_{18} does not make individual carbon and hydrogen atoms.

Explain why.

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

9 This question is about polymers **A** and **B**.

Look at the table.

It gives some information about polymers **A** and **B**.

	A	**B**
Density in g / cm^3	0.91	0.97
Melting point in °C	80	270
Relative strength	11.8	31.4
Relative flexibility	flexible	rigid

Explain, using information from the table, which polymer would be best for making water pipes. Relate the melting points of the two polymers **A** and **B** to a simple model of their structures.

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

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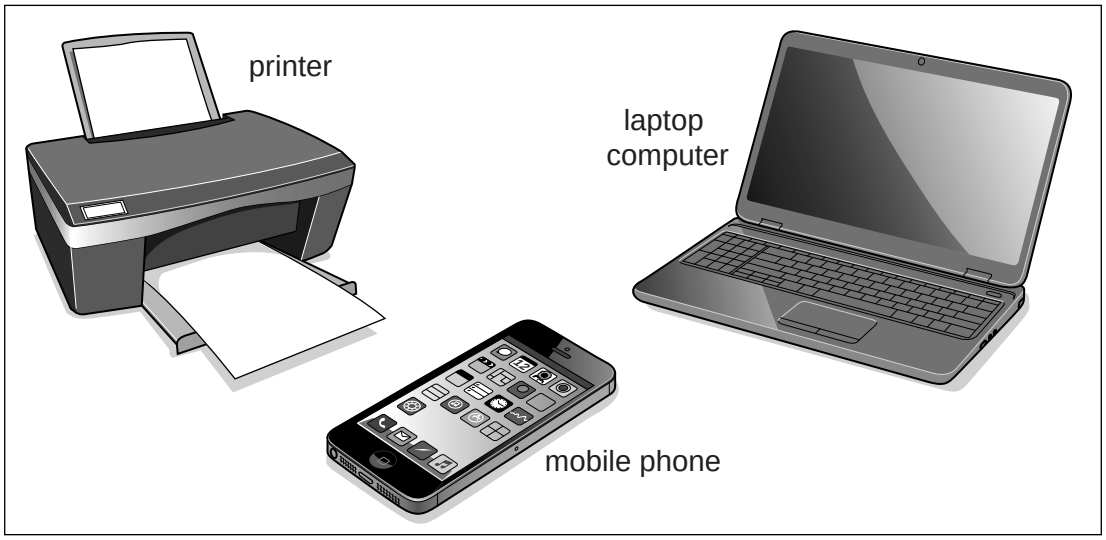
SECTION C – Module P1

10 OCRA is an advertising company.

Here is a picture from one of their adverts.



The advert is about using wireless technology.

(a) Wireless technology allows these three devices to communicate with each other.

Describe why wireless communication does **not** always work for these devices.

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

(b) The laptop computer has an **infrared** mouse.

Describe the **type** of signals the infrared mouse uses and explain how the signals can be used to control different functions on the laptop computer.

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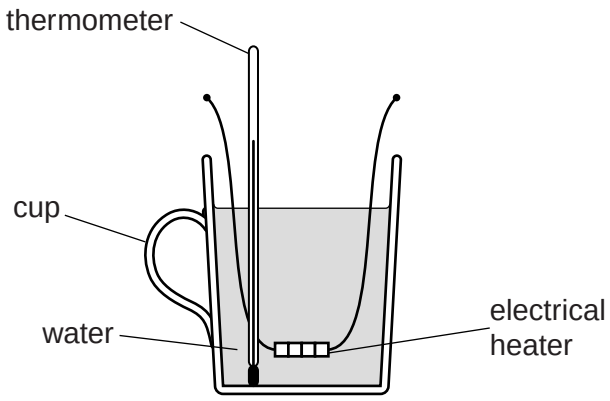
..... **[2]**

Question 11 begins on page 20

11 Emily does an experiment to calculate the energy needed to change the temperature of water.

(a) Here is the apparatus she uses.



Emily does the experiment three times.

Each time she changes the temperature of the water by different amounts.

Look at her results.

Mass of water in kg	Initial temperature in °C	Final temperature in °C	Energy absorbed by water in J	Energy supplied by heater in J
0.2	20	55	29400	49000
0.2	20	35	12600	18000
0.2	20	.....	8400	10000

The specific heat capacity of water is 4200 J/kg °C.

Calculate the missing final temperature in the table using the energy absorbed by the water.

Explain what Emily's results show using **all** the data from the table.

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

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

(b) Emily thinks that her results will change if she insulates the cup.

(i) What things can Emily do to the cup to reduce heat loss by **conduction** and **convection**?

conduction can be reduced by: .....

.....

convection can be reduced by: .....

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

(ii) Emily measures how long it takes to increase the temperature of this water by 60 °C. This takes 5 minutes.

She repeats this experiment with the same mass of water in an insulated cup.

Suggest what effect this has on the time taken to heat the water by 60 °C.

Explain your answer.

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

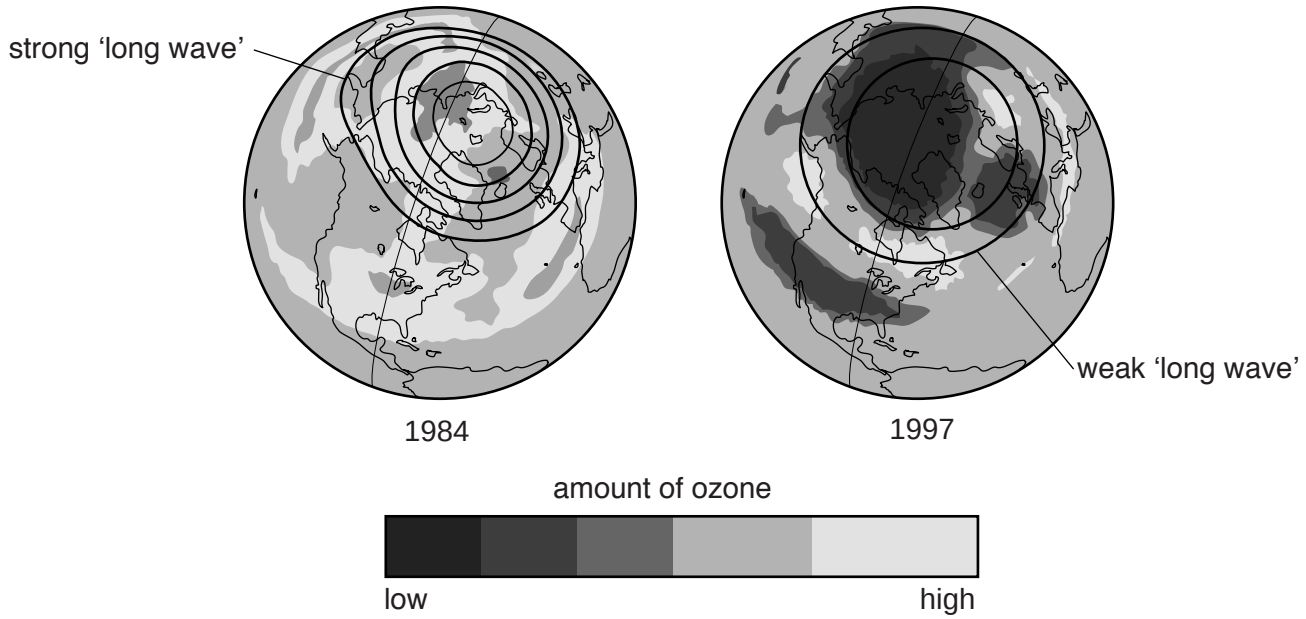
12 Scientists have measured the amount of ozone in the upper atmosphere.

They have also measured the strength of 'long waves'.

'Long waves' are bands of energy found in the upper atmosphere.

They help to keep the temperature of the upper atmosphere constant.

Here are the ozone and long wave measurements for the years 1984 and 1997.



(a) Scientists believe that the strength of the 'long waves' and the amount of ozone in the upper atmosphere are linked.

Use the information to explain why scientists think there is a link.

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

(b) Pollution from CFCs has changed the size of the hole in the ozone layer over Antarctica.

Describe how CFCs have increased the potential danger to human health.

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(c) In 2007 about 200 countries agreed to stop using CFCs completely by 2020.

(i) Why is an international agreement important?

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

(ii) Some other countries were given until 2030 to completely stop using CFCs.

Suggest why some countries have been given different time scales to stop using CFCs.

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

Question 13 begins on page 24

13 Microwaves and infrared radiation have different properties.

(a) Tick (✓) **two** correct statements about microwaves.

Microwaves penetrate about 10 cm into water. ☐

Microwaves can be absorbed by body tissue. ☐

Microwaves pass through glass but do **not** pass through plastic. ☐

The kinetic energy of water increases when it absorbs microwaves. ☐

Microwaves do **not** diffract at all. ☐

Microwave communication is **not** affected by poor weather conditions. ☐

[2]

(b) Tick (✓) **one** correct statement about infrared radiation.

Infrared radiation penetrates about 1 cm into food. ☐

Infrared radiation is refracted by shiny surfaces. ☐

Infrared radiation increases the kinetic energy of particles on the surface of food. ☐

The energy of infrared radiation **does not** depend on the frequency. ☐

[1]

(c) Infrared radiation can travel along an optical fibre.

Look at the table.

It shows some properties of materials **A**, **B**, **C** and **D**.

Material	Does total internal reflection happen?	Is Multiplexing possible?	Channel speed in bits per second
A	yes	yes	100×10^9
B	no	yes	171×10^9
C	yes	yes	146×10^9
D	no	no	273×10^9

The channel speed is the number of bits of information transferred per second.

Which material is the best for making optical fibres?

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

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Explain your answer.

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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.