

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)

Thursday 14 January 2010
Morning

Duration: 1 hour



Candidate
Forename

Candidate
Surname

Centre Number

Candidate Number

MODIFIED LANGUAGE

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, however additional paper may be used if necessary.

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

BLANK PAGE

Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

4

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

1 This question is about being healthy.

(a) A balanced diet contains all the following food types.

carbohydrate

fat

protein

minerals

vitamins

fibre

water

The amount of each food type you should eat varies from person to person.



Mary



Vicki

Mary is in a swimming club and swims every day.

Vicki is the same age and weight as Mary, but does **not** exercise as much.

How should Mary's diet be different from Vicki's?

In your answer, write about

- which food type or types Mary should have more of or less of than Vicki
- the reason or reasons for this.

.....

.....

.....

[2]

5

- (b) Vicki is concerned about her health.

She measures her mass and height so that she can calculate her BMI (body mass index).

Vicki's mass is 60 kg.

Her height is 170 cm.

Calculate Vicki's BMI.

Use the formula

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

answer

[2]

- (c) Vicki's BMI shows she is not overweight.

Having a high BMI increases the risk of getting heart disease.

- (i) Smoking can also increase the risk of heart disease.

Nicotine is one substance in cigarette smoke that is linked to heart disease.

Write down **one other** substance in cigarette smoke that is linked to heart disease.

..... [1]

- (ii) Look at the list of drug types.

depressant

hallucinogen

painkiller

performance enhancer

stimulant

What type of drug is nicotine?

Choose your answer from the list.

..... [1]

[Total: 6]

6

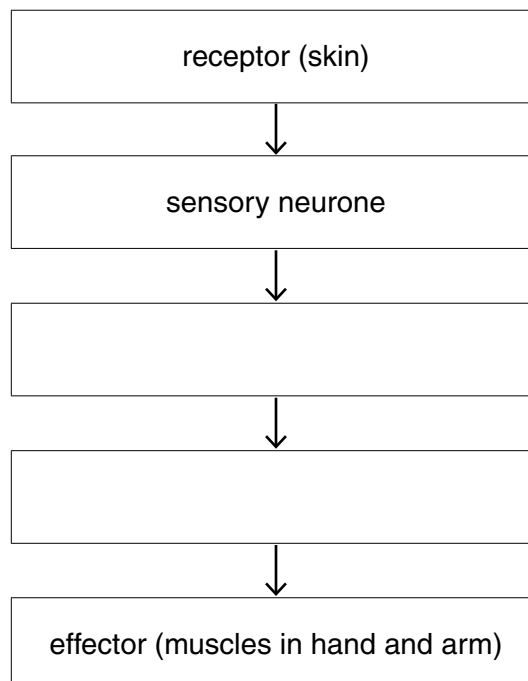
2 Lynne is going to have a bath.



She puts her hand in the water and quickly pulls it out because it is too hot.

This is an example of a **spinal reflex**.

(a) Complete the flow diagram to show the reflex arc involved in this reflex.



[2]

(b) If Lynne had been drinking alcohol, her reaction would have been slower.

Explain why.

.....

.....

..... [1]

[Total: 3]

- 3 Some people have free earlobes.

Some people have attached earlobes.



free earlobe



attached earlobe

The allele for free earlobes (**E**) is dominant to the allele for attached earlobes (**e**).

- (a) Two parents with free earlobes have a child with attached earlobes.

- (i) What does this tell you about the earlobe alleles of both parents?

..... [1]

- (ii) What is the probability that their next child will also have attached earlobes?

In your answer include a fully labelled genetic diagram.

probability [2]

- (b) Which of the following statements is true? Put a tick (✓) in the correct box.

People who are homozygous for the **e** allele have free earlobes.

☐

People who are homozygous for the **E** allele have free earlobes.

☐

People who are heterozygous for the **e** allele have attached earlobes.

☐

People who are heterozygous for the **E** allele have attached earlobes.

☐

[1]

[Total: 4]

4 Iain has diabetes.

He has to take insulin injections to control his blood glucose levels.

(a) How does insulin control blood glucose levels?

.....

.....

.....

..... [3]

(b) Controlling blood glucose levels is an example of **homeostasis**.

Explain what the term homeostasis means.

.....

.....

..... [1]

(c) The gene for making insulin is present in every body cell.

However, insulin is only made in the pancreas.

Why is insulin **not** made by any other body cells?

.....

..... [1]

(d) Glucose is used in the body for respiration.

There are two types of respiration, anaerobic and aerobic.

Write down **two** ways anaerobic respiration is different from aerobic respiration.

1

.....

2

..... [2]

[Total: 7]

Section B – Module C1

- 5 Crude oil is a fossil fuel.

Crude oil is a mixture of hydrocarbons.

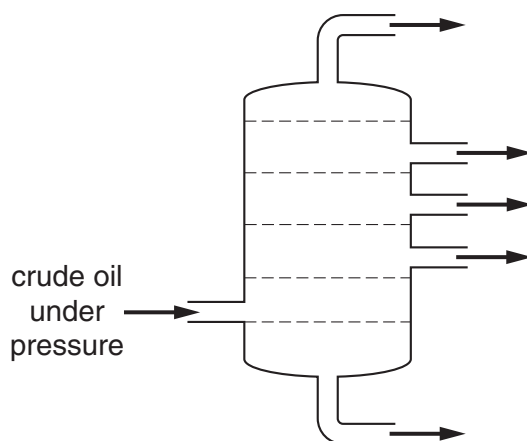
- (a) What is a **hydrocarbon**?

..... [1]

- (b) Crude oil can be separated into useful chemicals by **fractional distillation**.

Look at the diagram.

It shows a fractionating column.



- (i) **On the diagram** put the letter **X** in the **hottest** part of the fractionating column. [1]

- (ii) Complete the sentence about fractional distillation.

Fractional distillation separates crude oil into fractions containing many substances with similar properties such as [1]

- (c) Methane, CH_4 , is a hydrocarbon.

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

Write a balanced **symbol** equation for the burning of methane.

..... [2]

- (d) The reaction between methane and oxygen is **exothermic**.

What is meant by the word exothermic?

..... [1]

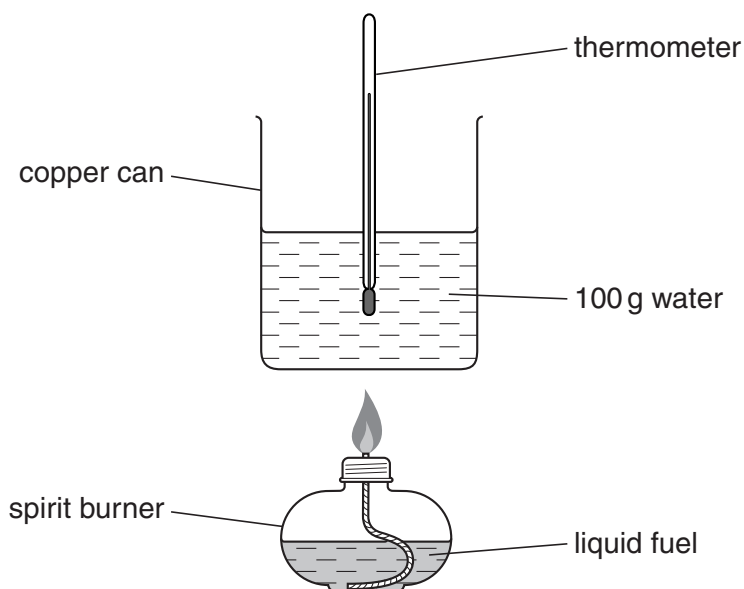
[Total: 6]

6 Steve and Sarah investigate some fuels.

They want to find out which fuel gives off most energy.

They test four liquid fuels.

Look at the diagram. It shows the apparatus they use.



They burn 1.0g of fuel each time.

Look at the table.

The table shows their results.

fuel	temperature at start in °C	temperature at end in °C
ethanol	20	37
methanol	18	28
paraffin	20	35
petroleum spirit	18	42

(a) Which fuel transfers the **most** energy to the water?

.....

Explain how you know.

.....

..... [2]

11

- (b) Calculate the amount of heat energy transferred by 1.0g of paraffin to 100g of water.

Use the equation

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

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

.....

.....

.....

answer J [2]

[Total: 4]

7 This question is about polymers.

(a) Poly(chloroethene) is a polymer.

The plastic from this polymer is used to make water pipes.



One property of poly(chloroethene) is that it is easy to shape.

Write about **other** properties of poly(chloroethene) that make it suitable for making water pipes.

.....

 [2]

(b) Poly(chloroethene) is a polymer.

Look at the table. It shows some information about polymers.

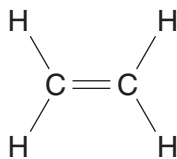
Complete the table.

formula of monomer	name of polymer	repeat unit of polymer
$\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array}$	poly(ethene)	$\left[\begin{array}{cc} \text{H} & \text{H} \\ & \\ -\text{C} & - & \text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right]$
	poly(chloroethene)	$\left[\begin{array}{cc} \text{Cl} & \text{H} \\ & \\ -\text{C} & - & \text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right]$
$\begin{array}{c} \text{F} & & \text{F} \\ & \diagdown & / \\ & \text{C} = \text{C} \\ & / & \diagdown \\ \text{F} & & \text{F} \end{array}$	poly(tetrafluoroethene)	

13

(c) Poly(ethene) is made from ethene.

Look at the displayed formula of ethene.



Ethene is an **unsaturated** hydrocarbon.

What is meant by unsaturated?

..... [1]

[Total: 5]

14

- 8 Sam has bought a new bottle of perfume.



- (a) One of these chemicals gives this perfume its smell.

Which one?

Choose from the list.

acid

ester

salt

water

..... [1]

- (b) Draw a straight line to join each property of Sam's perfume to the reason it is important.

Draw only **three** lines.

property of the perfume

insoluble

non-irritant

non-toxic

reason

so Sam can put the perfume
directly onto her skin

so the perfume cannot be
washed off easily

so Sam is not poisoned

[2]

15

(c) Sam's friends are able to smell her perfume because it evaporates easily.

Write about how Sam's perfume evaporates.

Your answer should include ideas about

- the energy of the perfume particles
- the forces of attraction between the particles.

A labelled diagram may help your answer.

.....

.....

.....

.....

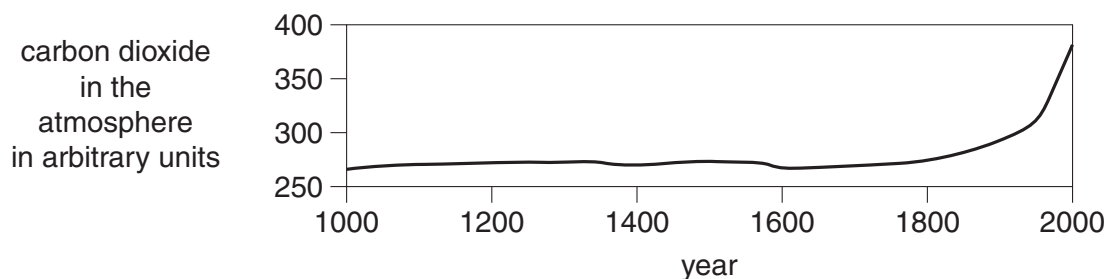
..... [2]

[Total: 5]

Section C – Module P1

9 The **carbon dioxide** levels in the Earth's atmosphere are changing.

(a) Look at the graph showing information about carbon dioxide, CO₂, in the Earth's atmosphere.



(i) Describe what has happened to the carbon dioxide levels during the last 1000 years.

.....
 [1]

(ii) How has the change in carbon dioxide levels affected the Earth?

..... [1]

(iii) What has caused the change in carbon dioxide levels?

..... [1]

(b) Erupting volcanoes can cause the Earth's temperature to **fall**.

Explain how.

.....

 [2]

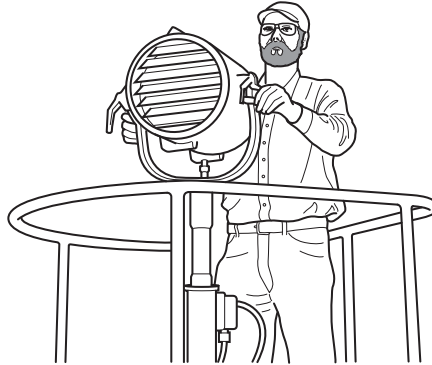
[Total: 5]

17

10 Many years ago it was difficult to send messages long distances.

A runner had to carry a written message.

The use of flashing light signals greatly improved this.



(a) Messages sent this way use a series of flashing lights.

This is a type of code.

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

.....

[1]

(b) There are two types of signal.

- analogue
- digital

Analogue signals have a continuously varying value.

Digital signals are used in optical fibres.

Describe a digital signal.

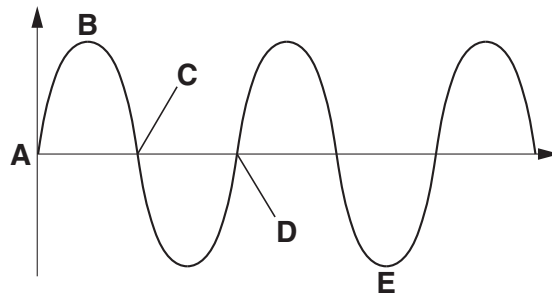
.....

[1]

18

(c) A light wave is a **transverse** wave.

Look at the diagram.



Describe what is meant by the **wavelength** of the wave.

Use the letters from the diagram in your answer.

.....

..... [1]

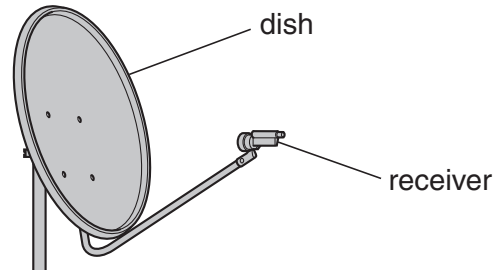
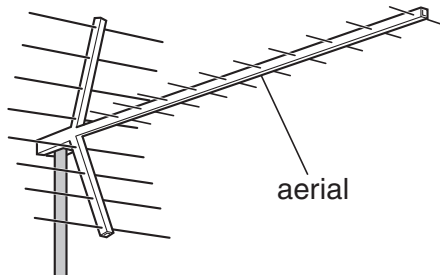
[Total: 3]

19

11 The diagrams show an aerial and a satellite receiver dish.

Aerials can be used to receive long wave radio signals.

Satellite dishes are used to receive digital TV signals.



Signals are sent out into the upper atmosphere from a transmitting station.

How do the signals get **back down** to Earth?

Complete the sentences.

Long wave radio signals get back down to an aerial by

.....

Digital TV signals get back down to a receiver dish by

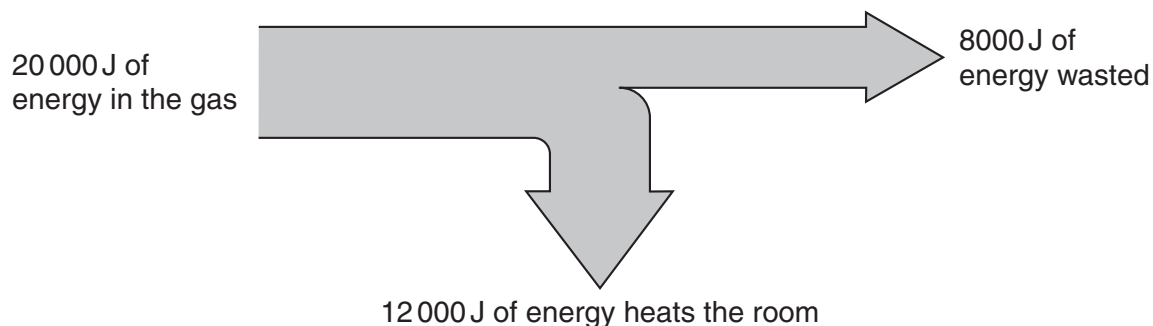
..... [2]

[Total: 2]

20

- 12** Asif has a gas fire that heats the living room of his house.

The diagram shows how much of the energy in the gas actually heats the room.



- (a)** Calculate the efficiency of the gas fire.

The equations on page two may help you.

.....

.....

answer [2]

- (b)** Asif insulates his loft. It costs £240.

This reduces his energy bill by £80 every year.

Calculate the payback time for his loft insulation.

.....

.....

answer years [1]

[Total: 3]

13 Microwaves and infrared waves are used in cooking and in communications.

Some scientists think that microwaves could cause brain damage.

This could be from

- microwaves escaping from a microwave cooker
- using a mobile phone for too long.

(a) Explain how the brain absorbs the microwaves.

In your answer, write about

- what substance absorbs microwaves
- what happens to this substance.

.....

.....

.....

..... [2]

(b) Some microwaves cause more damage than others.

What **two** things can make microwaves more dangerous?

1

.....

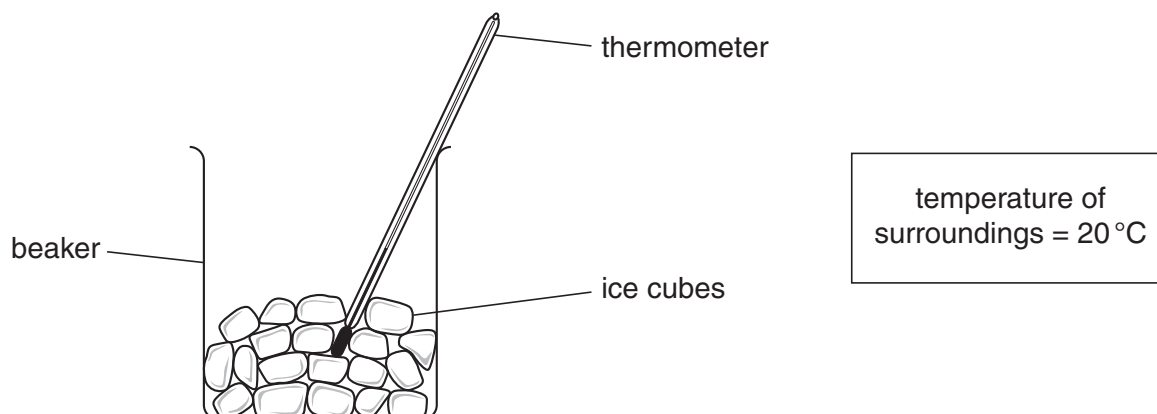
2

..... [2]

[Total: 4]

14 Beth is doing an experiment with ice cubes.

The temperature of the room is 20°C .



The ice cubes are melting.

(a) Why do the ice cubes melt?

..... [1]

(b) What happens to the temperature of the ice **as the ice melts**?

..... [1]

(c) Complete the sentence about the **specific latent heat** of ice.

Choose from

boil

defrost

energy

melt

temperature

warm

The specific latent heat of ice is the amount of needed

to 1 kg of ice. [1]

[Total: 3]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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1	2	1 H hydrogen 1					3	4	5	6	7	0					
		Key															
		relative atomic mass atomic symbol name 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						

* 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.