

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 28 May 2010
Morning

Duration: 1 hour



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

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

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

1 Dominic has cystic fibrosis.

He has inherited cystic fibrosis from his parents.

(a) Neither of Dominic's parents have cystic fibrosis.

What does this tell you about the allele that causes cystic fibrosis?

..... [1]

(b) Cystic fibrosis can cause a number of changes in the body.

It often stops the pancreas from working properly.

The pancreas stops making enzymes such as lipase and the hormone insulin.

(i) Write down the job of the enzyme **lipase**.

..... [1]

(ii) Write down the name of the disorder caused by a lack of insulin.

..... [1]

(c) Cystic fibrosis can also stop the liver working properly.

It may not make enough bile and may develop cirrhosis.

(i) Write down what bile does to fat droplets.

..... [1]

(ii) Write down **one other** possible cause of cirrhosis.

..... [1]

[Total: 5]

4

- 2 Most people take their hands away very quickly if they pick up a hot object.

The heat from the object is detected by pain receptors in the skin.



- (a) Nerve cells carry impulses from the pain receptors to the central nervous system.

Put a tick (✓) next to the type of nerve cells that carry these impulses.

motor neurone

☐

relay neurone

☐

sensory neurone

☐

[1]

- (b) Scientists have been investigating a young boy and his family.

The family cannot feel pain.

This is because they all have inherited a mutation in a single gene.

The gene codes for a chemical that turns on the nerve cells that carry impulses.

In people with the mutation the chemical does not work.

- (i) What type of chemical do genes code for?

..... [1]

- (ii) A mutation causes a change in the structure of the chemical produced.

How does it cause this change?

.....
 [1]

5

- (c) The scientists hope that they can make a drug that will also turn off the nerve cells.

This drug would prevent pain without altering any other parts of the body.

If the scientists produce a drug it will need to be tested.

Describe how scientists might perform a **double blind** test on a new drug.

.....

.....

.....

..... [3]

[Total: 6]

6

3 Anthony and Declan are talking about their fitness.



They both measure their resting pulse rate and blood pressure.

Anthony

Resting pulse rate 95
Blood pressure 150/95 mmHg

Declan

Resting pulse rate 75
Blood pressure 130/80 mmHg

(a) (i) Anthony's and Declan's blood pressure readings each have two numbers.

Why does the blood pressure reading include two numbers?

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

(ii) Anthony's blood pressure is higher than Declan's.

This could be because of differences in their diets.

Finish this sentence to suggest **one** possible difference in their diets.

Anthony's diet might contain
..... [1]

- (b) Anthony decides to exercise to get fitter.

He reads in a book that he should only increase his pulse rate to 70% of its maximum value.

This should make sure that he respire aerobically not anaerobically.

Write down **one** advantage of respiring aerobically rather than anaerobically.

.....
 [1]

- (c) Anthony's book says that there are different types of fitness.

Draw straight lines to link each **type of fitness** with its **definition** and a **method of measurement**.

type of fitness	definition	method of measurement
agility	The ability to change the position of the body quickly.	Measure how long a person can cycle without going above a certain pulse rate.
flexibility	A muscle's ability to perform a maximum contraction time after time.	Measure how far a person can stand from a wall and bend forward to touch the wall with their knees.
stamina	The ability of part of the body to achieve a wide range of movement.	Measure how fast a person can run zig-zagging between cones.

[2]

[Total: 5]

- 4 Jane and Sadia are planning a holiday to Africa.



- (a) Jane is worried about getting malaria.

Jane is unlikely to get malaria from drinking water.

- (i) How is malaria usually spread?

..... [1]

- (ii) If a person has malaria they develop a high body temperature.

Explain how a very high body temperature can be harmful to the body.

.....
 [2]

9

(b) Sadia says that they can have immunisations when they get home.

Why is it better to have immunisations **before** they go on holiday?

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

It is less likely to produce side effects if the antigens are not already present in the blood.

☐

It would produce antibodies in the blood in preparation for possible antigens.

☐

It would destroy any antigens in the blood before they go on holiday.

☐

It would provide passive immunity which lasts for a long time.

☐

[1]

[Total: 4]

Section B – Module C1

- 5 This question is about food and food additives.

An additive is given an E number.

Look at the table. It gives some information about E numbers.

type of food additive	E number range
food colours	E101 to E199
preservatives	E200 to E299
antioxidants	E300 to E321
emulsifiers and stabilisers	E400 to E499
sweeteners	E950 to E967

Look at the food label found on a packet of instant drink.

INGREDIENTS

Sugar, drinking chocolate, skimmed milk powder, vegetable oil, instant coffee, lactose, dried glucose syrup, E340, E452, E331, milk proteins, salt

- (a) What type of food additive is E452?

..... [1]

- (b) Emulsifiers help oil and water to mix and not separate.

- (i) Describe how emulsifiers keep oil and water from separating.

Your answer should include

- the structure of an emulsifier molecule
- how the molecule works.

.....

.....

..... [2]

11

- (ii) Write down the name of one food that contains an emulsifier.

Choose from:

cooking oil

chicken

orange squash

mayonnaise

answer..... [1]

- (c) Baking powder is a raising agent which contains sodium hydrogencarbonate, NaHCO_3 .

Sodium hydrogencarbonate breaks down when heated.

Sodium carbonate, Na_2CO_3 , water and carbon dioxide are made.

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

..... [2]

- (d) What is the test for carbon dioxide?

substance used.....

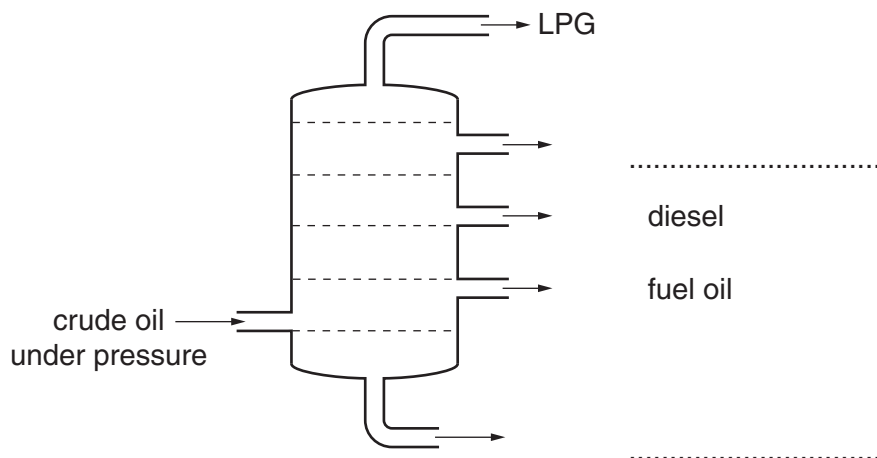
result..... [2]

[Total: 8]

12

- 6 This question is about fractional distillation and cracking.

Look at the diagram. It shows a fractionating column.



A fractionating column separates crude oil into **fractions**.

- (a) Complete the diagram to show the missing fractions.

Choose from:

bitumen

heating oil

petrol

waxes

[2]

- (b) Crude oil can be separated by fractional distillation.

Answer these questions to explain how.

- (i) What happens to the intermolecular forces between hydrocarbon molecules during fractional distillation?

..... [1]

- (ii) Why do large molecules have a higher boiling temperature than small molecules?

..... [1]

13

- (c) Some fractions from crude oil can be cracked.

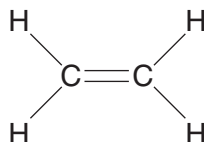
Cracking converts large molecules into smaller petrol molecules.

Ethene is also made.

- (i) Write down **one** use of ethene.

..... [1]

- (ii) Look at the displayed formula of ethene.



Ethene is **unsaturated**.

Explain what is meant by unsaturated.

..... [1]

- (iii) Write down the **molecular** formula of ethene.

..... [1]

[Total: 7]

7 Liz is designing a new power station.

She must choose a fuel to burn in the power station.

One of the factors she needs to consider is the cost of the fuel.

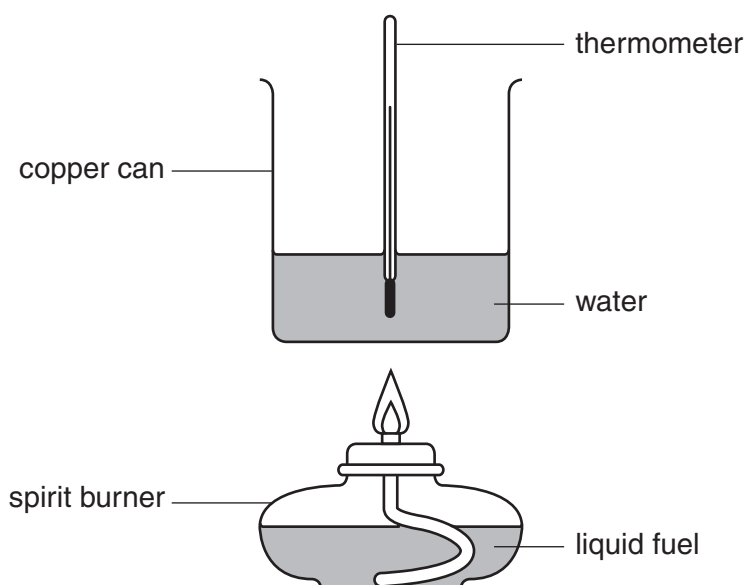
(a) Write about the **other** factors Liz needs to think about when she chooses the fuel.

.....

.....

..... [2]

(b) Look at the diagram. It shows the apparatus Liz uses to compare three fuels.



When 1.5 g of ethanol is burned, 17640 J of energy is transferred.

Calculate the energy transferred when 1.0 g of ethanol is burned.

.....

.....

answer J [2]

(c) Burning fuels is an **exothermic** reaction.

What is meant by an exothermic reaction?

..... [1]

[Total: 5]

Section C – Module P1

8 This question is about waves.

(a) Look at the statements about **microwaves**.

Some statements are true and some are false.

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

Two have been done for you.

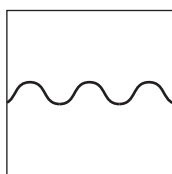
	true	false
They are electromagnetic waves.		
They are longitudinal.		✓
They penetrate to the centre of all foods.		
They are absorbed by water molecules.	✓	
They can go through plastic.		
They are reflected by metals.		
They can be absorbed by body tissues and cause burns.		

[2]

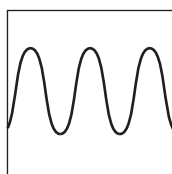
(b) Anna uses an oscilloscope to study different waves.

She does **not** change the settings on the oscilloscope.

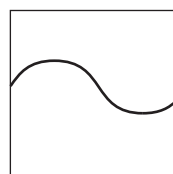
Look at the traces she sees.



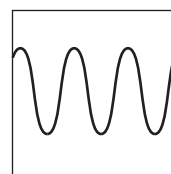
A



B



C



D

(i) Which trace shows the wave with the lowest frequency?

Choose from: **A** **B** **C** **D**

answer

[1]

(ii) Which trace shows the wave with the smallest amplitude?

Choose from: **A** **B** **C** **D**

answer

[1]

[Total: 4]

Turn over

9 This question is about light rays in glass.

(a) The critical angle for a glass-air boundary is 42° .

What is meant by **critical angle**?

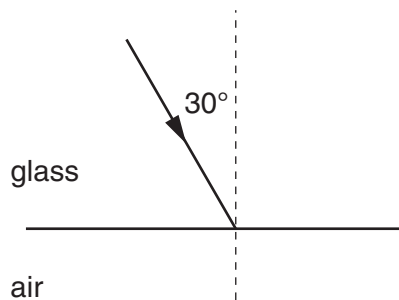
.....
 [1]

(b) Look at the three diagrams.

They show light rays incident at the boundary between glass and air.

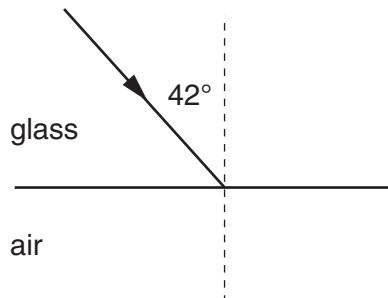
The critical angle for the glass-air boundary is 42° .

(i) Complete the path of the ray to show what happens after it meets the boundary.



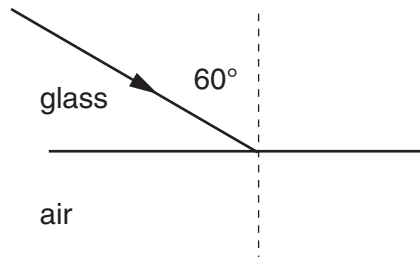
[1]

(ii) Complete the path of the ray to show what happens after it meets the boundary.



[1]

(iii) Complete the path of the ray to show what happens after it meets the boundary.



[1]

17

- (c) One advantage of using optical fibres is that the signals can be **multiplexed**.

What is multiplexing?

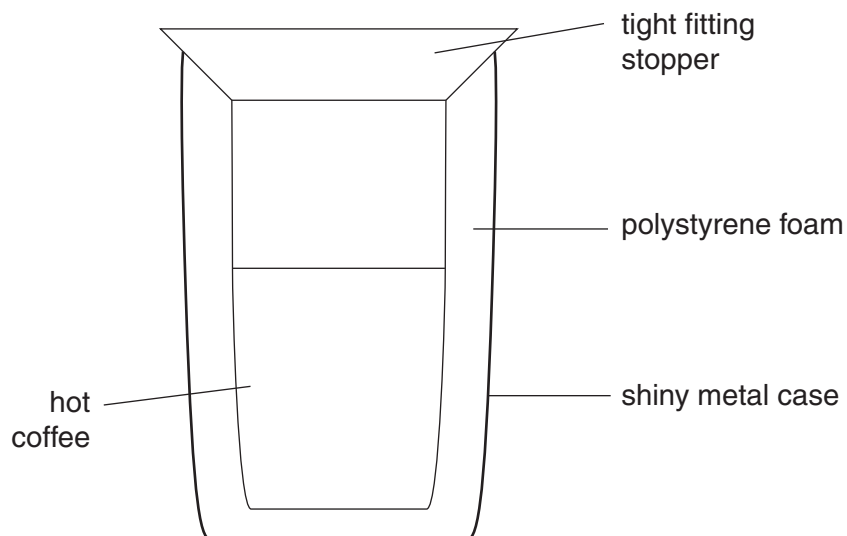
.....
..... [1]

[Total: 5]

18

10 (a) Look at the diagram of a thermal mug.

It is used to keep coffee hot.



Explain how the thermal mug reduces energy transfer.

In your answer write about

- conduction
- convection
- radiation.

.....

.....

.....

.....

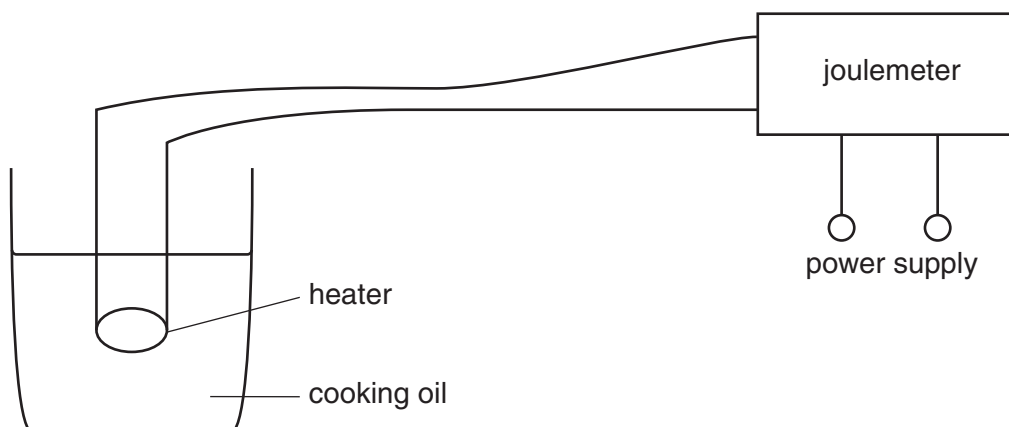
..... [3]

19

(b) Ben has a beaker containing 0.18 kg of cooking oil.

The starting temperature of the cooking oil is 20°C.

Look at the diagram.



He supplies 9000 J of energy to the cooking oil.

The specific heat capacity of cooking oil is 800 J/kg °C.

Calculate the final temperature of the cooking oil after heating.

Ignore any heat losses.

The equations on page 2 may help you.

.....

.....

.....

answer

[3]

[Total: 6]

11 Look at the information about energy saving methods.

insulation method	cost to fit in £	payback time in years	savings each year in £	energy saved each year in kWh
cavity wall insulation	960	4.0	240	2000
double glazing	3000	15.0	200	1667
draught excluders	48	0.5	96	800
loft insulation	240	2.0	120	

(a) Draught excluders **only** save £96 each year.

Andy still decides to fit them.

Suggest why.

.....
 [1]

(b) Energy costs 12p per kWh.

How many kWh of energy does loft insulation save each year?

.....

answer kWh [1]

[Total: 2]

12 Both human activity and natural phenomena can affect the environment.



- (a) The eruption of a volcano causes a fall in the temperature of the land around the volcano.

Explain why.

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

- (b) Human activity has lead to an increase in the amount of ultraviolet light reaching the Earth.

Explain how human activity caused the increase in ultraviolet light reaching the Earth.

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

[Total: 3]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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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