

Wednesday 20 June 2012 – Morning

**GCSE 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)

Duration: 40 minutes



Candidate
forename

Candidate
surname

Centre number

Candidate number

MODIFIED LANGUAGE

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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- 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.
- 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 **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS**Useful Relationships****Explaining Motion**

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

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

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

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

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

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

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

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

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

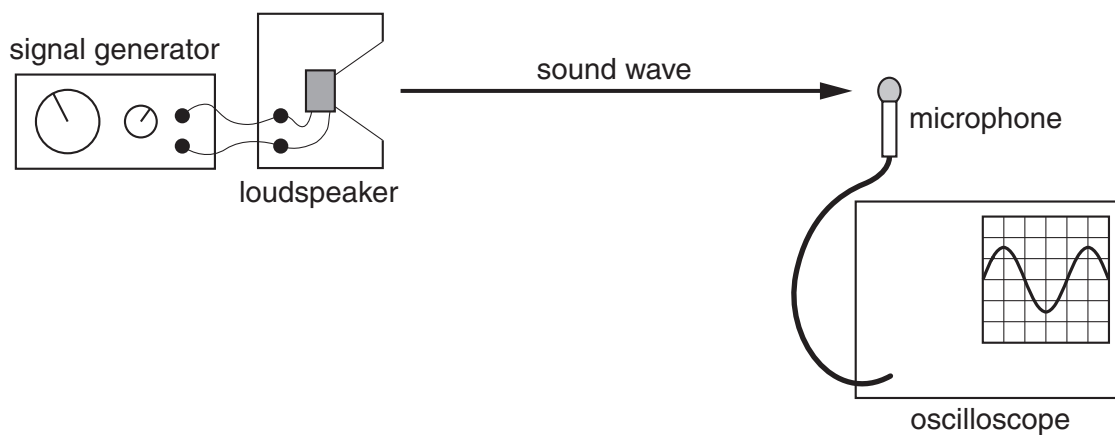
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Question 1 starts on page 4

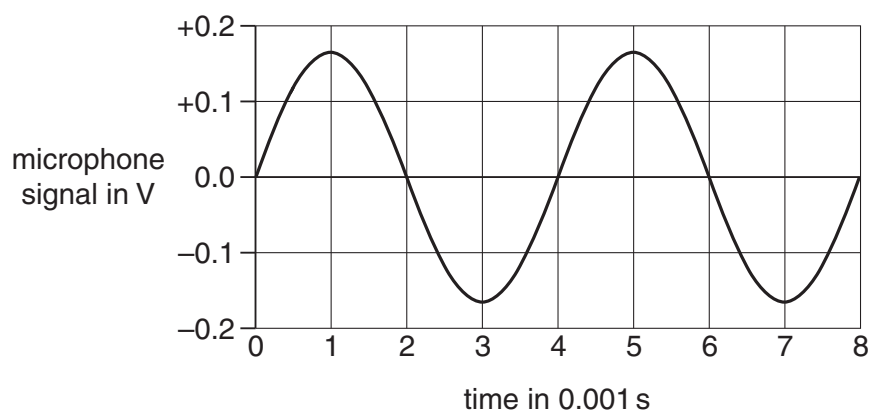
PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

- 1 Doris investigates sound waves with the apparatus below.



- (a) The oscilloscope screen shows this voltage-time graph for the microphone signal.



- (i) How should Doris calculate the frequency of the sound wave?

Put a ring around the correct calculation.

$$\frac{1}{8 \times 0.001}$$

$$\frac{1}{6 \times 0.001}$$

$$\frac{1}{4 \times 0.001}$$

$$\frac{1}{2 \times 0.001}$$

[1]

- (ii) Doris alters the signal generator to increase the frequency of the sound wave.

Complete each sentence by putting a **ring** around the correct option in **bold**.

The frequency of the sound increases.

The speed of the sound **decreases** / **increases** / **stays the same**.

So the wavelength of the wave **decreases** / **increases** / **stays the same**.

[1]

- (b) Doris knows that sound is a longitudinal wave.

Here are some statements about longitudinal waves moving **forwards** through solid matter.

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

They carry matter with them as they pass through.

☐

They do not have any effect on the matter as they pass through.

☐

They make matter move from side to side as they pass through.

☐

They make matter move backwards and forwards as they pass through.

☐

[1]

- (c) Complete the sentence about waves. Choose words from this list.

electromagnetic

empty space

solids

sound

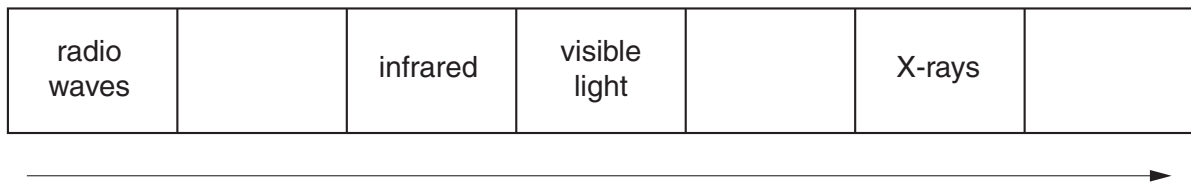
..... waves cannot pass through

[1]

[Total: 4]

2 Here is a diagram of the electromagnetic spectrum.

Some words are missing from the diagram.



(a) What wave property always increases from left to right in the diagram?

Put a ring around the correct property.

amplitude

frequency

speed

wavelength

[1]

(b) Write **microwaves** in the correct place on the diagram of the spectrum above.

[1]

(c) Mark uses a microwave oven to cook some food.

The walls of the oven are made of metal and the door has a metal grid.



Explain how microwaves can cook food safely inside the oven.

Your answer should include

- how the microwaves cook the food
- why the walls and door of the oven are made of metal.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 5]

- 3 Jack and Jill use two-way radios to communicate.



- (a) Jack talks into his radio.

How does this affect the radio waves emitted by the aerial?

Put a ring around the correct word.

accelerates

diffracts

modulates

refracts

[1]

- (b) Here are some possible reasons why radio waves might be used for communication.

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

Radio waves cannot be reflected.

☐

Radio waves are absorbed by the ground.

☐

Radio waves travel slower than sound waves.

☐

Radio waves pass through the air without being absorbed.

☐

[1]

- (c) Jill walks away from Jack as she listens to him on her radio.

The sound quality from her radio gets worse as she walks further away.

Explain why the sound quality decreases as Jill moves away.

.....

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.....

.....

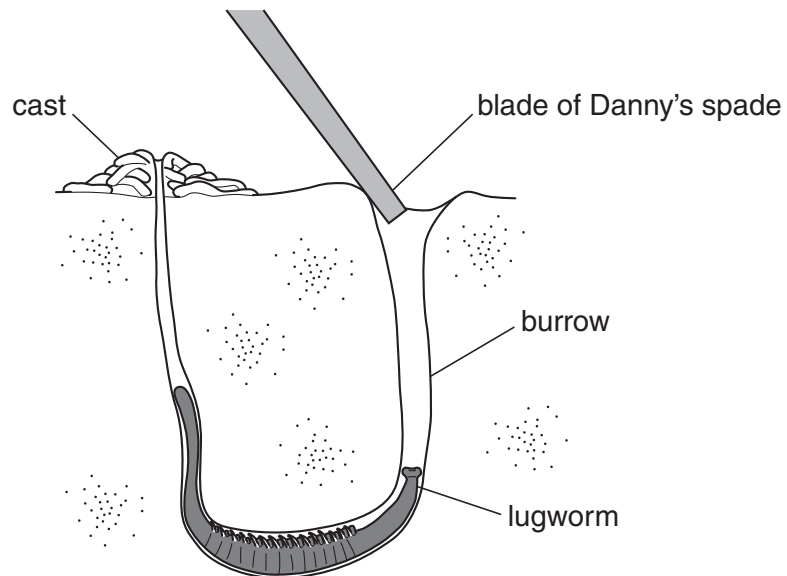
.....

..... [3]

[Total: 5]

- 4 Danny and James are digging for lugworms on the beach.

Lugworms are simple animals that burrow in the sand.



- (a) When Danny digs, the worm's muscles contract, helping it to escape.

Put a tick (✓) in the box next to the correct word to complete each sentence.

The sound of Danny digging is a

receptor	<input type="checkbox"/>
response	<input type="checkbox"/>
stimulus	<input type="checkbox"/>

for the lugworm.

The lugworm escapes using a

complex	<input type="checkbox"/>
simple	<input type="checkbox"/>
voluntary	<input type="checkbox"/>

reflex.

Lugworms rely on reflexes for

most	<input type="checkbox"/>
none	<input type="checkbox"/>
all	<input type="checkbox"/>

of their escape behaviour.

[2]

- (b) Danny's nervous system is more complex than the lugworm's.

Draw straight lines to connect each **part of Danny** to the correct **system**.

You should draw **four** lines.

part of Danny	system
brain	
sensory neurons	central nervous system
spinal cord	peripheral nervous system
motor neurons	

[2]

- (c) (i) On his previous holiday, James was told how to catch lugworms.

He remembers how to do this.

Put rings around the **two** words which correctly describe memory.

translating loss retrieval storage understanding

[2]

- (ii) James uses this memory from last year to catch lugworms.

Put a tick (✓) in the box next to the correct word to complete the sentence.

James is using his	short-term		verbal memory.
	medium-term		
	long-term		

[1]

[Total: 7]

- 5 Emma is learning the steps of a new dance.

Complete the sentences by choosing the best words from this list.

Each word may be used once, more than once, or not at all.

billions of

directions

neurons

less

hundreds of

a few

more

pathways

equally

Emma's brain has neurons.

These can make new as she practises the new steps.

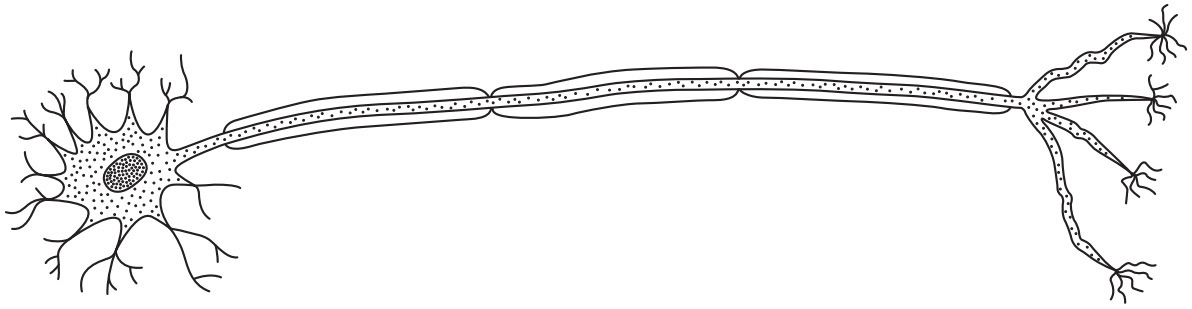
When Emma repeats the steps, these parts of her brain are

likely to transmit impulses.

[3]

[Total: 3]

- 6 This is a diagram of a motor neuron involved in a reflex arc.



- (a) Explain how this helps to produce rapid responses to changes in the environment.

Include ideas about the neuron and the reflex arc in your answer.

.....

.....

.....

.....

.....

..... [3]

- (b) The motor neuron can link to different cell types.

Put ticks (✓) in the boxes next to the **two** types of cell this motor neuron might send impulses to.

muscle cells	<input type="checkbox"/>
skin cells	<input type="checkbox"/>
retina cells	<input type="checkbox"/>
hormone secreting cells	<input type="checkbox"/>
cerebral cortex cells	<input type="checkbox"/>

[1]

[Total: 4]

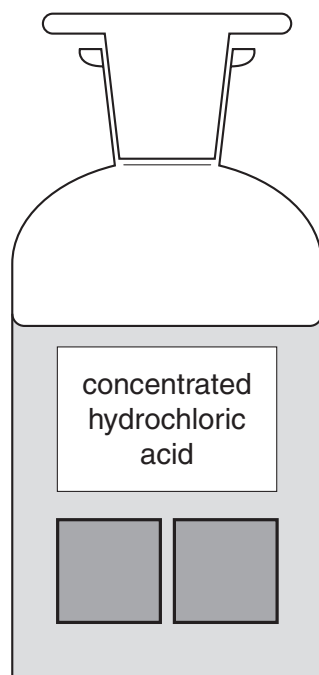





7 Nick's water tank is blocked up with limescale.

He removes the limescale with concentrated hydrochloric acid.

(a) Concentrated hydrochloric acid is toxic and corrosive.

Which two symbols should go on a bottle of the acid?

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

		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>

[1]

- (b) Limescale is made of calcium carbonate, CaCO_3 . It reacts with hydrochloric acid, HCl , to make calcium chloride, CaCl_2 , and water and a gas.

(i) What is the name of the gas?

Put a ring around the correct answer.

carbon dioxide

hydrogen

chlorine

oxygen

[1]

(ii) One of the substances made is a salt.

What is the name of this salt?

..... [1]

- (c) Nick adds a cupful of the acid to the limescale in the tank to remove the limescale.

Not all the limescale is removed.

When the acid is used up, he adds another cupful.

How can he tell when the acid is used up?

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

It stops fizzing.

☐

The acid goes green.

☐

The liquid disappears.

☐

The limescale catches fire.

☐

[1]

- (d) When Nick descales his kettle he uses a different acid.

He knows that when you put any acid into water it always produces the same ion.

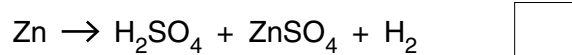
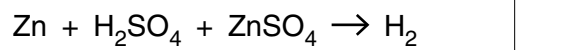
What is this ion?

..... [1]

[Total: 5]

8 Mary reacts pieces of zinc with sulfuric acid to make zinc sulfate and hydrogen gas.

(a) Put a tick (✓) in the box next to the correct equation for this reaction.



[1]

(b) It takes time for the zinc to react.

Mary knows that the reaction does not keep going at the same rate all the time.

She wants to find out how the rate of the reaction changes.

What should she measure, and when should she take her measurements?

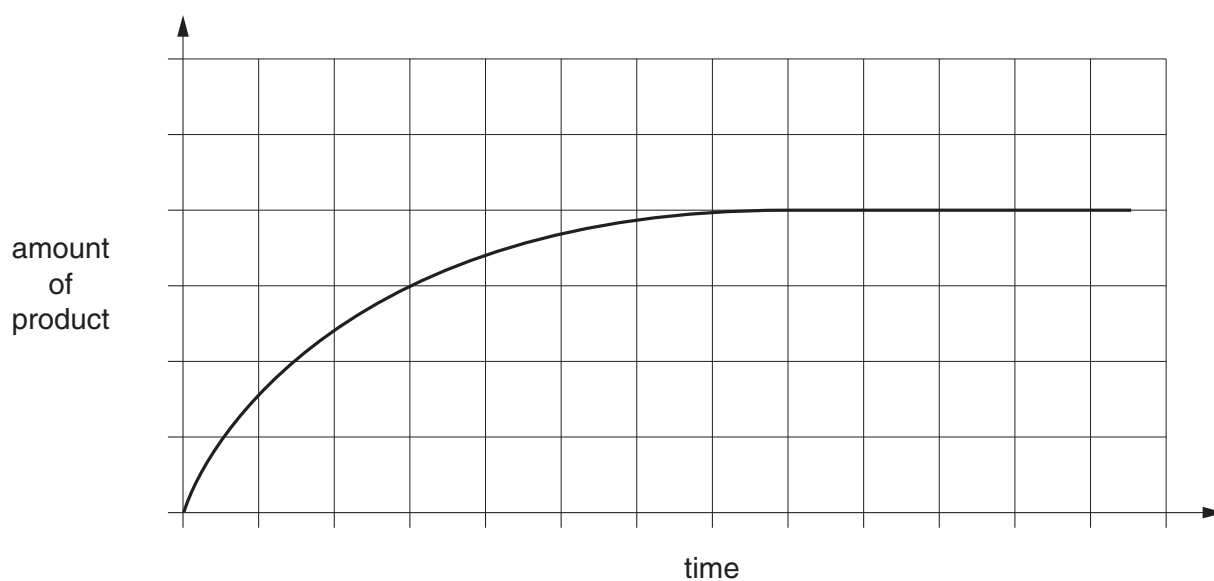
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.....

.....

..... [3]

(c) Mary plots a graph of the progress of her reaction.



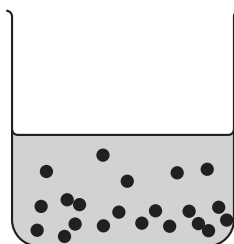
She does the experiment again.

The only difference is that this time she adds a catalyst.

On the graph draw a line to show the results of the experiment using the catalyst.

[2]

- (d) At the end of the reaction there is a solution of zinc sulfate with small pieces of zinc in the liquid.



Mary wants to make a clean, dry sample of the zinc sulfate.

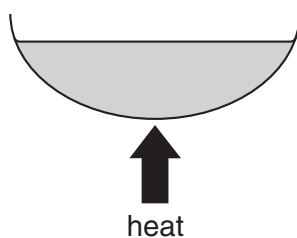
She puts the zinc sulfate solution and zinc into a filter funnel.



Put ticks (✓) in the correct boxes to complete the sentences.

This leaves	water	<input type="checkbox"/>	behind in the filter paper.
	zinc	<input type="checkbox"/>	
	zinc sulfate	<input type="checkbox"/>	

She heats the zinc sulfate solution.



Water from the solution goes into the air.

The water has ...

... crystallised.	
... dissolved.	
... evaporated.	
... neutralised.	

So that crystals can grow,
she stops heating when ...

... all the water has gone.	
... half the water has gone.	

She washes the crystals
and then she puts them in
a warm oven to ...

... dry.	
... melt.	
... purify.	

[3]

[Total: 9]

END OF QUESTION PAPER

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The Periodic Table of the Elements

20

1	2	Key										3	4	5	6	7	0		
1 H hydrogen 1		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								

* 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.