OCR
RECOGNISING ACHIEVEMENT

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A217/01

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 3 Modules B6 C6 P6 (Foundation Tier)

TUESDAY 29 JANUARY 2008

Afternoon

Time: 40 minutes

Candidates answer on the question paper
Additional materials (enclosed):
None

Calculators may be used
Additional materials: Pencil
Ruler (cm/mm)

CUP/T43015

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	5	
2	4	
3	5	
4	4	
5	7	
6	3	
7	4	
8	2	
9	8	
TOTAL	42	

This document consists of **18** printed pages and **2** blank pages.

[Turn over

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

wave speed = frequency × wavelength

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Question 1 starts on page 4

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Answer **all** the questions.

1 Isobel uses a remote control to adjust her TV set.

(a) The remote control uses a beam of infrared to carry information to the TV set.
Infrared is part of the electromagnetic spectrum.

(i) Here is a partly completed table of the electromagnetic spectrum.

	microwaves		**visible light**		**X-rays**	

frequency

Write **infrared** in the correct space in the table. [1]

(ii) Here are some statements about electromagnetic waves.

A They have the same speed through space.

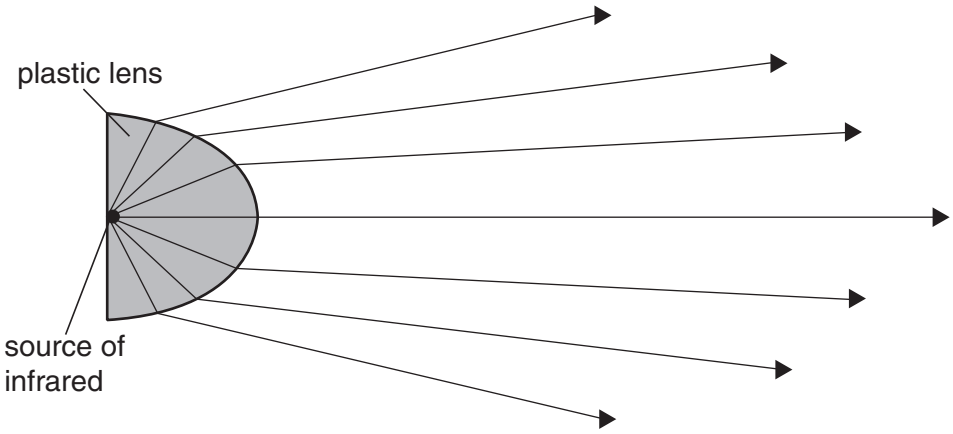
B They are strongly absorbed by water.

C They travel along long optical fibres.

Which statement, **A**, **B** or **C**, is true for **all** waves in the electromagnetic spectrum?

answer ..... [1]

(b) The source of the infrared from the remote control is in a plastic lens.



As the infrared leaves the plastic it changes direction.

Here are some possible reasons for this.

A The infrared refracts as it speeds up when it leaves the plastic.

B The infrared diffracts as it leaves the plastic.

C The infrared reflects from the surface of the plastic.

Which is the correct reason, **A**, **B** or **C**?

answer ..... [1]

(c) Finish the sentences. Choose words from the list.

digital
analogue
alternated
modulated

The infrared from the remote control must be ..... for it to carry information to the TV set.

The information is coded into the infrared by switching it on and off in short pulses.

This means that the remote control uses ..... transmission of information.

[2]

[Total: 5]

2 Jo uses a microwave oven to heat her dinner.

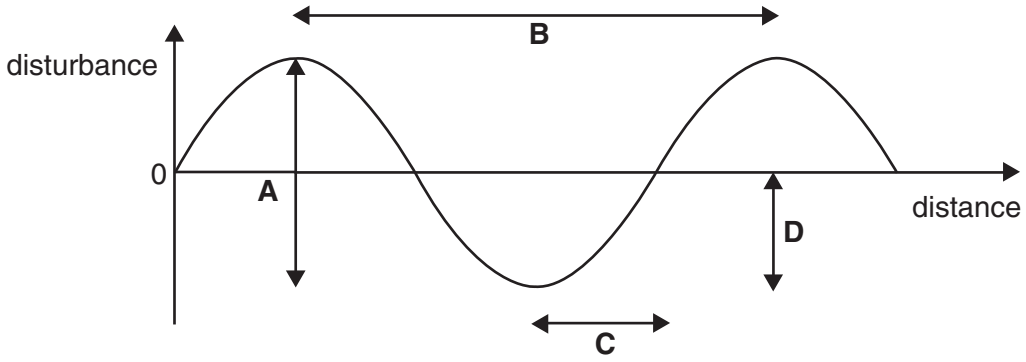
(a) These sentences are about the microwave oven.

Draw a straight line from the **start** of each sentence to its correct **end**.

start	end
The microwaves interfere ...	... by the water in the food.
The microwaves are reflected ...	... when they pass through a gap.
The microwaves are diffracted ...	... by the metal walls of the oven.
The microwaves are absorbed ...	... where they overlap with each other.

[3]

(b) This graph shows a microwave.



Which distance, **A**, **B**, **C** or **D**, is the wavelength of the microwave?

answer ..... [1]

[Total: 4]

3 Jenny is a presenter for Radio CA.

(a) She speaks into the microphone.
What does the sound wave carry from her mouth to the microphone?

Put a (ring) around the correct answer.

electricity **energy** **magnetism**

[1]

(b) Jenny sings a note into the microphone.
The sound wave has a frequency of 680 Hz and a wavelength of 0.5 m.

(i) Which of the following shows how to calculate the speed of the sound wave?

Put a (ring) around the correct answer.

$\frac{\textbf{680}}{\textbf{0.5}}$ **680 × 0.5** $\frac{\textbf{0.5}}{\textbf{680}}$

[1]

(ii) Finish these sentences about the note that Jenny sings.
Choose words from this list.

increases
decreases
doesn't change

The frequency of the note decreases from 680 Hz to 340 Hz.

The speed of the sound wave ..... .

The wavelength of the sound wave ..... .

[2]

(c) Radio CA uses radio waves to broadcast the sound of Jenny's voice.

Draw a straight line from each **wave** to its **type**.

wave	type
radio	standing
	transverse
sound	longitudinal

[1]

[Total: 5]

4 Jane has some copper.
She uses this to make copper sulfate.

(a) Jane uses one reaction from the **first** list and one from the **second** list.

Draw **one** straight line from the correct **first** reaction to the correct **second** reaction.

first	**second**
copper + oxygen → copper oxide	carbon dioxide + sulfuric acid → copper sulfate
copper + oxygen → copper sulfide	copper oxide + sulfuric acid → copper sulfate
copper + sulfur → copper oxide	copper oxide + sodium hydroxide → copper sulfate

[2]

(b) The copper sulfate Jane makes is not pure.
She uses these four steps to purify the copper sulfate.

They are in the wrong order.

A drying

B filtration

C dissolving

D crystallisation

Fill in the boxes to show the right order. The first one has been done for you.

C			

[2]

[Total: 4]

5 Bobby reacts magnesium with an acid to make hydrogen and magnesium sulfate.

(a) (i) Put a (ring) around the name of the acid that he uses.

hydrochloric acid **nitric acid** **sulfuric acid**

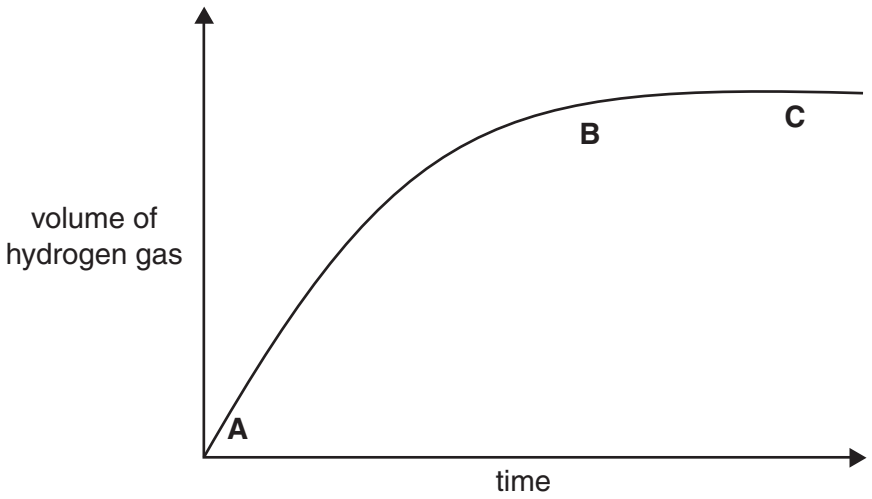
[1]

(ii) Put a (ring) around the formula of magnesium sulfate.

MgO **MgS** **$MgSO_4$**

[1]

(b) Bobby measures the total volume of hydrogen gas given off as the reaction takes place.



Three points on the graph are labelled **A**, **B** and **C**.
Put the correct letter in each box to show when the reaction is very fast, very slow or stopped.

very fast ☐

very slow ☐

stopped ☐

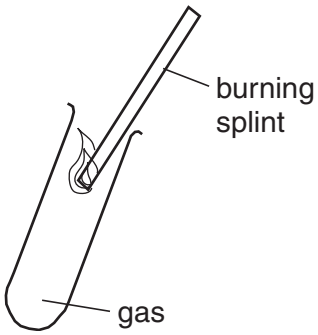
[2]

(c) Bobby puts a lighted splint into some hydrogen gas.

There is a loud 'pop'.

Here is the equation for the reaction.

$$2H_2 + O_2 \rightarrow 2H_2O$$



Here are some statements about this reaction.

Write **T** in the box next to each **true** statement and **F** in the box next to each **false** one.

	T (true) or **F** (false)
Some water is made.	
The water reacts with hydrogen.	
The hydrogen reacts with oxygen.	
The oxygen reacts with hydrogen.	
One molecule of hydrogen reacts with one molecule of oxygen.	
One molecule of hydrogen reacts with two molecules of oxygen.	
Two molecules of hydrogen react with one molecule of oxygen.	

[3]

[Total: 7]

6 Mary carries out a titration.

Here is a list of instructions that she uses. Some are in the wrong order.

A Fill the burette with acid.

B Take the first burette reading.

C Put 25 cm^3 of alkali solution into a conical flask.

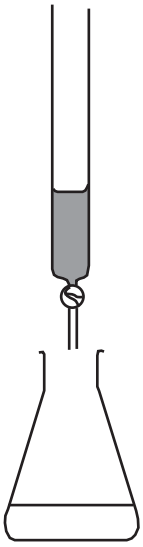
D Add indicator to the alkali.

E Take the second burette reading.

F Add acid drop by drop when the colour starts to change.

G Run acid from the burette into the flask, swirling at the same time.

H Stop adding the acid when the colour change is permanent.



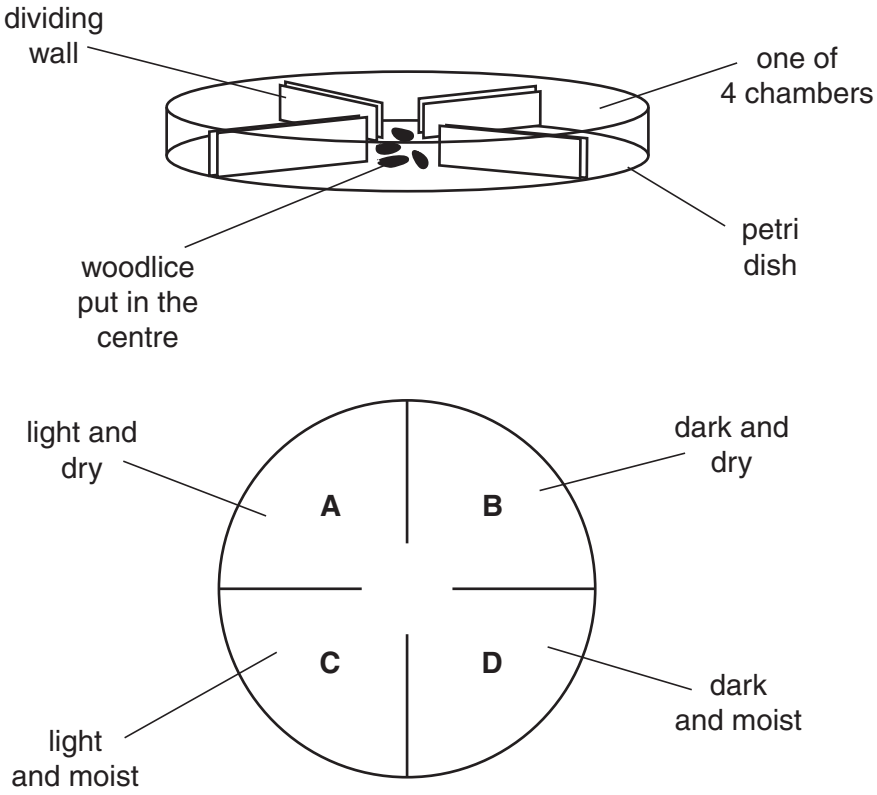
Fill in the boxes to show the right order. The first four have been done for you.

A	B	C	D				

[3]

[Total: 3]

7 Charlie carries out an experiment using woodlice.
He puts 20 woodlice into the centre of a petri dish so that they can move freely into four chambers, **A**, **B**, **C** and **D**. Each chamber has different conditions.



After five minutes, Charlie counts the woodlice in each chamber.
He records his results in a table.

chamber	chamber conditions	number of woodlice
A	light and dry	1
B	dark and dry	6
C	light and moist	4
D	dark and moist	9

(a) What is the percentage of woodlice found in chamber **D**?

Put a (ring) around the correct answer.

9% **20%** **45%** **90%**

[1]

(b) Put a tick (✓) in the box next to **each** statement which could be used to explain the behaviour of the woodlice in the experiment.

Woodlice are attracted to light.	☐
Woodlice are attracted to shade more than to moisture.	☐
Woodlice avoid too much moisture.	☐
Woodlice may dry out easily.	☐

[2]

(c) The behaviour pattern of the woodlice shown in this experiment is a reflex action. Finish the sentence. Choose a word from this list.

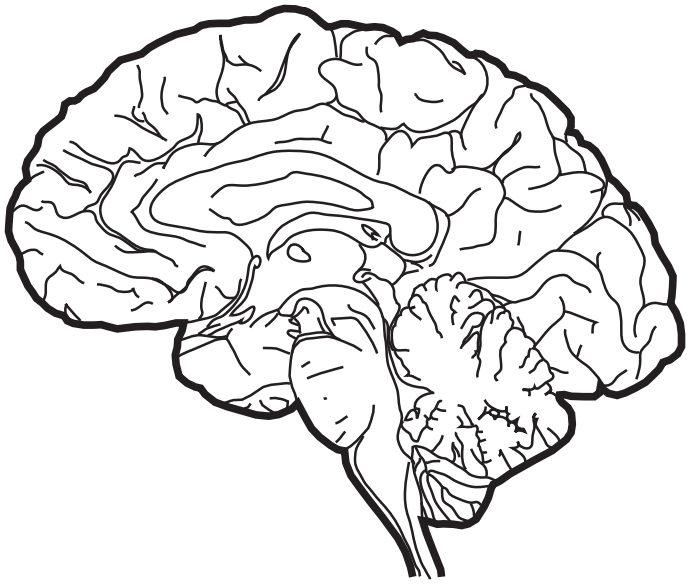
complex **involuntary** **voluntary**

Simple reflexes produce rapid ..... responses.

[1]

[Total: 4]

8 This question is about the cerebral cortex of the brain.



Complete the sentences using the best words from this list.

memory **balance** **intelligence** **body temperature**

The cerebral cortex is the part of the human brain most concerned with .....

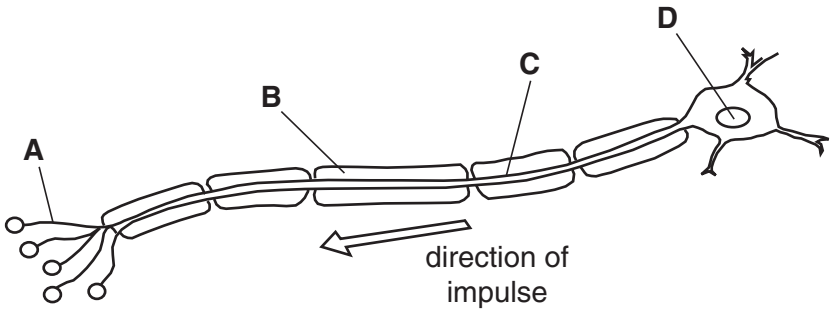
and ..... .

[2]

[Total: 2]

9 This question is about the human nervous system.

(a) The diagram shows a motor neuron.



Write the correct letter, **A**, **B**, **C** or **D**, in the box next to each label description.

label description	letter
axon	
cell nucleus	
fatty sheath	

[3]

(b) What are the functions of the fatty sheath?

Put a tick (✓) in the box next to each of the **two** correct answers.

to insulate the axon ☐

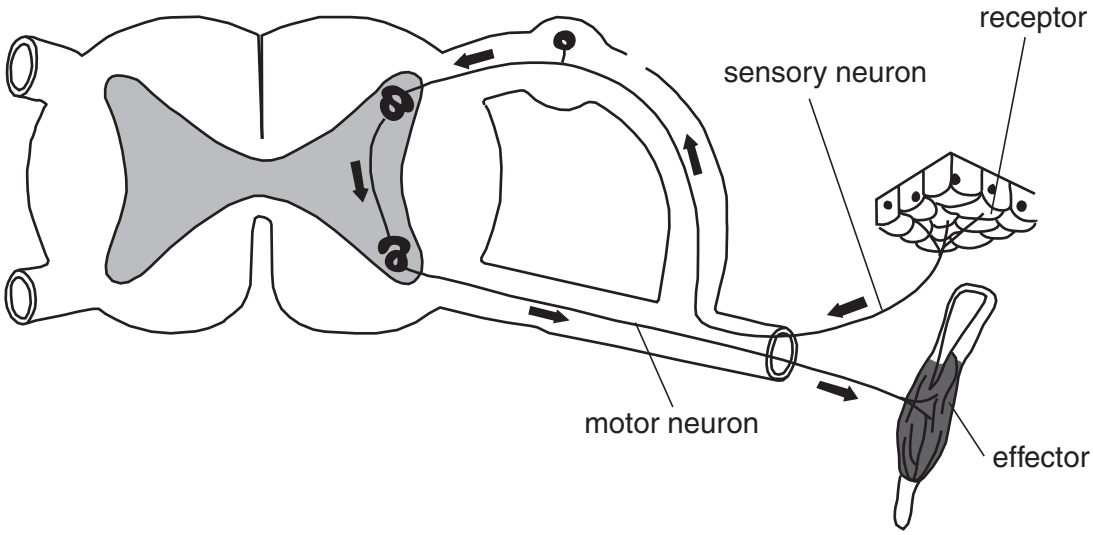
to insulate the cell nucleus ☐

to allow the nerve impulse to travel faster ☐

to improve the connection with other neurons ☐

[2]

(c) The diagram shows a reflex arc.



The reflex arc involves different parts of the nervous system.
Each part has a different task.

Draw a straight line from each **part** to its correct **task**.

part	task
effector	brings about a change in the body
motor neuron	carries the impulse away from the receptor
receptor	carries the impulse towards the effector
sensory neuron	detects a specific stimulus

[3]

[Total: 8]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
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

**** 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.