

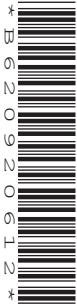
Tuesday 12 June 2012 – Morning**GCSE GATEWAY SCIENCE
SCIENCE B****B621/02** Unit 1 Modules B1 C1 P1 (Higher Tier)

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

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 number of marks is given in brackets [] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

2

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{fuel energy input} = \text{waste energy output} + \text{electrical energy output}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{energy (kilowatt hours)} = \text{power (kW)} \times \text{time (h)}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

3

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Question 1 begins on page 4.

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4

Answer **all** the questions.**Section A – Module B1**

- 1** Mary, Tom and Peter are investigating reaction times.

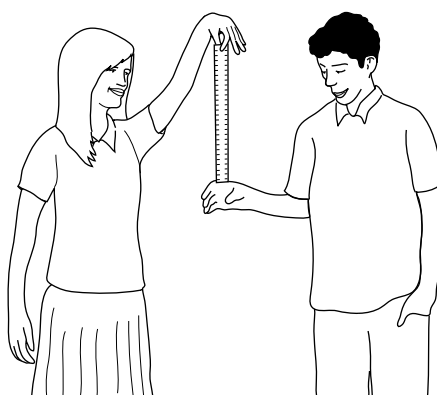
Mary holds a ruler so the 0 cm mark is level with the top of Tom's hand.

Mary lets go of the ruler and Tom catches it as quickly as he can.

Mary writes down the number on the ruler showing above Tom's hand.

She tests Tom four more times. Then Peter and Mary are tested.

They are short of time, so Peter and Mary are only tested four times.



The table shows their results.

The shorter the drop distance, the faster the reaction.

	drop distance in cm				
pupil	1 st attempt	2 nd attempt	3 rd attempt	4 th attempt	5 th attempt
Tom	4	17	12	6	11
Peter	13	3	14	2	no result
Mary	6	7	18	5	no result

- (a)** Who has the shortest average drop distance?

Use calculations to work out your answer. Show your working.

.....

answer

[3]

5

(b) When catching the ruler, what is the **effector**?

..... [1]

(c) During this reaction, nerve impulses travel along different neurones.

Between neurones there are gaps called synapses.

Impulses are passed more quickly across some synapses than others.

Suggest why.

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

[Total: 7]

6

- 2 Many human babies are fed on breast milk.

Look at this list of some of the substances in breast milk.

antibodies

carbohydrates

fats

minerals

proteins

vitamins

water

- (a) (i) The carbohydrates, fats and proteins are digested.

Describe what happens to substances as they are digested.

.....
 [1]

- (ii) One of the minerals is calcium.

Calcium does **not** need to be digested.

Suggest why.

.....
 [1]

- (b) Breast milk contains antibodies.

The antibodies protect the baby from pathogens.

- (i) What type of immunity do the antibodies give the baby?

Draw a ring around the correct answer.

active

aerobic

antibiotic

chemical

passive

[1]

- (ii) Explain the reason for your answer.

.....
 [1]

7

- (c) When a baby feeds from its mother, the milk is at body temperature.

Food is digested most quickly at this temperature.

Explain why.

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

- (d) If a mother is a cigarette smoker her breast milk may contain nicotine.

Describe **one** effect nicotine in breast milk may have on a baby.

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

[Total: 6]

- 3** Claire has a condition called sickle cell anaemia.

She wants to find out more about sickle cell anaemia and reads the following information in a book.

People with sickle cell anaemia have a different form of haemoglobin.

Haemoglobin is the red protein in red blood cells. Its job is to carry oxygen.

Sickle cell haemoglobin does not carry oxygen as well as the common form of haemoglobin.

Sickle cell anaemia is caused by a recessive allele.

- (a)** Sickle cell anaemia is caused by a mutation changing one base in DNA.

- (i)** Why can changing just one base in DNA cause sickle cell anaemia?

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

- (ii)** Write down the four bases in DNA.

..... [1]

9

- (b) Claire's parents do **not** have sickle cell anaemia.

She has two brothers and a sister who do **not** have sickle cell anaemia.

Draw a **genetic diagram** to show how Claire has inherited sickle cell anaemia but her brothers and sister have not.

Show Claire on the diagram by putting a circle around her alleles.

Use **H** as the symbol for the allele coding for the common form of haemoglobin.

Use **h** as the symbol for the allele coding for sickle cell haemoglobin.

Claire's mother

Claire's father

.....

.....

[3]

- (c) Claire finds it difficult to do any exercise.

One reason is that lactic acid quickly builds up in her muscles.

Explain why lactic acid builds up.

.....

.....

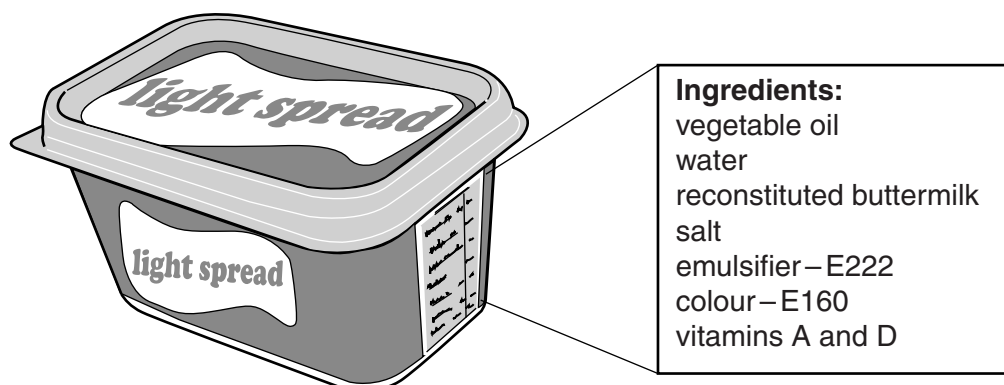
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[Total: 7]

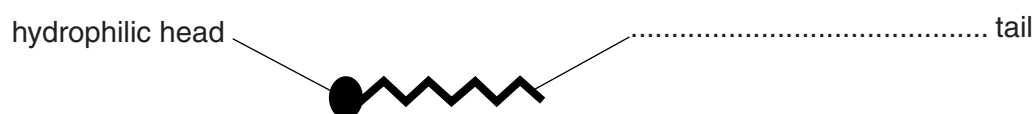
Section B – Module C1

4 Processed food contains food additives.

Look at the ingredients in the tub of margarine.

(a) The margarine contains an **emulsifier**.

Look at the diagram. It shows a molecule of an emulsifier.



(i) Complete the missing label on the diagram.

[1]

(ii) The emulsifier has a **hydrophilic** head.

What is meant by hydrophilic?

..... [1]

(b) Margarine is used in making cakes.

Tricalcium phosphate is an additive found in some cake mixes.

It has the formula $\text{Ca}_3(\text{PO}_4)_2$.

How many **atoms** are in the formula $\text{Ca}_3(\text{PO}_4)_2$?

answer [1]

(c) Some food has to be cooked before it can be eaten.

(i) Write down **one** reason why we cook food before eating it.

..... [1]

(ii) Cooking food is a chemical change.

Explain why.

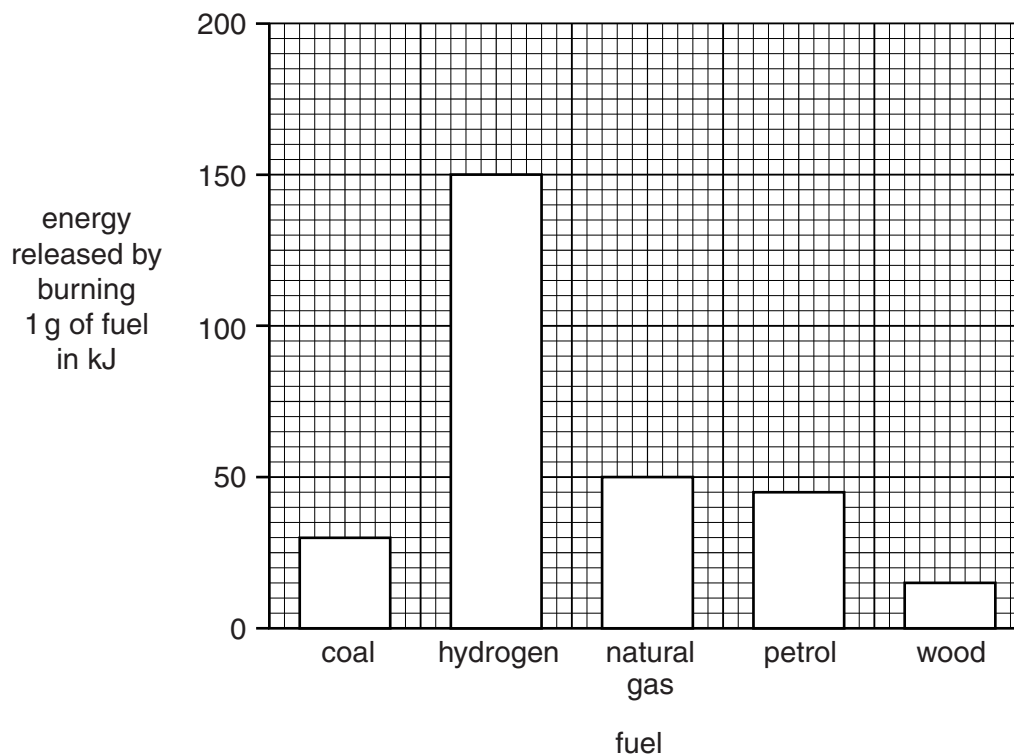
..... [1]

[Total: 5]

5 This question is about fuels.

Look at the bar chart.

It shows the energy released, in kJ, by burning 1g of five different fuels.



(a) Calculate the mass of **coal** that will release the same amount of energy as 1g of hydrogen.

.....

answer g [1]

(b) Petrol is a **hydrocarbon**.

What is meant by a hydrocarbon?

.....
 [1]

13

- (c) Natural gas contains methane, CH_4 .

Methane burns in oxygen, O_2 , to form carbon dioxide and water.

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

..... [2]

- (d) The Tornado steam locomotive was built in 2008.

It was the first steam locomotive to be built in the UK for 50 years.



60163 TORNADO
New Steam for the Main Line

Write down **two** factors that the owners of the locomotive needed to consider when choosing a fuel.

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

[Total: 6]

- 6 Julie gets very cold hands when she is outdoors in the winter.
- She uses a heat pack to help keep her hands warm.
- The heat pack contains a metal disc inside a liquid chemical.
- When Julie presses the metal disc a chemical reaction takes place.
- The heat pack gets hot.

(a) Look at the following statements.

One of the statements is correct.

Put a tick (✓) in the box next to the correct statement.

The bag gets hot because the reaction is endothermic.

☐

The bag gets hot because the reaction is exothermic.

☐

The bag gets hot because plastic is a good insulator.

☐

The bag gets hot because energy is transferred from Julie's hands.

☐

[1]

(b) Julie wears a GORE-TEX® jacket when she goes outside in the cold.



GORE-TEX® fabric is **breathable**.

This means it lets water vapour out, but does not let rain in.

Explain how this can happen.

Use ideas about the structure of GORE-TEX® fabric.

.....

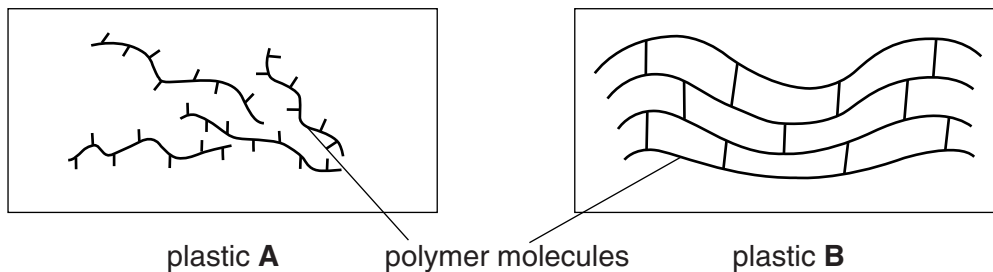
..... [1]

15

- (c) GORE-TEX® fabric is made from polymers.

Polymers make plastics.

Look at the diagrams. They show the structure of two plastics.



- (i) Complete the sentences about plastics **A** and **B**.

The type of strong bonds that hold atoms together in a polymer molecule are called bonds.

The weak forces between polymer molecules in plastic **A** are called forces.

[2]

- (ii) Plastic **B** is rigid and cannot be stretched.

Explain why. Use ideas about forces between polymer molecules.

.....

..... [1]

[Total: 5]

16

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- 7 This question is about crude oil.

The hydrocarbons in crude oil can be separated into useful products called fractions.

This process is called fractional distillation.

fraction	boiling temperature in °C	number of carbon atoms in hydrocarbon molecule	relative % in crude oil	relative % demand
LPG	less than 40	1 – 3	10	20
petrol	40 – 200	4 – 12	10	25
paraffin	200 – 250	12 – 16	15	23
heating oil	250 – 300	15 – 18	20	20
fuel oil	300 – 360	19+	45	12

- (a) Suggest why petrol costs more than fuel oil.

Use information from the table to help you.

.....
 [1]

- (b) The hydrocarbons in petrol have lower boiling temperatures than those in fuel oil.

Explain why. Use ideas about forces.

.....
 [1]

- (c) Another process that happens in an oil refinery is **cracking**.

Cracking converts large hydrocarbon molecules into smaller hydrocarbon molecules.

Explain why cracking is needed. Use the table to help you.

.....

 [2]

[Total: 4]

Section C – Module P1

- 8 (a) Ivan boils some water.

He continues to heat the water while it is boiling.

The temperature of the water does **not** increase as the liquid changes into a gas.

Explain what the energy supplied is being used for.

.....

 [1]

- (b) Ivan measures the mass of a pan containing boiling water.

He boils the water for 25 minutes.

He measures the mass of the pan again.

Look at his results.

initial mass of pan and boiling water	1.378 kg
final mass of pan and water after 25 minutes	1.047 kg
energy supplied	750 kJ ($7.5 \times 10^5 \text{ J}$)

Calculate the **specific latent heat** of water.

The equations on page 2 may help you.

.....

answer J/kg [2]

19

(c) Goran has a new gas central heating boiler.

In one day he uses 7.2 MJ (7 200 000 J) of energy.

6.5 MJ (6 500 000 J) is **usefully** used to heat the water.

The rest of the energy is **wasted** as hot gases.

Calculate the **efficiency** of the boiler.

The equations on page 2 may help you.

.....

.....

.....

.....

answer

[2]

[Total: 5]

9 This question is about using microwaves.

(a) **Infrared** radiation and **microwave** radiation heat food in different ways.

Write about these differences.

infrared radiation

.....

.....

microwave radiation

.....

..... [3]

(b) Julia often talks to her friends using a mobile phone.

Occasionally Julia cannot get a signal on her phone.

Mobile phone companies can improve signal coverage.

Suggest **two** things they could do.

1

.....

2

..... [1]

(c) Both the ionosphere and satellites can be used for long distance communications.

Transmitting signals using the ionosphere **differs** from using a satellite.

Explain how.

.....

.....

..... [1]

(d) Some signals are analogue.

What is an **analogue** signal?

.....

..... [1]

[Total: 6]

10 A laser produces an intense beam of light in which all the waves are in phase with each other.

(a) Draw a labelled diagram to explain the meaning of the words 'in phase with each other'.

[1]

(b) A laser beam is used in a CD player.



(i) How is the information **stored** on the CD?

.....
 [1]

(ii) How is the information **retrieved** from the CD?

.....
 [1]

[Total: 3]

- 11 (a) In 2010 a severe earthquake affected the city of Christchurch in New Zealand.

The earthquake produced seismic waves.

P-waves (primary) and **S-waves** (secondary) were produced.

P-waves are faster than **S-waves**.

Complete the sentences.

P-waves are waves and can travel through

.....

S-waves are waves and can travel through

.....

[2]

- (b) Human activity can affect the Earth and its atmosphere.

CFCs have been used to propel the contents from aerosol cans.

What effect do CFCs have on the atmosphere **and** therefore the Earth?

.....

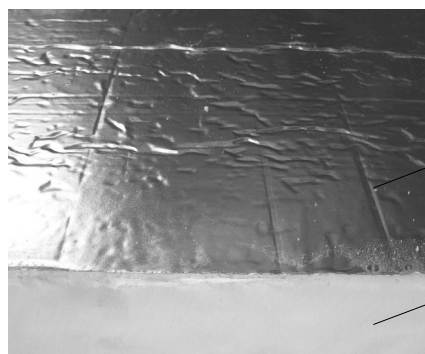
..... [1]

[Total: 3]

12 Kevin has an extension built to his home.

He notices that the builder uses large **foam** blocks, covered in **shiny** foil.

The blocks are placed in the cavity walls.



The builder tells Kevin these blocks will reduce his energy bills.

The blocks reduce energy transfer by conduction, convection and radiation.

(a) Explain how the blocks reduce conduction.

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

(b) Explain how the blocks reduce convection.

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

(c) Explain how the blocks reduce radiation.

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

[Total: 3]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol atomic (proton) number															
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

1	H	1
	hydrogen	

* 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.