

Monday 10 June 2013 – 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
MODIFIED LANGUAGE



Candidate
forename

Candidate
surname

Centre number

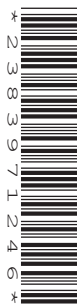
Candidate number

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

- Your 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

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

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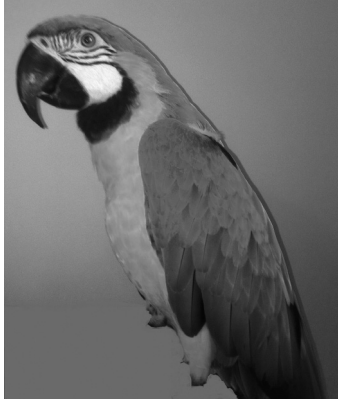
Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

SECTION A – Module B1

- 1** Look at the picture of a macaw.



- (a) (i)** There are 70 chromosomes in each **body** cell of a macaw.

Humans have 23 pairs of chromosomes in each body cell.

How many **pairs** of chromosomes are in a body cell of a macaw?

..... [1]

- (ii)** The macaw in the picture is male.

Sex is determined by sex chromosomes.

Write down the pair of sex chromosomes that are in each body cell of a **human male**.

..... [1]

- (b) In humans, like many animals, equal numbers of males and females are produced.

Explain how equal numbers of male and female offspring are produced.

Use a genetic diagram.

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..... [2]

- (c) The natural environment for a macaw is the top of trees in tropical rainforests.

The macaw has eyes on the sides of its head.

The position of the eyes makes it difficult to judge **distance**.

Explain why.

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..... [2]

[Total: 6]

(a) What does this hormone normally control in the body?

..... [1]

-
- fats, oils and sweets
- milk
- meat, meat substitutes and other proteins
- vegetables
- fruits
- breads, grains and other starches

The diabetic food pyramid is used as a guide for people with diabetes.



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

..... [6

- (c) Diabetes can affect the retina.

The retina is part of the eye.

Describe the job of the retina.

.....

.....

..... [2]

[Total: 9]

Question 3 begins on page 8

3 Look at the table.

It shows the number of cases and the number of deaths for four different types of cancer in the UK, in 2008.

Type of cancer	Number of cases		Number of deaths	
	Male	Female	Male	Female
colon	13 359	12 192	5 226	4 938
lung	22 846	17 960	19 863	15 393
stomach	4 923	2 687	3 186	1 992
thyroid	558	1 596	138	216

Use data from the table to answer the questions.

- (a) (i)** In this study, lung cancer is the most common cancer in both males and females.

The lifestyle of a person can greatly affect the chance of getting lung cancer.

What changes can someone make to their lifestyle to **reduce** the risk of lung cancer?

.....

 [2]

- (ii)** Calculate the ratio between cases and deaths for **thyroid** cancer in both males and females.

male cases to male deaths ratio

female cases to female deaths ratio [2]

- (iii)** Use your answer from **part (ii)** to explain whether males or females are more at risk of dying from thyroid cancer.

..... [1]

- (b) The treatment of cancer has been improved by the research of Sir Paul Nurse.

Read the article about his research.

Sir Paul Nurse is a scientist who investigated cell division in yeast.

In 1980, his research produced results that were not expected. He found that the increase in cell numbers happened because cell death was delayed. The increase was not because the cells divided more quickly.

For some time, he thought his experiment had mistakes in it. He did the experiment again but got the same results.

Cancer researchers used these results to help them develop completely new cancer treatments.

In 2001, Sir Paul Nurse received the Nobel Prize for his work.

Suggest reasons why this work has led to him receiving the Nobel Prize.

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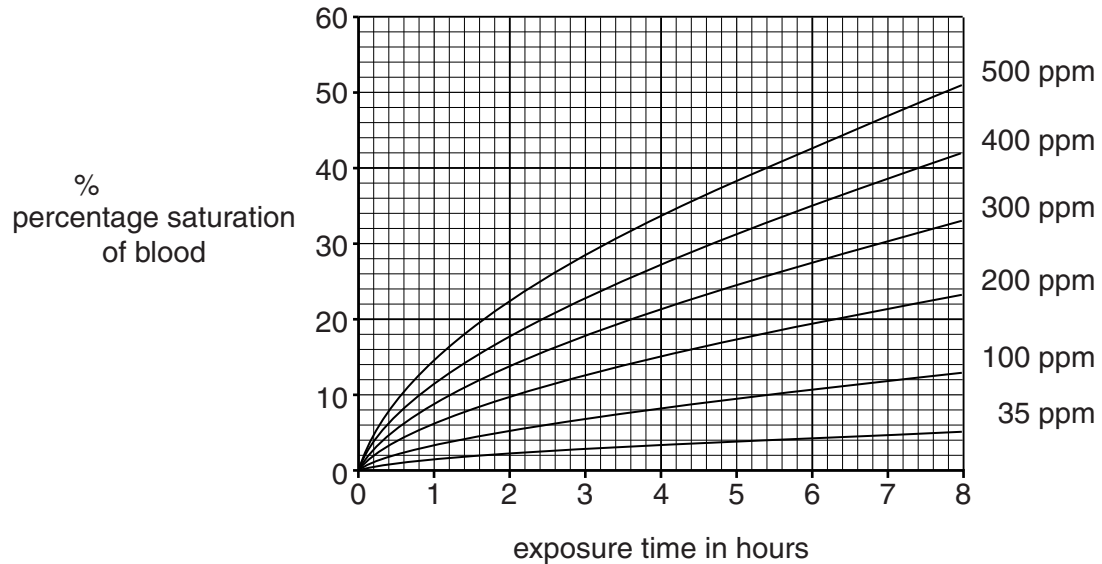
..... [2]

[Total: 7]

- 4 Carbon monoxide is a poisonous gas. It causes many deaths in the UK.

Look at the graph.

It shows the percentage saturation of blood during exposure to different levels of carbon monoxide (parts per million).



- (a) A person becomes unconscious at 40 per cent saturation of blood.

It takes longer to become unconscious at a carbon monoxide concentration of 400 ppm than 500 ppm. How much longer does it take?

..... [1]

- (b) An unconscious patient can be treated with oxygen.

The patient needs to breathe 100 per cent oxygen at high pressure.

Suggest how this treatment helps the body recover from carbon monoxide poisoning.

.....

 [2]

[Total: 3]

SECTION B – Module C1

- 5 Crude oil is a mixture of hydrocarbons.

Crude oil is separated into fractions in an oil refinery.

Look at the table. It shows information about some of the fractions.

Fraction	Number of carbon atoms per molecule	Boiling point in °C	Percentage in crude oil (the supply)	Percentage needed by the oil refinery (the demand)
Liquefied Petroleum Gases (LPG)	1 – 4	less than 30	4	11
Petrol	5 – 9	30 – 65	11	32
Naphtha	6 – 12	65 – 180	22	4
Paraffin	10 – 14	160 – 250	12	20
Diesel	13 – 20	250 – 340	18	15
Bitumen	Over 20	more than 340	23	4

- (a) An alkane has the molecular formula $C_{11}H_{24}$.

Estimate the boiling point of this alkane.

..... [1]

- (b) The petrol fraction has a lower boiling point than the diesel fraction.

Explain why.

..... [2]

- (c) **Cracking** helps an oil refinery to match the **supply** of certain fractions with the **demand** for them.

Use information from the table to explain how.

..... [2]

[Total: 5]

Turn over

- 6 The air may contain different pollutants.

Look at the table.

It shows the relative concentration of pollutants found in the air in two places in the world.

Pollutant	Relative concentration in the air	
	in a city centre	near a volcano
carbon monoxide	0.3	0.01
hydrogen sulfide	0.01	210
oxides of nitrogen	1.5	0.1
sulfur dioxide	200	1500
trichlorofluoromethane	0.01	0.005

- (a) Some scientists think that volcanic eruptions cause acid rain.

What evidence is there in the table of data to support this idea?

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..... [2]

- (b) Nitrogen monoxide, NO, reacts with oxygen, O₂.

Nitrogen dioxide, NO₂, is made.

Write down the **balanced symbol** equation for this reaction.

..... [2]

[Total: 4]

- 7 Butane, C_4H_{10} , is a hydrocarbon.

Butane is used as a fuel in a camping stove.



Butane burns in oxygen, O_2 , from the air.

Both **complete** combustion and **incomplete** combustion can happen when butane burns.

Explain the advantages of complete combustion compared to incomplete combustion of butane. Use **balanced symbol** equations in your answer to help you.



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

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..... [6]

[Total: 6]

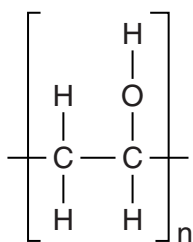
8 Chemists are developing new types of polymers that are:

- biodegradable
- soluble in water.

(a) Explain why chemists are developing these new types of polymers.

.....
 [1]

(b) Look at the displayed formula of a polymer that is soluble in water.



This polymer is **not** a hydrocarbon.

Explain why.

.....
 [1]

(c) These chemists publish their results using books, the internet and conferences.

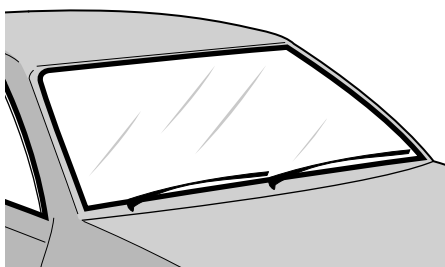
Why is it important that these chemists publish their results?

.....

 [2]

(d) Look at the table. It shows the properties of some polymers.

Polymer	Colour	Strength (1 = Weak, 10 = Strong)	Hardness (1 = Soft, 10 = Hard)	Biodegradable	Density (1 = Low, 10 = High)
A	white	10	10	yes	8
B	black	3	1	no	1
C	colourless	8	9	no	10
D	colourless	7	1	no	3
E	colourless	8	9	yes	1



Polymer **C** is used to make the windscreen of this car.

Explain why.

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..... [2]

[Total: 6]

- 9 Potato salad is a mixture of cooked potatoes and mayonnaise.

The mayonnaise contains an emulsifier to help stop oil and water from separating.

- (a) Explain, using a labelled diagram, how an emulsifier helps to stop oil and water from separating.

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..... [2]

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

Explain why.

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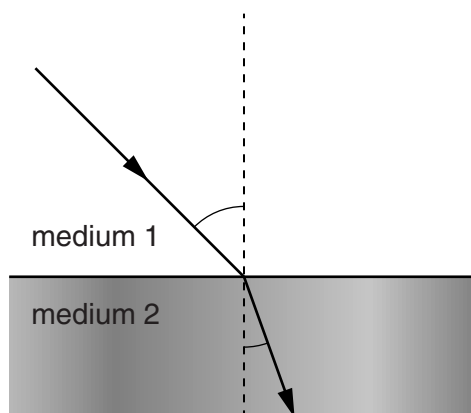
..... [2]

[Total: 4]

SECTION C – Module P1

10 This question is about light.

(a) (i) The diagram shows light being refracted from medium 1 to medium 2.



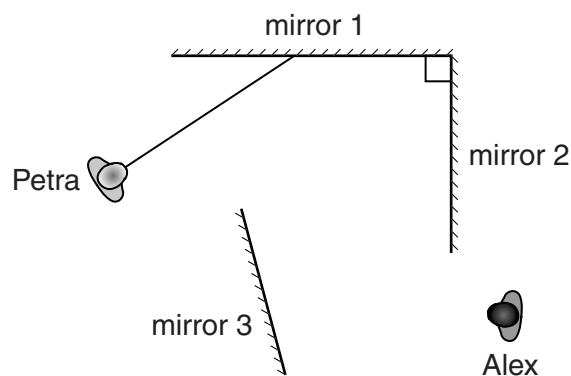
Why does **refraction** happen?

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 [1]

(ii) Alex and Petra are at a fairground.

They visit the Hall of Mirrors.

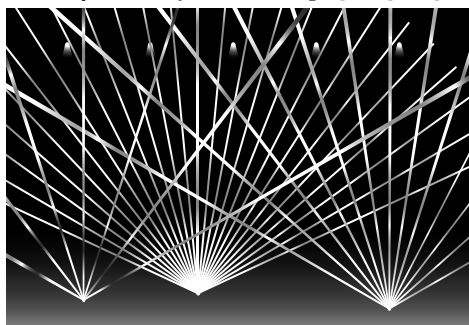
Complete the ray diagram to show how Alex and Petra can see each other.



[1]

(b) Light can be made by lasers.

Look at the picture of a laser light show.



Laser light shows use lasers with intense coherent beams.

Explain what is meant by an **intense coherent** laser beam.

.....

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..... [2]

(c) Morse code can be used for communication.

Look at the table showing part of the Morse code.

A	·—	1	·— — — —
B	—···	2	·· — — —
C	— · — ·	3	··· — —
D	— · ·	4	··· —
E	·	5	····
F	·· — ·	6	— ···

Morse code can be sent by light.

(i) In the past, coded light signals were used to send messages over **long** distances.

Explain how this was done.

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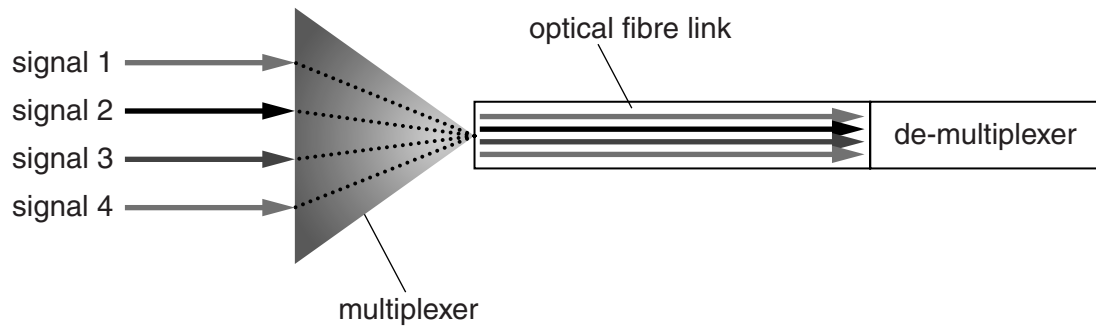
..... [2]

- (ii) Coded signals can also be sent using electrical pulses.

Explain **one advantage** of using light signals rather than electrical pulses in modern cable communication systems.

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 [1]

- (d) Light signals can be transmitted using an optical fibre link.

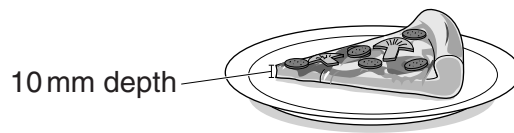


Describe the job of the **de-multiplexer**.

.....
 [1]

[Total: 8]

- 11 Gino wants to heat a thin slice of pizza.

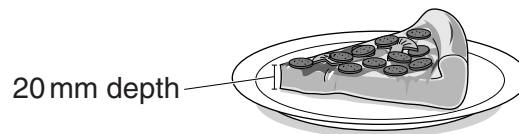


thin pizza slice

Look at the information about the two different methods of heating the **thin** pizza slice.

Method of heating	How a pizza slice is heated	Distance waves can penetrate into a pizza slice in mm	Time to heat the thin pizza slice in minutes
oven using infrared waves	heats the top surface of the pizza	<1	5
oven using microwaves	heats water and fat in the pizza	>7	1.5

Gino also wants to heat a thicker slice of pizza.



thick pizza slice

The **thick** pizza contains a greater percentage (%) of **water and fat**.

Estimate how long it would take to heat the **thick** pizza slice using each of the two different methods of heating.

Use your knowledge and understanding about energy transfer, and the information in the table, to explain your answers.



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

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..... [6]

[Total: 6]

12 Kathy and Jonathan collect information about different electromagnetic waves.

Type of electromagnetic wave	Wave speed in m/s	Wavelength in m
microwave	3×10^8	2×10^{-2}
radio	3×10^8	2
X-ray	3×10^8	2×10^{-9}
infrared	3×10^8	2×10^{-5}

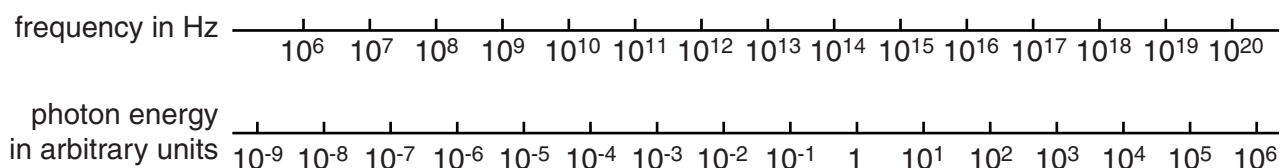
(a) Use the information in the table to calculate the **frequency** of the **microwave**.

.....

frequency = Hz [3]

(b) The energy of electromagnetic waves is carried by photons.

The chart shows information about frequency and photon energy.



(i) Use the chart to describe the relationship between frequency and energy.

.....
 [1]

(ii) Infrared waves can have different wavelengths.

Infrared radiation from source **A** has a wavelength of 1×10^{-5} m.

Infrared radiation from source **B** has a wavelength of 1×10^{-6} m.

Compare the energy **and** possible dangers to humans of the radiation from sources **A** and **B**.

.....

 [2]

[Total: 6]

13 Some waves can be harmful to humans.

(a) (i) Noah's skin is naturally **darker** than Aiden's skin.



Noah



Aiden

Noah thinks his darker skin may reduce his skin cancer risk from ultraviolet waves.

Is he correct?

.....

Explain why.

.....

.....

..... [1]

- (ii) Sunscreens can reduce the risk of sunburn.

A scientist collects evidence about a new sunscreen.

The scientist carries out four tests.

Test	Time taken for skin to burn in minutes	
	Without sunscreen	With the new sunscreen
A	30	70
B	40	90
C	10	15
D	20	50

The scientist **cannot** conclude that the sunscreen **more than** doubles the time you can safely stay in the sun.

Identify the conflicting evidence and suggest how the confidence of the conclusion could be increased.

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..... [2]

- (b) The ozone layer protects the Earth from ultraviolet radiation.

Environmental pollution from CFCs has reduced the ozone layer.

Explain why people are concerned about this.

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..... [2]

[Total: 5]

END OF QUESTION PAPER

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The Periodic Table of the Elements

28

1	2	3					4	5	6	7	0
<div>1<div>Hhydrogen</div>1</div>											
<div>Key</div>											
<div>relative atomic mass atomic symbol name atomic (proton) number</div>											
7 <div>Li lithium 3</div>	9 <div>Be beryllium 4</div>										
23 <div>Na sodium 11</div>	24 <div>Mg magnesium 12</div>										
39 <div>K potassium 19</div>	40 <div>Ca calcium 20</div>	45 <div>Sc scandium 21</div>	48 <div>Ti titanium 22</div>	51 <div>V vanadium 23</div>	52 <div>Cr chromium 24</div>	55 <div>Mn manganese 25</div>	56 <div>Fe iron 26</div>	59 <div>Co cobalt 27</div>	59 <div>Ni nickel 28</div>	63.5 <div>Cu copper 29</div>	65 <div>Zn zinc 30</div>
85 <div>Rb rubidium 37</div>	88 <div>Sr strontium 38</div>	89 <div>Y yttrium 39</div>	91 <div>Zr zirconium 40</div>	93 <div>Nb niobium 41</div>	96 <div>Mo molybdenum 42</div>	[98] <div>Tc technetium 43</div>	101 <div>Ru ruthenium 44</div>	103 <div>Rh rhodium 45</div>	106 <div>Pd palladium 46</div>	108 <div>Ag silver 47</div>	112 <div>Cd cadmium 48</div>
133 <div>Cs caesium 55</div>	137 <div>Ba barium 56</div>	139 <div>La* lanthanum 57</div>	178 <div>Hf hafnium 72</div>	181 <div>Ta tantalum 73</div>	184 <div>W tungsten 74</div>	186 <div>Re rhenium 75</div>	190 <div>Os osmium 76</div>	192 <div>Ir iridium 77</div>	195 <div>Pt platinum 78</div>	197 <div>Au gold 79</div>	201 <div>Hg mercury 80</div>
[223] <div>Fr francium 87</div>	[226] <div>Ra radium 88</div>	[227] <div>Ac* actinium 89</div>	[261] <div>Rf rutherfordium 104</div>	[262] <div>Db dubnium 105</div>	[266] <div>Sg seaborgium 106</div>	[264] <div>Bh bohrium 107</div>	[277] <div>Hs hassium 108</div>	[268] <div>Mt meitnerium 109</div>	[271] <div>Ds darmstadtium 110</div>	[272] <div>Rg roentgenium 111</div>	
Elements with atomic numbers 112-116 have been reported but not fully authenticated											