

Monday 10 June 2013 – Afternoon

**GCSE GATEWAY SCIENCE
SCIENCE B**

B711/01 Science modules B1, C1, P1 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

Duration: 1 hour 15 minutes

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)



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. 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 **24** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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

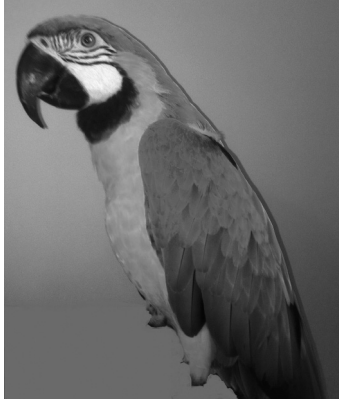
$$mgh = \frac{1}{2}mv^2$$

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

Answer **all** the questions.

SECTION A – Module B1

1 Look at the picture of a macaw.



There are 70 chromosomes in each body cell of a macaw.

(a) How many chromosomes are in a **sperm** cell of a macaw?

..... [1]

(b) Macaws can be bred in captivity.

There are **no visible differences** that identify male and female macaws.

Breeders often test the DNA of their macaws before they use them for breeding.

Suggest why they are tested.

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

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

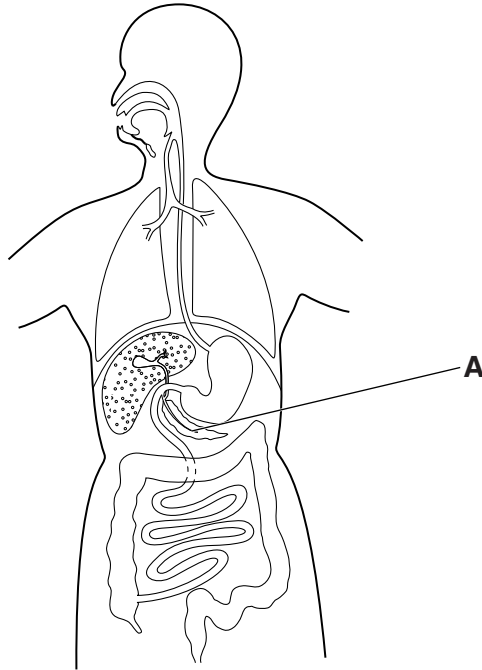
Explain why the position of the eyes on the head of a macaw would be an advantage in its natural environment.

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

[Total: 5]

2 This question is about diabetes.

(a) Look at the diagram.



What is the name of part **A**?

Choose your answer from the list.

liver

lung

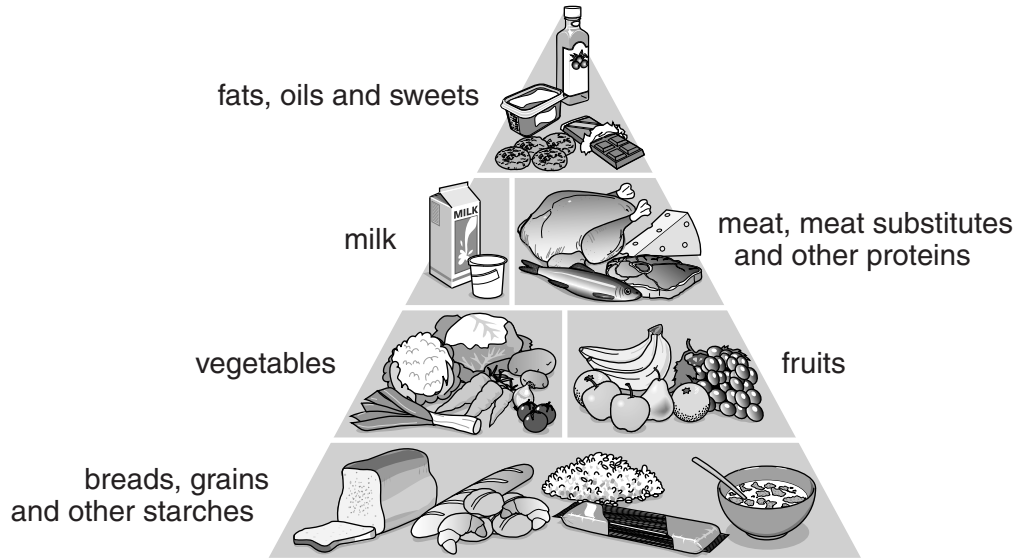
oesophagus

pancreas

stomach

answer [1]

- (b) Look at the picture of the diabetic food pyramid. It is a guide to the amounts of different types of food that people with diabetes should eat.



There are two forms of diabetes known as Type 1 and Type 2.

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

Explain what causes diabetes and why using this food guide can help with its control.



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

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[6]

(c) Diabetes can affect the retina.

The retina is part of the eye.

Describe the job of the retina.

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..... [2]

[Total: 9]

3 Alex is a marathon runner preparing for a race.

Diet specialists recommend that he uses a **high energy** diet during the month before his race.



(a) Look at the diets.

Diet A	
food group	%
carbohydrate	60
protein	20
fat	10
fibre	10

Diet B	
food group	%
carbohydrate	70
protein	15
fat	10
fibre	5

Diet C	
food group	%
carbohydrate	65
protein	15
fat	10
fibre	10

Which diet should Alex use during the month before his race?

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

diet [1]

(b) Alex can improve his fitness by training.

A person's maximum heart rate in beats per minute, can be calculated by subtracting their age from 220.

Alex is 26 years old.

(i) What is Alex's maximum heart rate?

.....beats per minute [1]

(ii) During training Alex's heart rate varies between 126 and 146 beats per minute.

126 beats per minute is 65% of his maximum heart rate.

Calculate what percentage 146 beats per minute is of his maximum heart rate.

answer % [2]

(iii) During training, Alex should keep his heart rate between 70% and 80% of his maximum heart rate. This will improve his fitness.

Use your answer from **part (ii)** to evaluate whether Alex's training will improve his fitness.

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

[Total: 6]

4 Nicola is a pharmacist.

She is asked to recommend a treatment for a disease called athlete's foot.

Athlete's foot causes skin to crack and flake.

Nicola advises that there are two drug treatments, but one of them needs a prescription.

(a) What type of pathogen causes athlete's foot?

..... [1]

(b) Explain why some drugs need a prescription.

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

(c) It is important to repair the damaged skin as quickly as possible.

One reason is to reduce the pain and discomfort.

Suggest and explain **one other** reason.

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

[Total: 5]

SECTION B – Module C1

5 Many foods contain food additives.

(a) Draw **four** straight lines to match the type of **food additive** with its **job**.

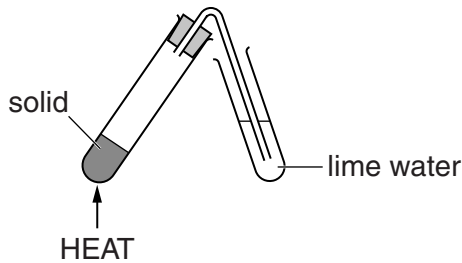
food additive	job
antioxidant	improves the colour of a food
emulsifier	makes a food taste better
flavour enhancer	stops foods reacting with oxygen
food colour	helps to stop oil and water separating in a food

[2]

(b) Baking powder helps to make a cake rise when it is baked in an oven.

Oscar heats a sample of baking powder for five minutes.

Look at the apparatus he uses.



The baking powder does not change colour while it is heated.

Oscar sees bubbles in the lime water.

The lime water turns milky during the heating.

How can you tell that heating baking powder is a chemical change?

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..... [2]

[Total: 4]

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.

Pollutant	Molecular formula	Relative concentration in the air	
		in a city centre	near a volcano
carbon monoxide	CO	0.3	0.01
hydrogen sulfide	H ₂ S	0.01	210
nitrogen dioxide	NO ₂	1.5	0.1
sulfur dioxide	SO ₂	200	1500
trichlorofluoromethane	CFC ₁₃	0.01	0.005

(a) Write down the names of **two** of the pollutants that have molecules with only **three** atoms.

..... and [1]

(b) The concentration of air pollutants in a city centre is different from that near a volcano.

(i) There is a **higher** concentration of carbon monoxide in a city centre than near a volcano. Suggest why.

..... [1]

(ii) Describe **two other** differences in the concentrations of air pollutants.

.....

 [2]

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

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

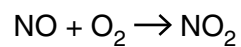
.....

 [2]

(d) Nitrogen monoxide, NO, reacts with oxygen, O₂.

Nitrogen dioxide, NO₂, is made.

Look at the symbol equation for this reaction. It is not balanced.



Construct the **balanced symbol** equation for this reaction.

..... [1]

[Total: 7]

Question 7 begins on page 12

7 Butane, C₄H₁₀, is a hydrocarbon.

Butane is used as a fuel in a camping stove.



Butane burns in oxygen from the air.

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

Describe, with the help of **word** equations, the complete and incomplete combustion of butane.



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 polymers that are

- biodegradable
- soluble in water.

(a) Suggest **advantages** of polymers that are biodegradable.

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

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

Why is it important that these chemists publish their results?

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

(c) Polymers are large molecules made from many small molecules called monomers.

A polymer is made from the monomer chloroethene.

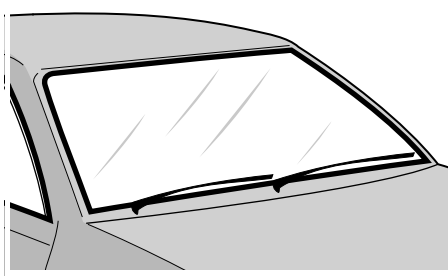
What is the name of this polymer?

..... [1]

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

Polymer	Colour	Hardness (1 = Soft, 10 = Hard)	Biodegradable
A	white	10	yes
B	black	1	no
C	colourless	9	no
D	colourless	1	yes

The windscreen of a car is made from a polymer.



Which polymer is best to use for a car windscreen?

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

polymer [1]

[Total: 6]

9 Stowmarket Synthetics make a perfume.



The perfume must have certain properties.

One of these properties is that the perfume should not dissolve in water.

Write about some of the **other** properties that a perfume must have.

.....

.....

.....

..... [2]

[Total: 2]

SECTION C – Module P1

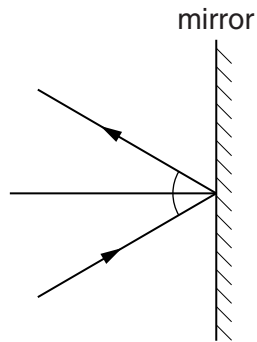
10 This question is about light.

(a) (i) Light can change direction when it passes from one medium into another.

What is the **name** of this effect?

..... [1]

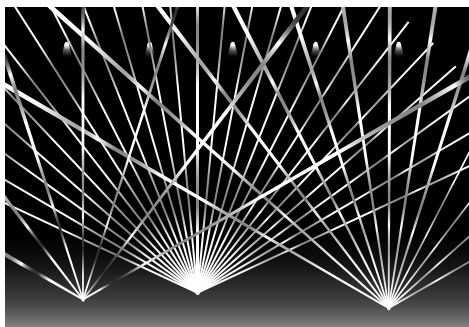
(ii) What is happening to the ray of light in this diagram?



..... [1]

(b) Light can be produced by lasers.

Look at the picture of a laser light show.



Each laser produces a narrow beam of light of a single colour.

Describe how the properties of light produced by lasers allows them to be used for laser light shows.

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

(c) In the past, Morse code was 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	—····

(i) Morse code is a **digital** code.

Describe how **light** is used to send a Morse code message.

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..... [2]

(ii) Morse code can be sent by using light signals through the air.

It can also be sent using electricity in wires.

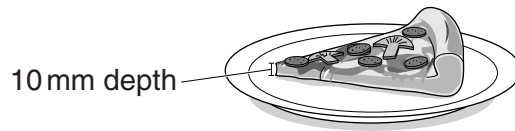
Give **one advantage** of using light rather than using electricity.

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..... [1]

[Total: 7]

11 Gino wants to heat a thin slice of pizza.

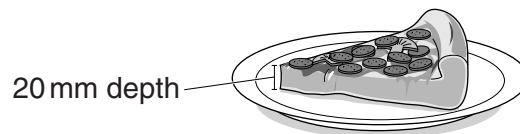


thin pizza slice

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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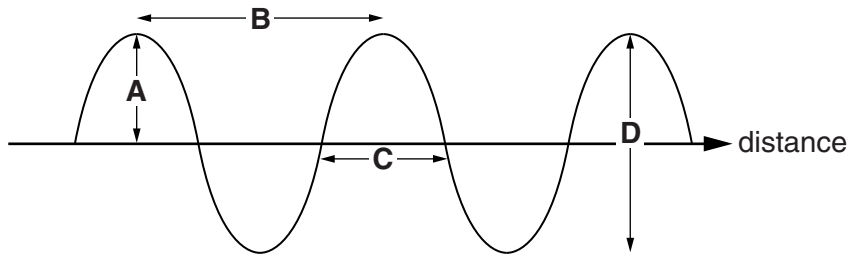
.....

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..... [6]
[Total: 6]

12 This question is about waves.

(a) Look at the diagram of a transverse wave.

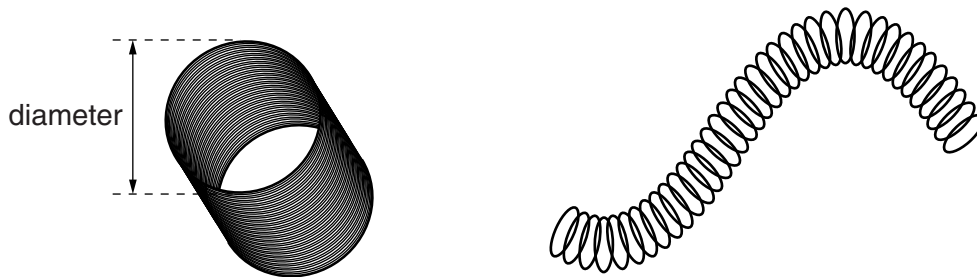


Complete the sentence.

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

The wavelength is represented by letter [1]

(b) Kathy and Jonathan use springs to make transverse waves.



They collect data about springs with different diameters.

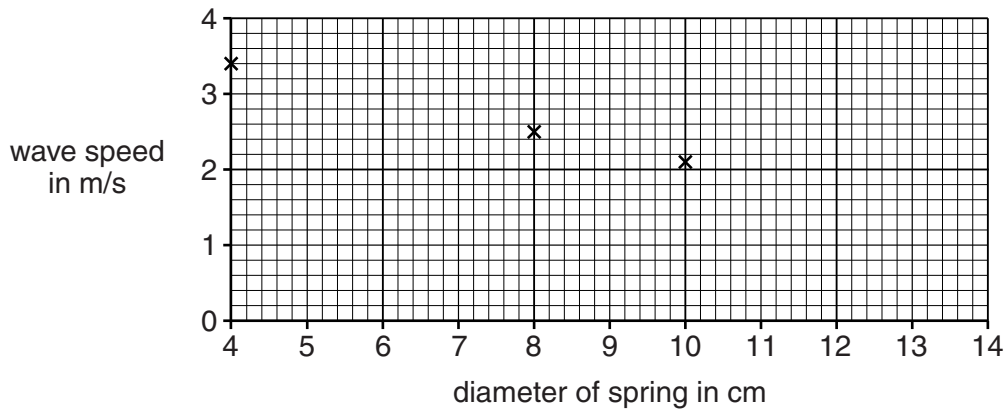
Diameter of spring in cm	Wavelength in m	Frequency in Hz	Wave speed in m/s
4	1.68	2.0	3.36
6	1.42	2.0
8	1.26	2.0	2.52
10	1.05	2.0	2.10

Calculate the **wave speed** of the spring with a diameter of 6 cm.

.....

wave speed = m/s [2]

(c) Kathy plots a graph using the data.



Using the graph:

(i) Look at the wave speed you calculated in part (b).
 Plot the wave speed for a **6 cm** diameter spring using the letter **X**. [1]

(ii) Describe the relationship between the diameter of the spring and the wave speed.

 [1]

(iii) Find the **wave speed** of a spring with a diameter of 12 cm.
 wave speed = m/s [1]

[Total: 6]

13 Some waves are harmful to humans.

(a) The Sun emits harmful electromagnetic waves.

What type of electromagnetic waves causes sunburn?

Choose your answer from the list.

radio

ultraviolet

visible light

X-ray

answer [1]

(b) 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	90
B	40	120
C	10	30
D	20	60

The scientist makes the conclusion that the new sunscreen works.

Explain how the conclusion is based on the scientific evidence in the table.

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

(c) Earthquakes produce shock waves.

These shock waves can cause a tsunami.

Describe how earthquakes are **detected** and **recorded** and how this information can be **used** to reduce harm to humans from a tsunami.

.....

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..... [3]

[Total: 6]

END OF QUESTION PAPER



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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
	23 Al aluminum 13	24 Mg magnesium 12	27 Al aluminum 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	56 Fe iron 26	59 Co cobalt 27	63.5 Cu copper 29
	85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	101 Ru ruthenium 44	106 Pd palladium 46	112 Cd cadmium 48
	133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	190 Os osmium 76	195 Pt platinum 78	201 Hg mercury 80
	[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[277] Hs hassium 108	[271] Ds darmstadtium 110	[272] Rg roentgenium 111
								Elements with atomic numbers 112-116 have been reported but not fully authenticated
								[222] Rn radon 86

1
H
hydrogen
1

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.