

GENERAL CERTIFICATE OF SECONDARY EDUCATION
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.

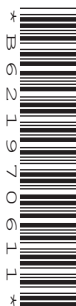
OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Friday 27 May 2011
Morning

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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.

PLEASE DO NOT WRITE ON THIS PAGE

4

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

- 1 (a) Dalia lives in a part of Africa where there are food shortages.

She has not eaten enough **protein**.



- (i) What is the name of Dalia's condition?

Put a ring around the correct answer.

constipation diabetes kwashiorkor obesity scurvy

[1]

- (ii) The recommended daily amount of protein (RDA) can be calculated using the formula:

$$\text{RDA in g} = 0.75 \times \text{body mass in kg}$$

Dalia's friend Nia has a body mass of 40 kg.

Calculate Nia's RDA of protein.

.....

answer g

[1]

- (iii) Nia's body mass is greater than Dalia's.

Nia eats more meat and fish.

Protein from meat and fish is called **first class protein**.

Why is it called first class protein?

.....
 [1]

5

(b) Malaria is a common disease in the part of Africa where Dalia and Nia live.

Describe how malaria is spread.

In your answer include

- what causes malaria
- how it is spread from one person to another.

.....

.....

.....

.....

..... [3]

[Total: 6]

2 Joe takes part in a 100m race.



(a) Joe starts to run when he **hears** the **sound** of the starting gun.

In this reaction

- (i) what is the stimulus? [1]
- (ii) what is the receptor? [1]
- (iii) what is the effector? [1]

(b) During the race Joe's muscles use **anaerobic respiration**.

This produces lactic acid.

(i) Why do Joe's muscles use anaerobic respiration during the race?

.....
 [1]

(ii) What effect does lactic acid have on Joe's muscles?

.....
 [1]

(c) During the race Joe's skin becomes redder because of vasodilation.

(i) Explain how vasodilation makes the skin redder.

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

(ii) Vasodilation increases heat transfer from the body.

Describe how it increases heat transfer.

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

(iii) Vasodilation helps Joe's body temperature stay at 37 °C.

This is important for cells to function efficiently.

Explain why.

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

[Total: 8]

3 Huntington's chorea is a genetic disorder.

It affects muscle co-ordination and mental ability.

Someone who has Huntington's chorea does **not** usually suffer any effects until around the age of 40.

Huntington's chorea is caused by a dominant allele, **H**.

(a) Rob has the genotype **Hh**.

He has had a genetic test to find this out.

(i) Rob is married to Mary, who has the genotype **hh**.

If Rob and Mary have a child, what is the probability that the child will grow up to get Huntington's chorea?

You **must** use a labelled genetic diagram to work out your answer.

The probability that their child will get Huntington's chorea is **[3]**

- (ii) There is a possibility that Rob's brother Dave might also have the genotype **Hh**.

However, Dave has chosen **not** to have the genetic test to find out.

Suggest why Dave has chosen **not** to have the genetic test.

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

- (b) The **h** allele codes for a protein called huntingtin.

The **H** allele is a mutated form of the **h** allele.

The **H** allele has extra C, A and G bases.

- (i) Suggest why having extra C, A and G bases causes Huntington's chorea.

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

- (ii) Apart from C, A and G, what is the other base found in genes?

..... [1]

[Total: 6]

10

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Section B – Module C1

4 This question is about food.

(a) Apples are eaten raw.

Potatoes are cooked before they are eaten.



One of the reasons potatoes are cooked is to improve their texture.

Write down two **other** reasons why potatoes are cooked before they are eaten.

1

2 [2]

(b) When potatoes are cooked their cell structure changes.

Write about this change.

Your answer should include

- how the potato cells change
- how this makes the cooked potato better for eating than the raw potato.

.....

.....

..... [2]

[Total: 4]

5 This question is about polymers.

(a) Polymers are made in a process called **polymerisation**.

What are the conditions needed for polymerisation?

1

2 [2]

(b) Waste plastics can be disposed of in landfill sites.



Disposing of waste plastics can sometimes cause problems.

Write down **one** problem with landfill sites.

.....

..... [1]

(c) Look at the information about polymers **A**, **B**, **C** and **D**.

polymer	melting point in °C	easy to mould?	easily coloured?	stiff or flexible?
A	250	no	yes	stiff
B	98	yes	no	flexible
C	240	yes	no	flexible
D	160	yes	yes	stiff

Which polymer would be best for making a washing-up bowl?

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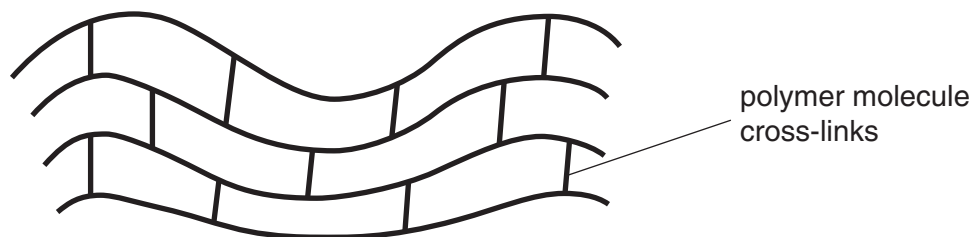
Explain your choice.

.....

..... [1]

13

(d) The diagram shows the structure of polymer **A**.



Polymer **A** cannot be stretched.

Explain why. Use the diagram to help you.

.....

..... [1]

[Total: 5]

6 This question is about hydrocarbon fuels.

Look at the table.

It shows information about four gases which can be used as fuels.

gas	molecular formula	displayed formula
methane	CH ₄	$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array} $
ethane	C ₂ H ₆	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $
propane		$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $
butane	C ₄ H ₁₀	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $

(a) What is the **molecular** formula for propane?

Write your answer in the table.

[1]

(b) Propane and butane are made from crude oil by fractional distillation.

Fractional distillation separates fractions because they have different boiling temperatures.

Explain why crude oil can be separated by fractional distillation.

Use ideas about

- the size of the molecules
- the forces between the molecules.

.....

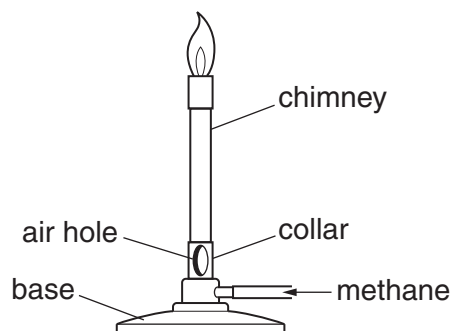
.....

.....

..... [2]

15

(c) A Bunsen burner uses methane.



When the air hole is open the flame is blue.

When the air hole is closed the flame is yellow.

Carolyn heats 100 g of water for 3 minutes. She uses a blue flame.

Carolyn does the experiment again. This time she uses a yellow flame.

Look at her results.

Bunsen flame	temperature of water before heating in °C	temperature of water after heating in °C
blue	15	69
yellow	15	41

(i) The energy supplied by a yellow flame is much less than by a blue flame.

Suggest why.

.....
 [1]

(ii) The energy supplied to heat the water using a yellow flame is 10920 J.

Calculate the energy supplied by the blue flame.

energy transferred = mass × specific heat capacity × temperature change

The specific heat capacity of water is 4.2 J/g °C.

.....

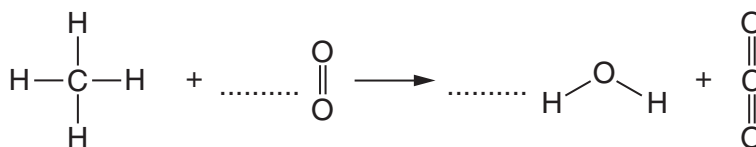
answer J

[2]

16

(d) Carolyn writes an equation for the complete combustion of methane.

Look at her equation. It is not balanced.

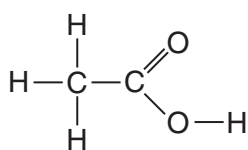


Balance this equation by placing numbers on the dotted lines.

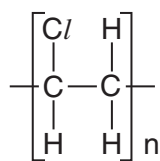
[1]

[Total: 7]

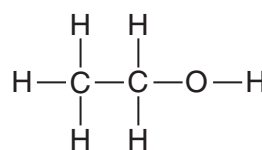
7 Look at the displayed formulas.



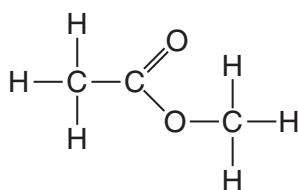
compound A



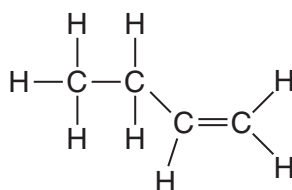
compound B



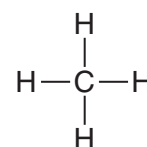
compound C



compound D



compound E



compound F

(a) (i) Which compound is a **polymer**?

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

answer [1]

(ii) Which compound will decolourise bromine water?

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

answer [1]

(b) Compound **D** is an **ester**.

(i) Complete the sentence about making an ester.

Alcohols react with to make esters and water. [1]

(ii) Write down **one** use for an ester.

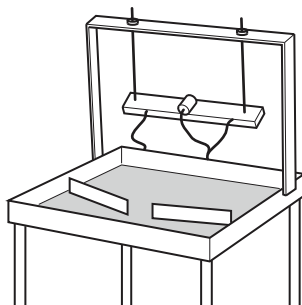
..... [1]

[Total: 4]

Section C – Module P1

- 8 Mrs Powers teaches her class about waves.

She shows them some water waves in a ripple tank.



- (a) The water waves have a frequency of 3 Hz.

What does **frequency** mean?

.....
 [1]

- (b) The class measures the water waves.

The waves have a frequency of 3 Hz.

Their wavelength is 0.04 m.

Calculate the **speed** of the waves.

The equations on page 2 may help you.

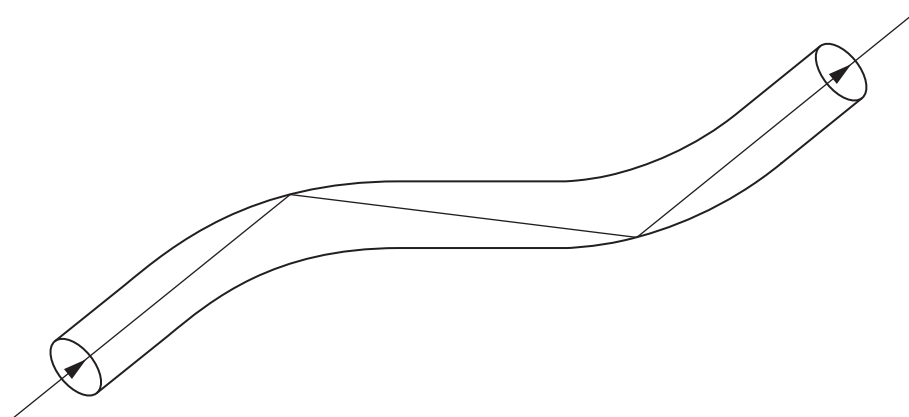
.....

answer m/s [2]

[Total: 3]

- 9 Optical fibres can be used to communicate.

Look at the diagram of part of an optical fibre.



- (a) Light is transmitted along the optical fibre as shown in the diagram.

What is the process shown in the diagram called?

..... [1]

- (b) Optical fibres normally carry **digital** rather than **analogue** signals.

Complete the sentences.

Digital signals can be either or

Analogue signals have a continuously

The light rays in the optical fibre carry data in of light. [3]

- (c) Write down two **advantages** of using digital signals.

1

.....

2

..... [2]

[Total: 6]

- 10** Jake and Grace like to play in the sunshine.

Playing in the sunshine can be dangerous.

Ultraviolet radiation from the Sun causes skin cancer.



- (a)** Grace's dark skin reduces her risk of skin cancer.

Explain how.

.....

.....

.....

..... [2]

- (b)** Grace can stay in the sunshine without burning for 60 minutes.

Jake can only stay in the sunshine safely for 12 minutes.

Jake's dad puts sun block on Jake. He wants Jake to be safe in the sun for 60 minutes.

What is the minimum SPF (sun protection factor) he should use?

.....

..... [1]

[Total: 3]

11 Alex cooks potatoes in his microwave oven.



(a) Look at the statements about microwaves.

A	microwaves penetrate about 1 cm into food
B	microwaves go through metals
C	microwaves go through glass and plastics
D	microwaves do not burn skin when they are absorbed

Which **two** statements are false? Choose from **A**, **B**, **C** and **D**.

answer and

[1]

(b) A potato takes 10 minutes to cook in the microwave oven.

Explain how the microwaves cook the potato.

In your answer write about

- which material in the potato heats up
- how the centre of the potato gets cooked.

.....

.....

.....

..... [2]

21

- (c) Alex now heats up some water in the microwave oven.

He switches the microwave oven on for 3 minutes.

After 1 minute the water is boiling.

The water boils for a further 2 minutes but its temperature stays the same.

- (i) The energy from the microwave does not raise the temperature of the boiling water.

How does this energy affect the water particles?

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

- (ii) 135 kJ of energy are used in the 2 minutes that the water boils.

60 g of water is changed into steam during boiling.

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

The equations on page 2 may help you.

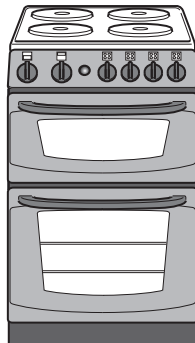
.....
.....

answer kJ/g [2]

(d) Alex cooks some more potatoes.

This time he uses a different oven.

This oven uses **infrared** waves.



It takes 1 hour to cook the potatoes in this oven.

The potatoes are crispy on the **surface**.

(i) These potatoes are crispier than the ones he cooked in the microwave.

Suggest why.

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

(ii) It is **quicker** to cook potatoes using the microwave oven.

Explain why.

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

[Total: 8]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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24

1	2	Key										3	4	5	6	7	0			
		relative atomic mass atomic symbol name atomic (proton) number																4 He helium 2		
7 Li lithium 3	9 Be beryllium 4																	19 F fluorine 9	20 Ne neon 10	
23 Na sodium 11	24 Mg magnesium 12																	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									

24

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