

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL SCIENCE A**

**A217/01**

Unit 3: Modules B6 C6 P6 (Foundation 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)

**Tuesday 22 June 2010  
Morning**

**Duration: 40 minutes**



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.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- This document consists of **16** pages. Any blank pages are indicated.

## TWENTY FIRST CENTURY SCIENCE EQUATIONS

### Useful Relationships

#### Explaining Motion

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

#### Electric Circuits

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

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

$$\text{power} = \text{potential difference} \times \text{current}$$

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

#### The Wave Model of Radiation

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

Answer **all** the questions.

- 1 Jane uses her mobile phone to talk to Mike.



- (a) Draw straight lines to join the **start** of each sentence to its correct **end**.

**start**

**end**

What Jane says ...

... is affected by noise.

The quality of the signal from Jane's phone ...

... is converted into a digital code.

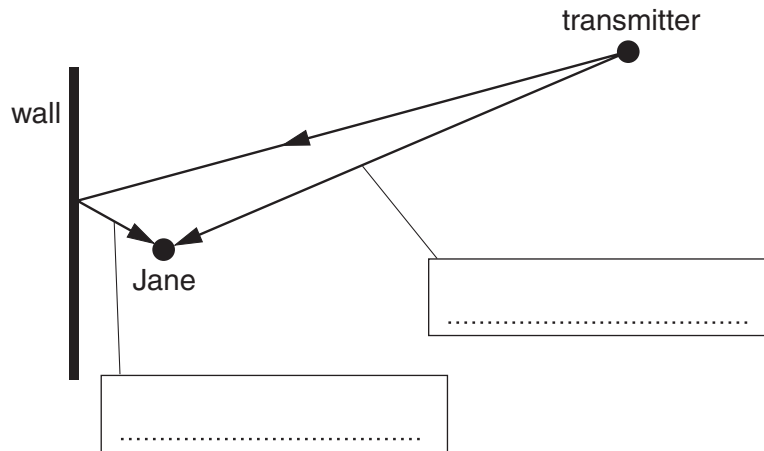
The wave from Jane's phone ...

... is modulated by the digital code.

[2]

(b) Jane stands close to a wall.

She finds that mobile phone reception is very bad close to the wall.



(i) Write the names of the two waves from the transmitter in the boxes.

Choose words from this list.

**absorbed**

**direct**

**reflected**

[1]

(ii) She thinks that the bad reception is due to **destructive interference**.

Describe the process of **destructive interference**.

.....

.....

..... [2]

[Total: 5]

2 Ted shouts, making a sound wave of frequency 1500Hz with a wavelength of 0.2m.



(a) What is the speed of the wave?

Put a **ring** around the correct answer.

30 m/s

300 m/s

3000 m/s

30 000 m/s

[1]

(b) Draw straight lines to link each **wave property** to its **meaning**.

**wave property**

**meaning**

intensity

waves per second

amplitude

energy per second

frequency

size of disturbance

wavelength

distance between crests

[2]

(c) Complete the sentences below using words from this list.

**increases**

**decreases**

**stays the same**

The sound wave travels away from Ted.

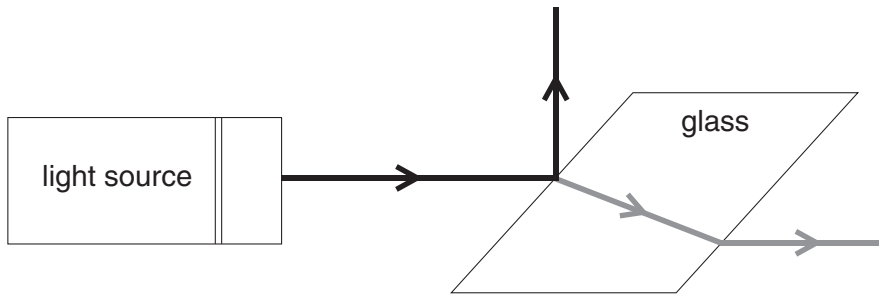
Its amplitude ..... as it travels away.

Its speed ..... as it travels away.

[1]

[Total: 4]

3 Fiona shines a beam of light onto a block of glass.



(a) When the light enters the glass it changes direction.

What is the name of this effect and why does it happen?

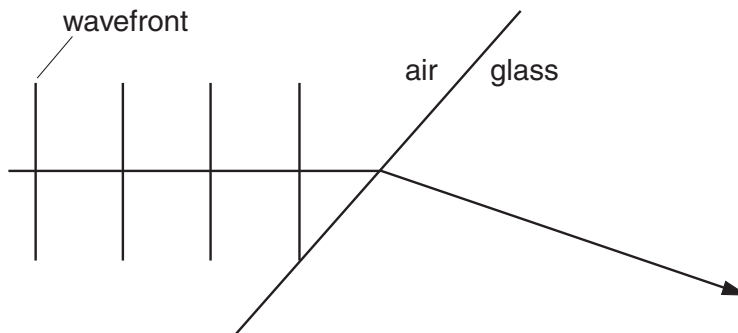
.....

.....

..... [2]

(b) The diagram shows four wavefronts of the light as it approaches the glass surface.

Draw on the diagram the four wavefronts when they are **inside** the glass.



[1]

(c) The light is an electromagnetic wave in the visible part of the spectrum.

Here are some electromagnetic waves.

**gamma rays**

**radio waves**

**visible light**

Write these waves into the correct boxes of the spectrum shown below.

	microwaves	infrared		ultraviolet	X-rays	
--	------------	----------	--	-------------	--------	--

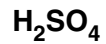
[2]

[Total: 5]

4 A chemical engineer chooses an acid to clean away corrosion from pieces of metal.

(a) Which of these formulas does **not** represent an acid?

Put a (ring) around the correct answer.



[1]

(b) The acid she chooses is corrosive.

Put a (ring) around the symbol which should go on the bottle of acid to show that the acid is corrosive.



[1]

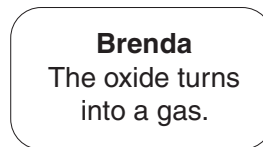
(c) The corrosion on the metal is made of metal oxide.

The metal oxide disappears when the acid reacts with it.

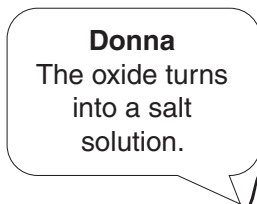
Some friends try to explain what happens to the oxide.



**Alex**  
The acid eats  
the oxide.



**Brenda**  
The oxide turns  
into a gas.



**Donna**  
The oxide turns  
into a salt  
solution.



**Charles**  
The acid  
burns the  
oxide away.

Who gives the **best** answer?

answer ..... [1]

(d) Acids will also react with alkalis.

(i) Put **rings** around the **two** alkalis in this list.



[2]

(ii) When an acid reacts with an alkali, two substances are formed.

What are they?

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

[Total: 7]



5 Daisy chooses an acid to clean metals.

Acids can be bought with different levels of purity.

Some are very pure. Others still contain impurities.

(a) Suggest and explain why she chooses an impure acid to clean metals.

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

(b) Daisy wants to find the pH of the acid before she uses it.

Give **two** ways that she could do this.

For each method

- state what she will use
- describe what she will see.

method one .....

.....  
.....

method two .....

.....  
.....

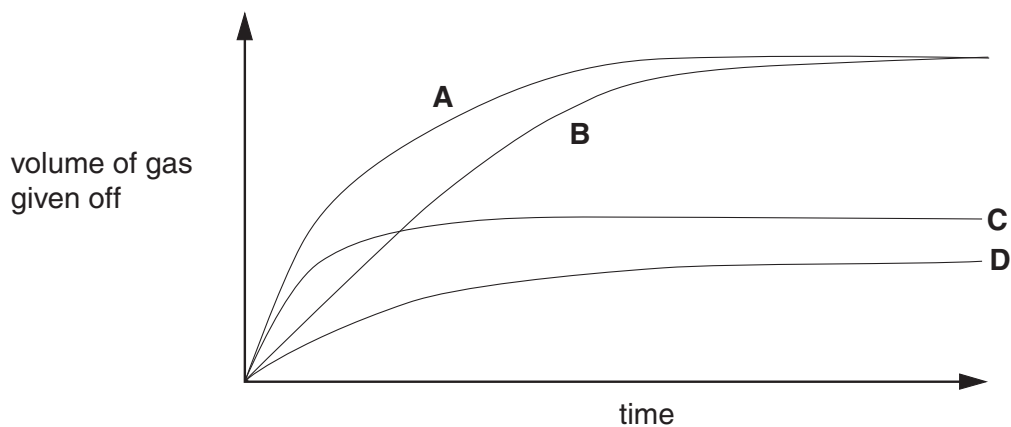
[2]

[Total: 4]

6 Some students react acid with an excess of marble chips.

They measure the amount of gas given off.

Here are the results of four different experiments, **A**, **B**, **C** and **D**.



(a) Which **two** experiments gave the same volume of gas at the end?

answer ..... and ..... [1]

(b) Which experiment gave off gas at the fastest rate at the start?

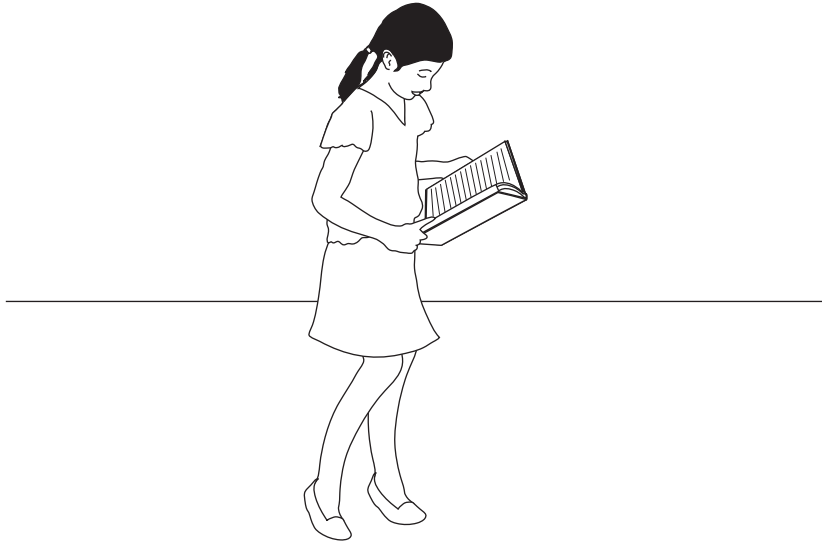
answer ..... [1]

(c) In which experiment did the reaction finish first?

answer ..... [1]

[Total: 3]

- 7 Amelia is learning the words for her part in the school play.



- (a) What is happening to the information in Amelia's memory as she rehearses the play?

Put a **ring** around each of the **two** words which best describe what is happening.

**duplication      loss      retrieval      storage      transmission**

[1]

- (b) The sentences below describe what happens in her brain.

Complete the sentences below using the **best** words from this list.

**axon      billions      experience**  
**hundreds      response      thousands      transmit**

Amelia's brain has ..... of neurons.

They can connect together to make pathways.

When she first reads her words, they are a new .....

This causes new pathways to form.

When she repeats the words, these new pathways are more likely to ..... impulses.

[2]

(c) After a week of rehearsals, some of Amelia's words in the play are changed.

She has to learn new words.

How is this possible?

Put a tick (✓) in the box next to the **best** explanation.

Some neurons will stop transmitting impulses.

New pathways are created by moving neurons around.

New experiences remove existing pathways in the brain.

The variety of potential pathways makes it possible to adapt to new situations.

[1]

[Total: 4]

8 Keith is sitting near a window.

A wasp disturbs him.

Keith tries to swat the wasp, but it avoids his hand.

The wasp keeps bumping into the window as it tries to escape.

(a) Put ticks (✓) in the boxes next to the **two** correct statements.

Simple reflexes have to be learnt.

Keith uses simple reflexes to swat the wasp.

The wasp quickly learns to avoid Keith's hand.

The wasp has difficulty in responding to new situations.

The wasp relies on reflex actions for most of its behaviour.

[2]

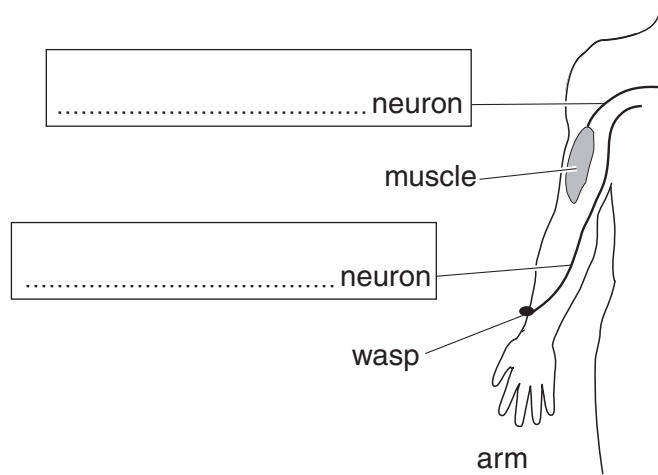
(b) (i) The wasp later lands on Keith's arm and stings him.

His arm quickly moves to shake the wasp off.

This is a reflex.

Add labels to the diagram by writing the names of the two neurons in the boxes. Choose words from this list.

**central                    motor                    peripheral                    sensory                    synapse**



[2]

(ii) The neurons in Keith's arm are part of a reflex arc.

Describe the operation of a reflex arc.

Your answer should include

- how information passes along the reflex arc
- where the neurons meet in the nervous system.

.....

.....

.....

.....

..... [3]

[Total: 7]

9 Scientists have studied the cerebral cortex of the brain.

(a) What is the cerebral cortex used for?

Put a **ring** around the **best** answer.

**balance**

**breathing**

**digestion**

**language**

[1]

(b) Give **two** methods used by scientists to map the cerebral cortex.

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

[Total: 3]

**END OF QUESTION PAPER**



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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0
	1 <b>H</b> hydrogen 1							4 <b>He</b> helium 2
		9 <b>Be</b> beryllium 4						20 <b>Ne</b> neon 10
	7 <b>Li</b> lithium 3	23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12		12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9
					28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17
					27 <b>Al</b> aluminium 13	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33
						65 <b>Zn</b> zinc 30	63.5 <b>Cu</b> copper 29	80 <b>Br</b> bromine 35
						59 <b>Ni</b> nickel 28	59 <b>Co</b> cobalt 27	112 <b>Cd</b> cadmium 48
						106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	127 <b>I</b> iodine 53
						103 <b>Rh</b> rhodium 45	197 <b>Au</b> gold 79	[222] <b>Rn</b> radon 86
						192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[210] <b>At</b> astatine 85
						190 <b>Os</b> osmium 76	201 <b>Hg</b> mercury 80	[209] <b>Po</b> polonium 84
						186 <b>Re</b> rhenium 75	204 <b>Tl</b> thallium 81	[222] <b>Rn</b> radon 86
						[98] <b>Tc</b> technetium 43	207 <b>Pb</b> lead 82	
						184 <b>W</b> tungsten 74		
						178 <b>Hf</b> hafnium 72		
						184 <b>W</b> tungsten 74		
						[264] <b>Bh</b> bohrium 107		
						[266] <b>Sg</b> seaborgium 106		
						[262] <b>Db</b> dubnium 105		
						[261] <b>Rf</b> rutherfordium 104		
						[227] <b>Ac*</b> actinium 89		
						[227] <b>La*</b> lanthanum 57		
						139 <b>La*</b> lanthanum 57		
						137 <b>Ba</b> barium 56		
						88 <b>Sr</b> strontium 38		
						89 <b>Y</b> yttrium 39		
						45 <b>Sc</b> scandium 21		
						48 <b>Ti</b> titanium 22		
						51 <b>V</b> vanadium 23		
						52 <b>Cr</b> chromium 24		
						55 <b>Mn</b> manganese 25		
						56 <b>Fe</b> iron 26		
						59 <b>Co</b> cobalt 27		
						59 <b>Ni</b> nickel 28		
						65 <b>Zn</b> zinc 30		
						70 <b>Ga</b> gallium 31		
						73 <b>Ge</b> germanium 32		
						75 <b>As</b> arsenic 33		
						79 <b>Se</b> selenium 34		
						80 <b>Br</b> bromine 35		
						84 <b>Kr</b> krypton 36		
						88 <b>Sr</b> strontium 38		
						89 <b>Y</b> yttrium 39		
						91 <b>Zr</b> zirconium 40		
						93 <b>Nb</b> niobium 41		
						96 <b>Mo</b> molybdenum 42		
						101 <b>Ru</b> ruthenium 44		
						103 <b>Rh</b> rhodium 45		
						106 <b>Pd</b> palladium 46		
						112 <b>Cd</b> cadmium 48		
						115 <b>In</b> indium 49		
						119 <b>Sn</b> tin 50		
						122 <b>Sb</b> antimony 51		
						127 <b>I</b> iodine 53		
						128 <b>Te</b> tellurium 52		
						131 <b>Xe</b> xenon 54		
						133 <b>Cs</b> caesium 55		
						137 <b>Ba</b> barium 56		
						87 <b>Fr</b> francium 87		
						88 <b>Ra</b> radium 88		
						[223] <b>Fr</b> francium 87		
						[226] <b>Ra</b> radium 88		
						[227] <b>Ac*</b> actinium 89		
						[261] <b>Rf</b> rutherfordium 104		
						[262] <b>Db</b> dubnium 105		
						[266] <b>Sg</b> seaborgium 106		
						[264] <b>Bh</b> bohrium 107		
						[277] <b>Hs</b> hasseium 108		
						[268] <b>Mt</b> meitnerium 109		
						[271] <b>Ds</b> darmstadtium 110		
						[272] <b>Rg</b> roentgenium 111		
						201 <b>Hg</b> mercury 80		
						204 <b>Tl</b> thallium 81		
						207 <b>Pb</b> lead 82		
						209 <b>Bi</b> bismuth 83		
						209 <b>Po</b> polonium 84		
						210 <b>At</b> astatine 85		
						222 <b>Rn</b> radon 86		
						Elements with atomic numbers 112-116 have been reported but not fully authenticated		

1 <b>H</b> hydrogen 1
--------------------------------

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.