OCR
Oxford Cambridge and RSA

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Wednesday 25 May 2016 – 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 *

* 1 2 4 4 3 8 6 5 0 9 *

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 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

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

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 Jim is a 14 year old boy who has Type 1 diabetes.

(a) Jim needs medical treatment to control his condition.

He injects insulin into his body.

Describe how insulin travels around the body.

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

(b) The more carbohydrate Jim eats, the more insulin he needs.

Explain why.

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.....

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

(c) Describe where and how carbohydrates are stored in the body.

.....

.....

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

(d) Jim thinks he inherited diabetes.

Inherited characteristics are controlled by genes.

Cystic fibrosis is another inherited disorder.

Cystic fibrosis is caused by a recessive allele.

Complete the table below to describe the phenotypes of different individuals.

Genotype	Phenotype
FF	
Ff	
ff	

[2]

[Total: 7]

2 This question is about alcohol.

(a) Explain why alcohol slows down transmission along nerve pathways.

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.....

.....

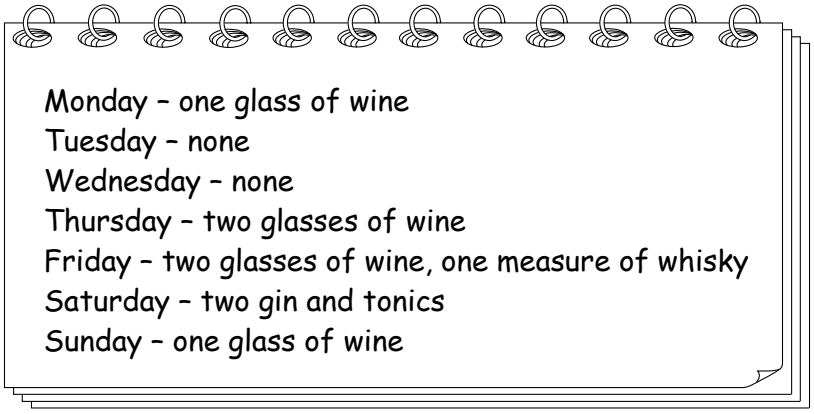
..... **[3]**

(b) Women are advised to drink no more than **14 units** of alcohol each week.

Look at the table.

Drink	Amount	Units of alcohol
beer	one pint	2.3
gin and tonic	one measure	1.0
cider	one pint	2.6
wine	one glass	3.0
whisky	one measure	1.0

Connie writes down all the alcoholic drink she has in one week.



Connie has drunk more than the advised amount.

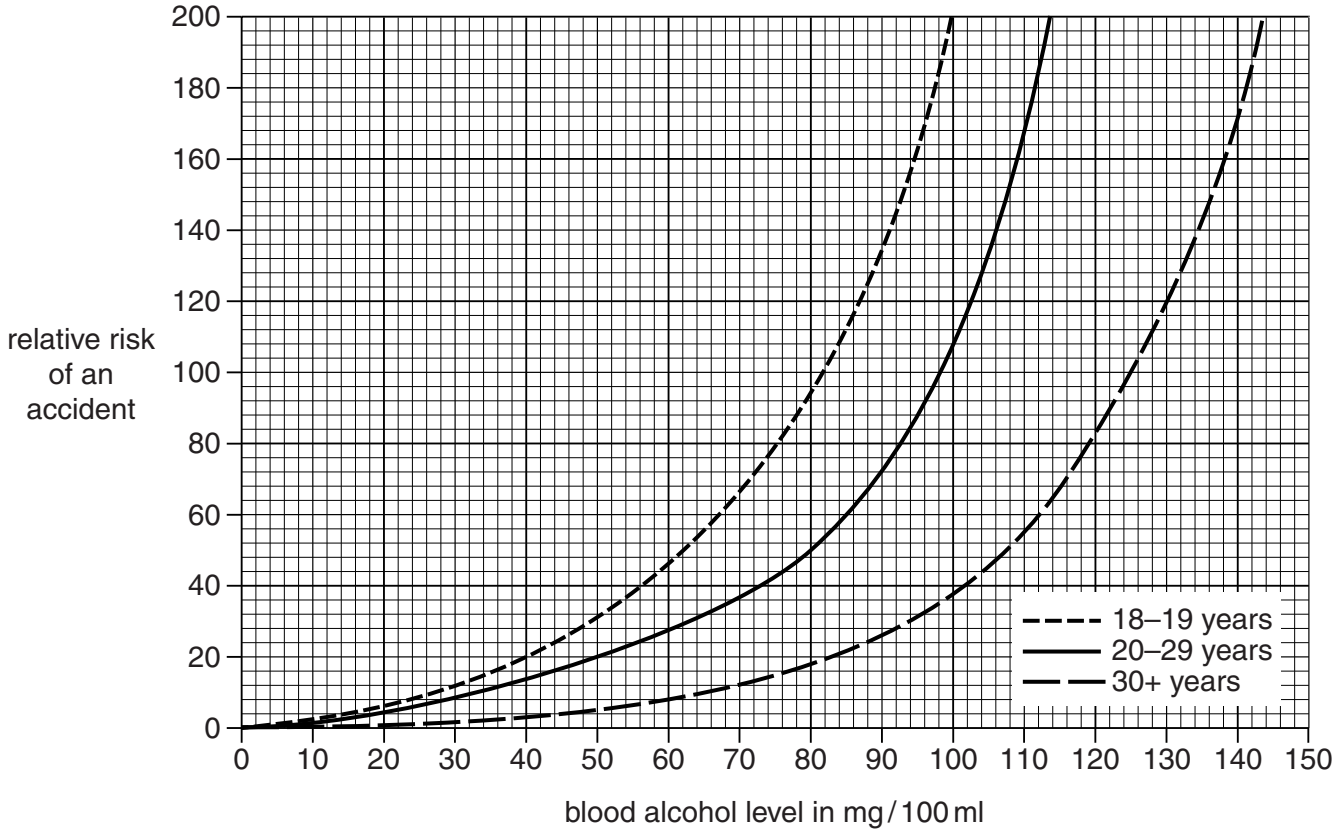
Calculate by how much she is over the advised amount.

answer ..... units **[2]**

(c) Connie is concerned about drinking alcohol.

She researches the effects of alcohol and finds this graph below.

It shows the relative risk of having an accident if you drink alcohol and drive.



Connie writes down some conclusions about the graph.

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

20–29 year olds reduce the relative risk of an accident by 30 if they have blood alcohol level of 50 mg / 100 ml instead of 80 mg / 100 ml. ☐

Only those aged 18–19 will have an accident with a blood alcohol level of 10 mg / 100 ml. ☐

People over 30 are 20 times better drivers than people in other age groups. ☐

People with a blood alcohol level of 150 mg / 100 ml are at least 200 times more likely to have an accident than people with no alcohol in their blood. ☐

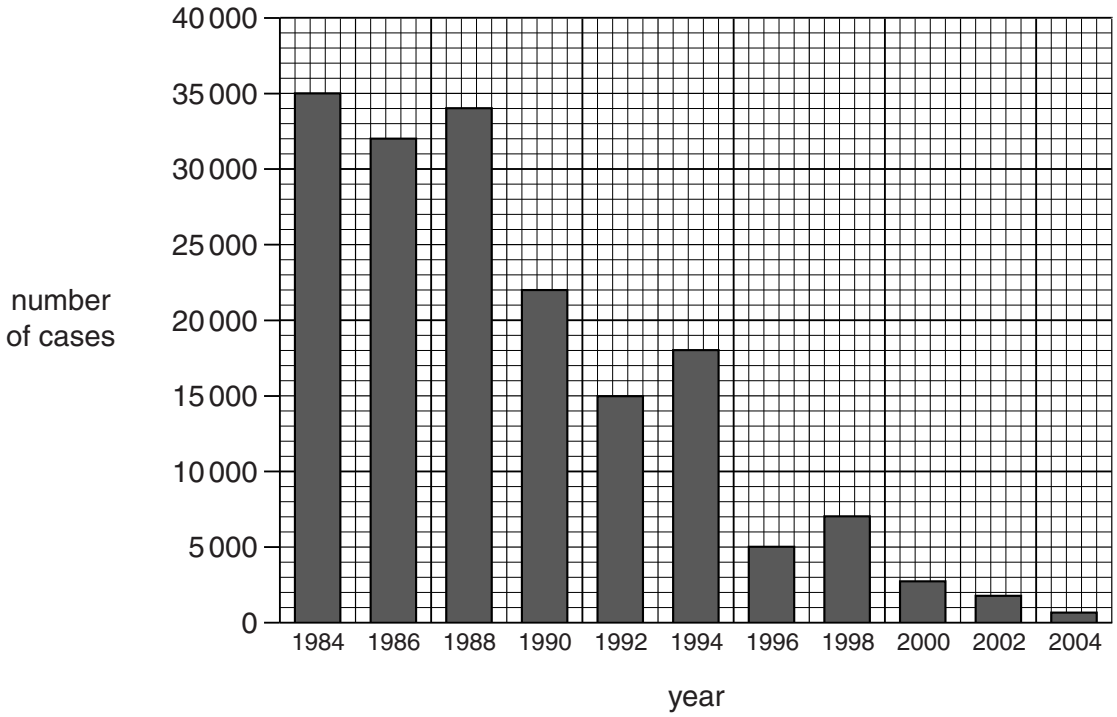
The lower the blood alcohol level the more likely you are to have an accident. ☐

[2]

[Total: 7]

3 Polio is an illness caused by a virus.
In 1988 a campaign started to rid the world of polio.
The campaign wanted to vaccinate children all over the world.

Look at the graph below. It shows the number of polio cases in the world from 1984 to 2004.



Explain how vaccinations work and use the data to conclude if the campaign was successful or not.

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

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

[Total: 6]

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Question 4 begins on page 8

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4 Benny is cooking his tea.

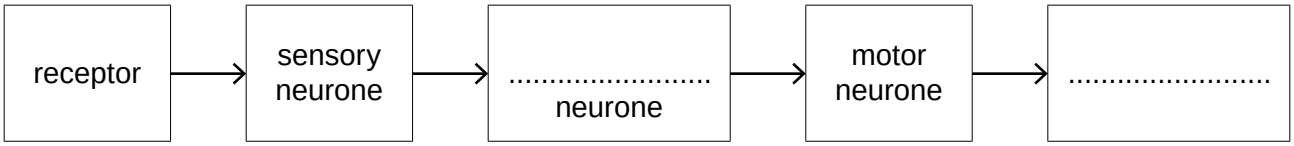
He lifts a hot plate of food.

The plate is too hot to hold.

Benny drops the plate.

(a) Benny's response to the hot plate is a reflex action.

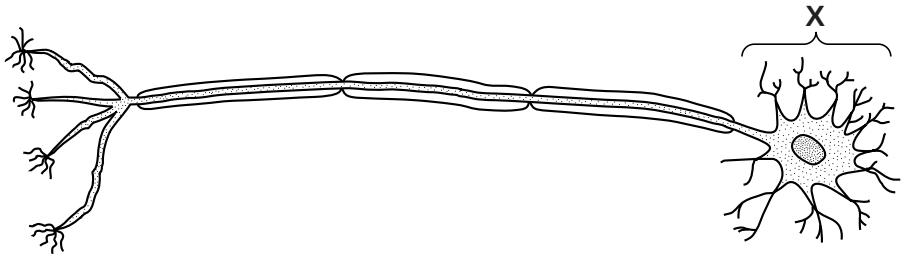
Finish the flow chart below to show the path taken by the impulse that causes the reflex.



[2]

(b) Motor neurones are part of Benny's nervous system.

Look at the diagram below of a motor neurone.

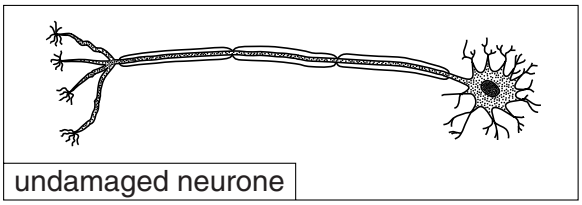


Write down the name of part **X**.

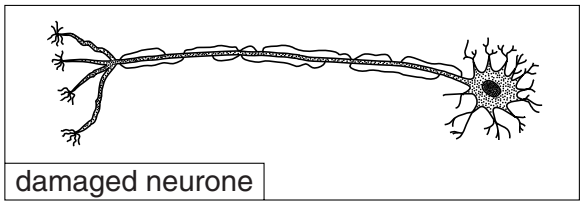
..... **[1]**

(c) Sometimes neurones can be damaged.

Look at the pictures of an undamaged and a damaged neurone.



undamaged neurone



damaged neurone

How would the damage affect the transmission of impulses?

Explain your answer.

.....

.....

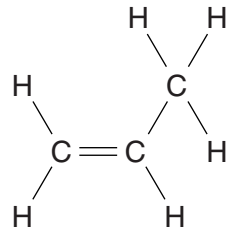
..... **[2]**

[Total: 5]

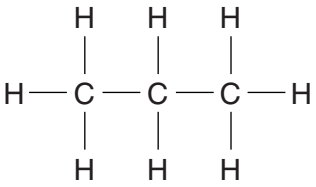
SECTION B – Module C1

5 This question is about carbon compounds.

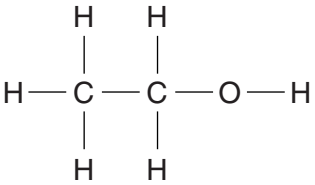
Look at the displayed formulas.



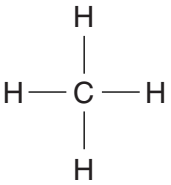
A



B



C



D

(a) Which compound is **not** a hydrocarbon?

Explain your answer.

.....

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

(b) What is the **molecular formula** of compound **C**?

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

(c) Compound **A** is an **unsaturated** compound.

Explain why.

.....

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

(d) Molecules of compound **A** can join together to make a polymer.

Draw the **displayed formula** of the polymer made.

[1]

[Total: 5]

Question 6 begins on page 12

6 This question is about crude oil.

Crude oil is a fossil fuel.

(a) Fossil fuels are **finite** resources and are **non-renewable**.

Explain what is meant by finite **and** non-renewable.

.....

.....

.....

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

(b) Crude oil is often transported in large ships called oil tankers.

This could cause **environmental problems**.

Explain **two** of these environmental problems.

.....

.....

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

(c) Crude oil is separated into useful fractions by fractional distillation.

Look at the table below. It shows information about some of the fractions separated from crude oil.

Fraction	Percentage supply in crude oil	Percentage demand from customers
LPG	2	4
petrol	15	27
diesel	14	21
paraffin	14	9
heating oil	14	14
fuel oil and bitumen	36	25

There is not enough petrol to meet the demand for it.

(i) Write down the names of **two** other fractions where the supply does not meet the demand from customers.

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

(ii) Explain how an oil refinery matches the supply of **petrol** with the demand for it.

Use information from the table above to help you.

.....

.....

.....

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

[Total: 7]

7 This question is about fuels.

(a) Butane, C_4H_{10}, burns in oxygen, O_2.

Carbon dioxide and water are made.

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

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

(b) Some carbon monoxide is made when petrol burns in a car engine.

A catalytic converter changes carbon monoxide into another gas.

What is the name of this gas?

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

(c) Look at the information about some fuels.

Fuel	State at room temperature	Availability	Energy released in kJ/g	Carbon dioxide released (0=low, 5=high)	Cost of 1 kg in £
coal	solid	good	33	3.7	0.3
methane	gas	good	56	2.8	1.3

Richard wants to use methane to heat a new factory.

Edward suggests using coal instead of methane.

Evaluate the advantages and disadvantages of these two fuels and suggest which would be the more sensible choice to heat the factory.

Use the information from the table to help you.

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

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

[Total: 9]

8 Helen has bought a new bottle of perfume.

(a) Draw a straight line to join each **property of Helen's perfume** to the most important **reason**.

Draw only **three** lines.

Property of Helen's perfume	Reason
	so the perfume cannot be washed off easily
insoluble in water	
	so Helen is not poisoned
does not react with water	
	so Helen can put the perfume directly onto her skin
non-irritant	
	so that the perfume does not react with perspiration

[2]

(b) Helen's friends are able to smell her perfume because it is **volatile** (evaporates easily).

Explain, using ideas about particles, why Helen's perfume evaporates easily.

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

[Total: 4]

SECTION C – Module P1

9 This question is about waves.

(a) Look at the list.

It shows waves from the electromagnetic spectrum.

infrared

radio

ultraviolet

visible

X-rays

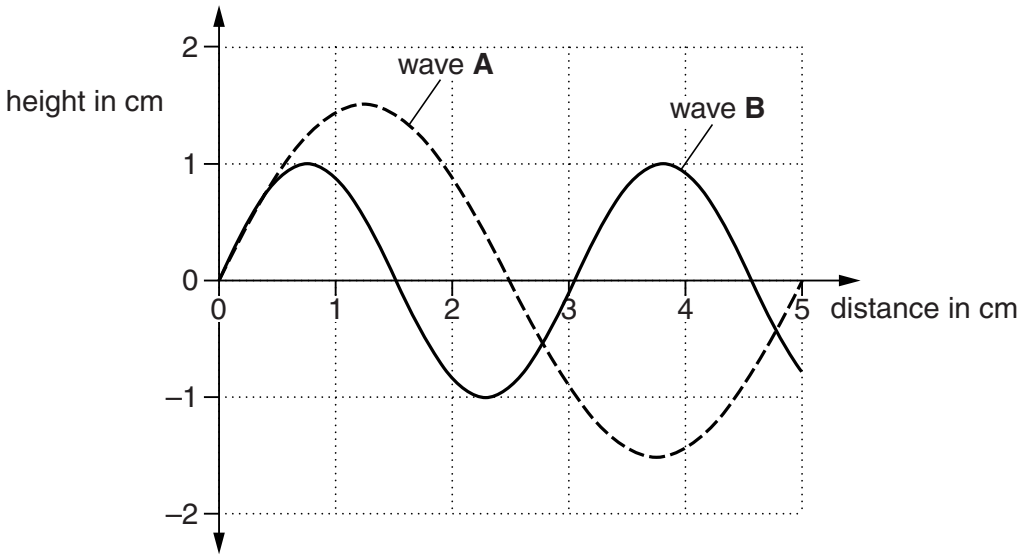
Complete the sentences using words from the list.

(i) The wave that is reflected by shiny surfaces and can heat the surface of food is

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

(ii) The wave with the greatest wavelength is ..... . **[1]**

(b) Look at the diagram below of two transverse waves.



What is the **difference** in wavelength between wave **A** and wave **B**?

.....

Difference in wavelength ..... cm **[1]**

Turn over for the remainder of question 9

(c) Mobile phones use microwave signals.

There is not much diffraction of microwave signals around large buildings.

This causes signal loss.

One way a mobile phone company can reduce the problem is to boost the signal.

Suggest **two** other ways a mobile phone company can reduce the problem of signal loss.

.....

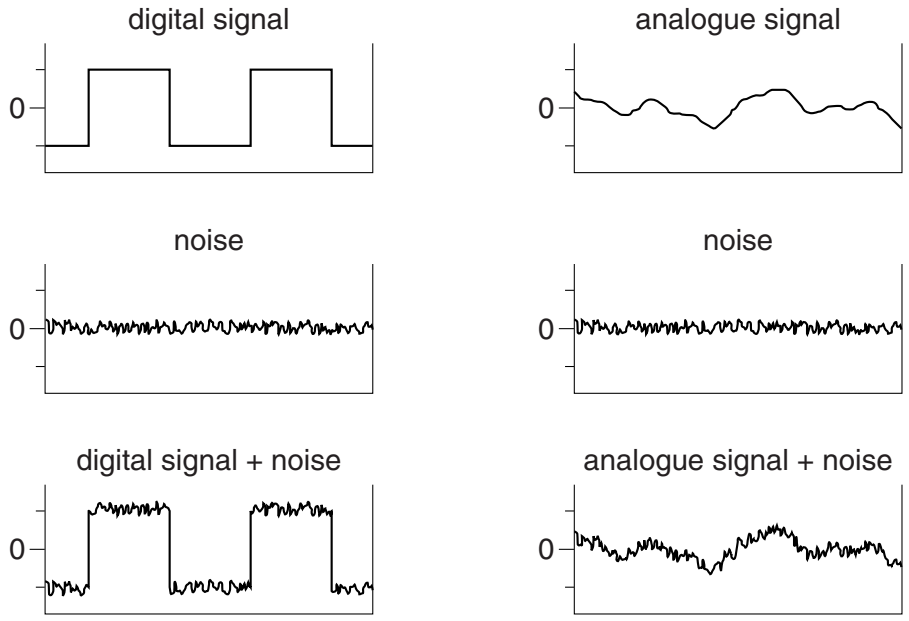
.....

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

[Total: 5]

10 This question is about digital and analogue signals.

Look at the information showing what happens to the signals when noise is added to them.



Use the diagrams to explain why it is easier to remove noise from digital signals and how the properties of digital signals played a part in the switching from analogue to digital TV broadcasts.

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

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

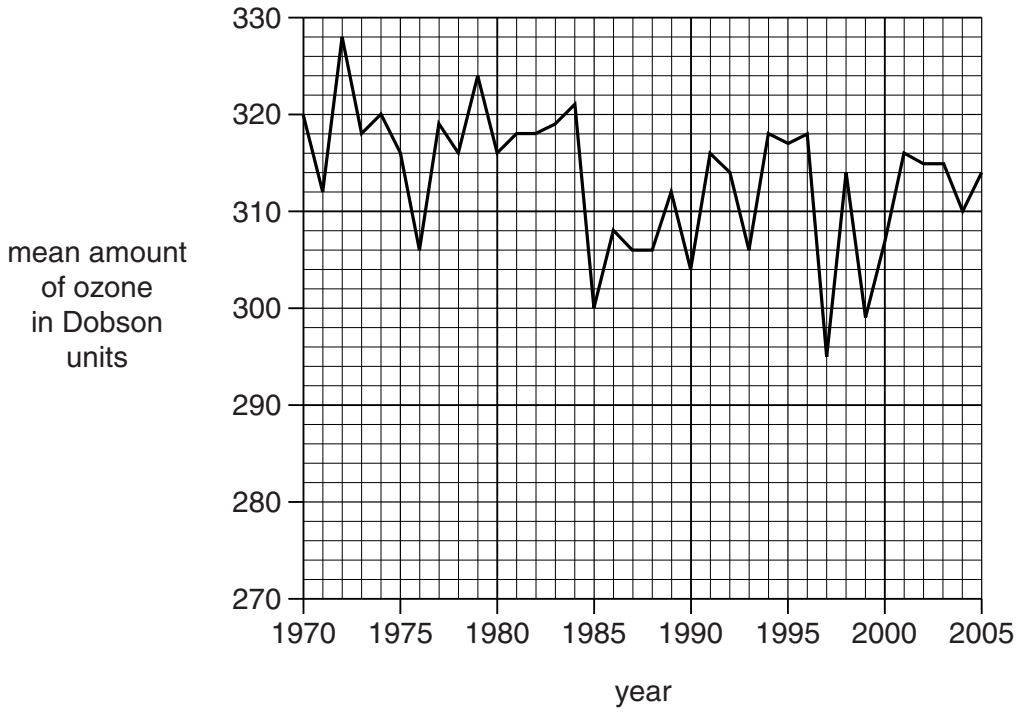
[Total: 6]

11 The condition of the ozone layer near the South Pole concerns scientists.

Scientists have been measuring the mean amount of ozone in the upper atmosphere.

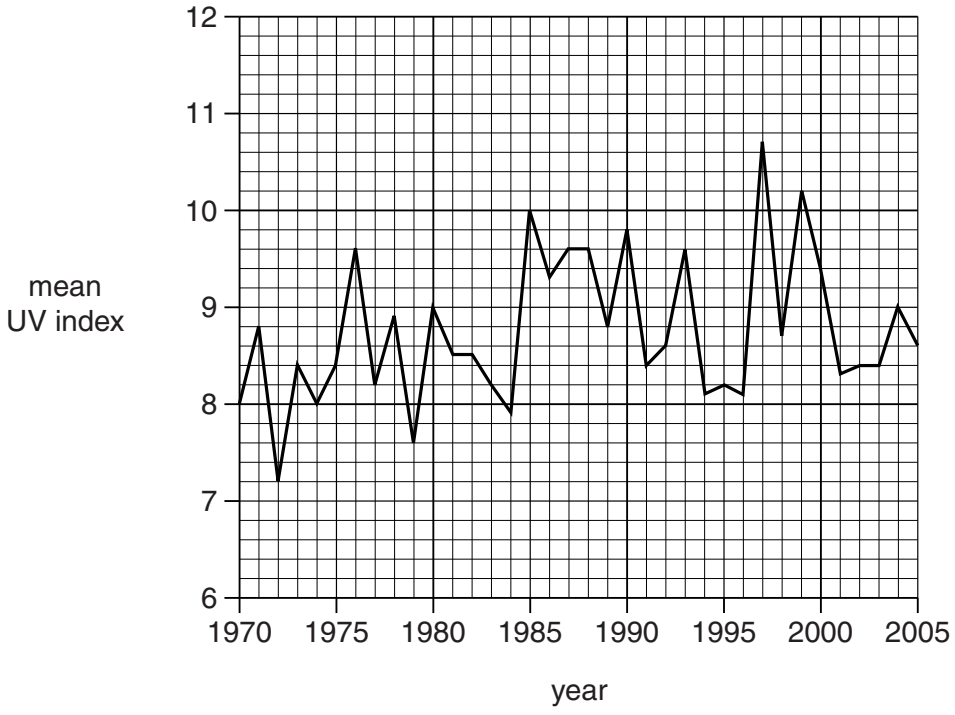
Look at their results from 1970 to 2005.

Graph 1



Scientists have also been measuring the mean ultraviolet (UV) index from 1970 to 2005.

Graph 2



(a) Look at **Graph 1**.

Scientists predicted that the amount of ozone in 1997 was the lowest they were likely to record.

Is this prediction correct?

.....

Explain your answer.

.....

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

(b) **(i)** Compare Graphs **1** and **2**.

Describe the relationship between the mean amount of ozone and mean UV index.

.....

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

(ii) Describe why it is important to maintain a high level of ozone in the Earth's upper atmosphere.

.....

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

(c) Describe why the reduction in the level of pollution from CFCs needed international agreement to benefit society.

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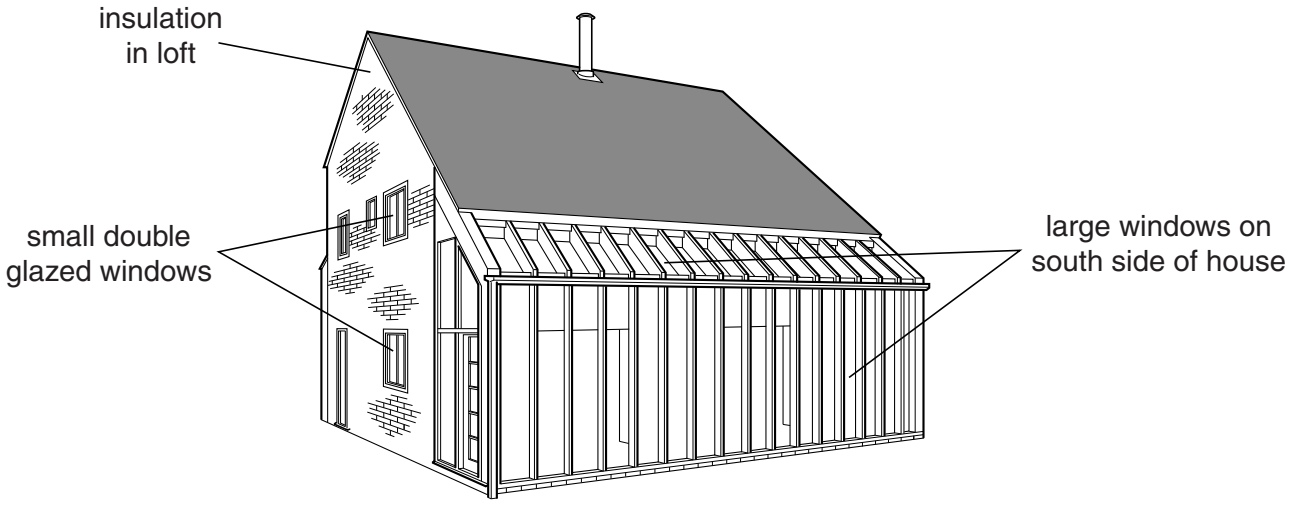
..... **[2]**

[Total: 5]

12 Lyndsay and Kevin buy a new house.



(a) Their house does **not** have cavity wall insulation but is more energy efficient than most houses.

Look at the picture.

Explain how **two** energy saving features of their house improve its energy efficiency.
Use ideas about energy transfer in your answer.

.....

.....

.....

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

(b) Here are three different ways to increase the energy efficiency of Lyndsay and Kevin's house.

How to increase energy efficiency	Cost to install in £	Saving on energy bills each year in £
Cavity wall insulation	1400	400
Low energy light bulbs for whole house	20	10
Thermostat for heating	35	100

(i) One of the ways to increase efficiency is to add cavity wall insulation to the house.

Lyndsay thinks this is a good idea because they will be living in the house for at least 5 years.

Use the information in the table above to show that Lyndsay is correct.

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

(ii) Kevin thinks the cost of cavity wall insulation is expensive.

He wants to spend £55 on low energy light bulbs and a thermostat.

Which will save more money after 5 years

- cavity wall insulation
- low energy light bulbs and a thermostat?

answer .....

Explain your answer.

.....

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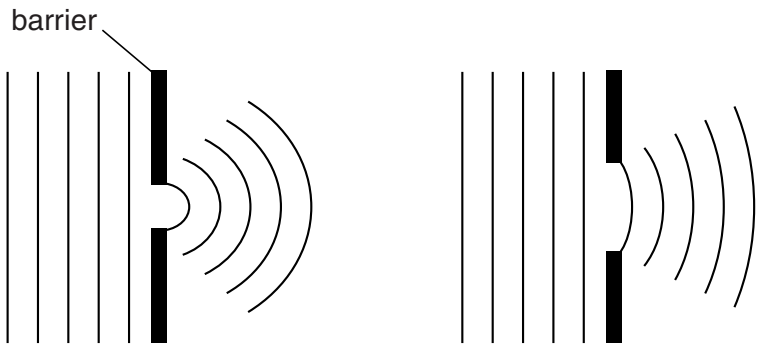
..... **[2]**

[Total: 6]

13 Diffraction patterns in water are made using a ripple tank.

Look at the two different diffraction patterns.



Diffraction pattern **A** Diffraction pattern **B**

Describe and explain the similarities and differences between these two diffraction patterns.

You may draw on the diffraction patterns and draw diagrams to help explain your answer.

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.....

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

[Total: 3]

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 margins.

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.