

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

Unit 2: Modules B5 C5 P5
 (Foundation Tier)

A216/01



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)

Wednesday 24 June 2009
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, 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.
- 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

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

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

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

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

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

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

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

Electric Circuits

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

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

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

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

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

The Wave Model of Radiation

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

BLANK PAGE

Question 1 starts on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Erupting volcanoes give out a mixture of gases.



(a) The information below shows some gases given out by a volcano.

(i) Draw straight lines to join the **name** of each gas to its **formula**.

name

formula

carbon dioxide

H2S

hydrogen sulfide

CO

carbon monoxide

SO2

sulfur dioxide

CO2

[2]

(ii) Only one of these gases is normally present in the atmosphere.

Name the gas.

..... [1]

(b) Mary knows two important things about gases in the air.

- the size of the particle
- the type of particle.

Put a **(ring)** around the best term in each pair.

Gases in the air are made of **large** **small** particles.

The particles are **molecules** **giant structures**.

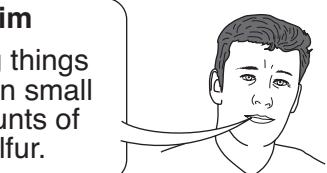
[1]

(c) Some of the gases from a volcano are sulfur compounds.

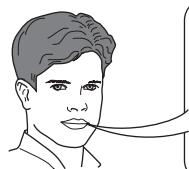
Mary asks her friends if sulfur is in living things.



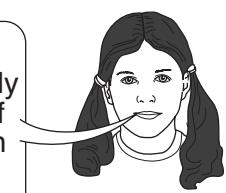
Su
Living things
don't contain
sulfur.



Jim
Living things
contain small
amounts of
sulfur.



Mike
Living things
contain large
amounts of
sulfur.



Kate
Living things only
contain sulfur if
they have been
poisoned.

Who gives the **best** answer?

answer [1]

[Total: 5]

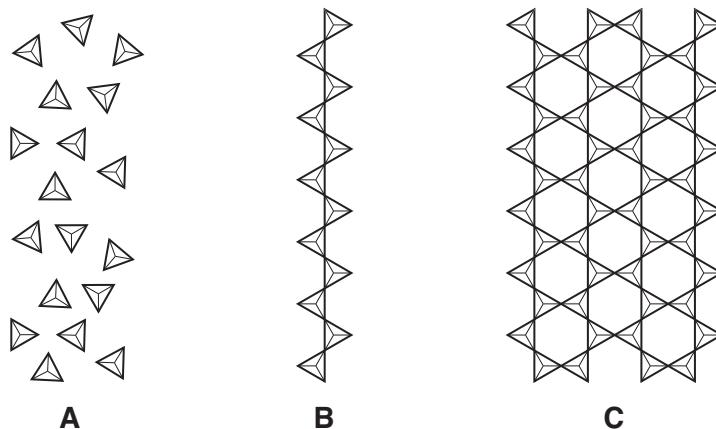
2 Volcanic lava can be runny or it can be stiff.

Volcanoes with stiff lava often explode dangerously.

Lava is made of silicon compounds.

The more links there are within a compound, the stiffer the lava.

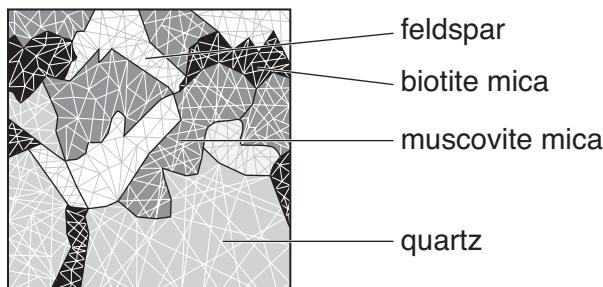
(a) Here are some of the particles of different silicon compounds in molten lava.



Which compound, **A**, **B**, or **C**, is most likely to be in runny lava?

answer [1]

(b) Molten rock sometimes cools to form granite.



(i) Granite contains crystals of different minerals.

Only one of these minerals is mainly made of silicon dioxide.

The other minerals are more complicated compounds of silicon.

Put a **ring** around the **one** mineral that is mainly made of silicon dioxide.

biotite mica

feldspar

muscovite mica

quartz

[1]

(ii) Here are some statements about silicon dioxide.

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

It is soft.

It has a low boiling point.

It has a high melting point.

It does not dissolve in water.

It conducts electricity when solid.

[2]

[Total: 4]

3 Mark finds this table in a text book.
It shows that different parts of the Earth's crust have different compositions.

	percentage in mantle	percentage in oceanic crust	percentage in continental crust
iron compounds	8	9	7
silicon compounds	45	49	60
calcium compounds	3	11	6
aluminium compounds	3	16	15
magnesium compounds	38	9	3

(a) Use a word from this list to complete the sentence.

aluminium calcium iron magnesium silicon

The continental crust has the highest percentage of compounds. [1]

(b) The compounds are not spread evenly, but often occur in deposits.

Some of these deposits contain magnesium carbonate.

Magnesium can be extracted from magnesium carbonate.

The first stage is to heat the magnesium carbonate to make magnesium oxide.



(i) Give the formula of one chemical in the equation which is a solid.

answer

Give the formula of one chemical in the equation which is a gas.

answer [1]

(ii) The magnesium then needs to be extracted from the magnesium oxide.

Mark knows that carbon will take the oxygen away from many metal oxides.

Complete the sentence.

Choose a word from this list.

dissolves evaporates neutralises reduces

When carbon takes oxygen away from a metal oxide, it the metal oxide. [1]

(c) Mark finds that the reaction does **not** work with carbon and magnesium oxide.

Put a tick (✓) in the box next to the most likely reason for this.

The magnesium is too reactive to be extracted this way.

The magnesium oxide has too high a melting point.

The magnesium oxide is too dense.

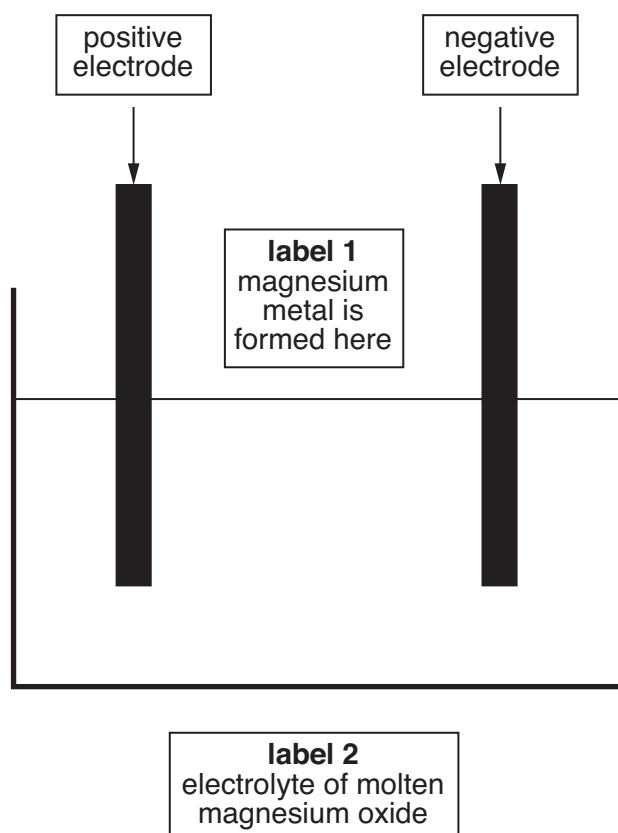
The magnesium oxide is too hot.

[1]

(d) He finds out that magnesium can be extracted by electrolysis.

One way might be to electrolyse molten magnesium oxide.

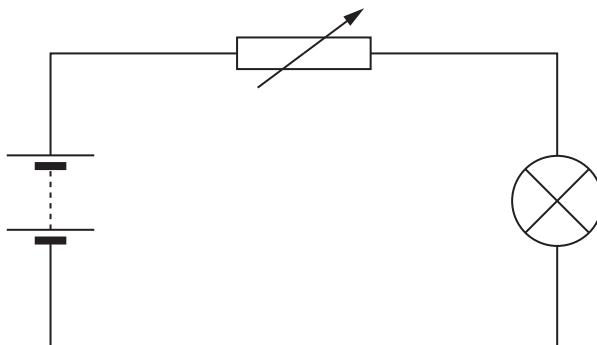
Complete labels 1 and 2 by drawing arrows to the correct parts of the diagram.



[2]

[Total: 6]

4 Sylvia sets up this circuit.



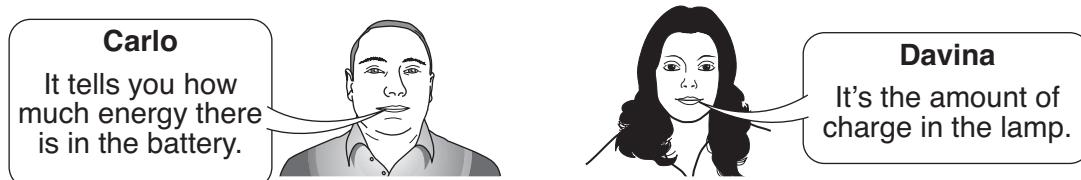
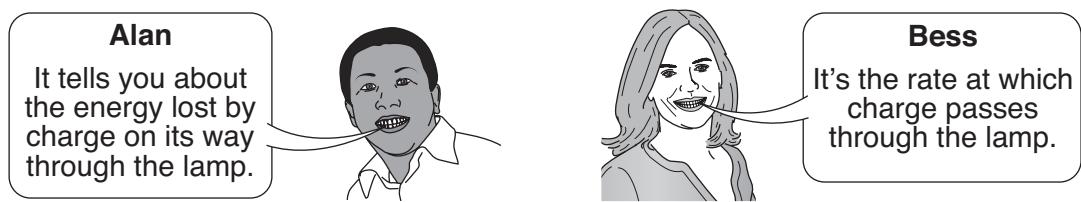
(a) Sylvia decides to measure the potential difference **across** the lamp.

Draw on the circuit diagram to show how she connects a voltmeter.

Use the correct symbol.

[1]

(b) The voltmeter across the lamp reads 4 V. Sylvia asks her friends what this means.



Who has the **best** answer?

answer [1]

(c) (i) Sylvia adjusts the variable resistor.

These four sentences explain why the brightness of the lamp changes.

They are in the **wrong** order.

- A The lamp gets dimmer.
- B The power of the lamp decreases.
- C The current in the resistor decreases.
- D The resistance of the circuit increases.

Put the sentences in the **correct** order. The last one has been done for you.

			A
--	--	--	---

[1]

(ii) Complete the sentences for the variable resistor.

Choose words from this list.

decreases **increases** **stays the same**

Sylvia adjusts the variable resistor.

The current in the variable resistor decreases.

The voltage across the variable resistor

The voltage across the battery

[1]

[Total: 4]

5 Brian has an electric toothbrush.



He connects it to the mains supply through a transformer.

(a) Complete the sentence about the transformer.

Choose words from the list.

copper iron plastic wood

A transformer is two coils of wire wound on a core made of

[1]

(b) The transformer is connected to the mains supply.

What is the voltage of the UK mains supply?

Put a (ring) around the correct answer.

13 V 50 V 230 V

[1]

(c) How does the transformer work?

Put a (ring) around the correct word in each pair.

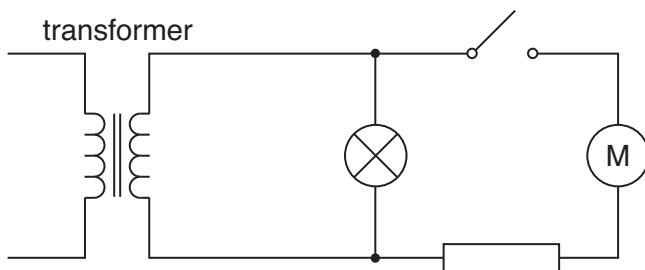
The transformer produces a lower **voltage** **current** than the mains supply.

The current in one coil makes **a magnetic** **an electric** field through the other coil.

Changes in that field induce a **voltage** **charge** in the other coil.

This is because the mains supply provides **alternating** **direct** voltage. [2]

(d) Here is the circuit diagram for Brian's toothbrush.

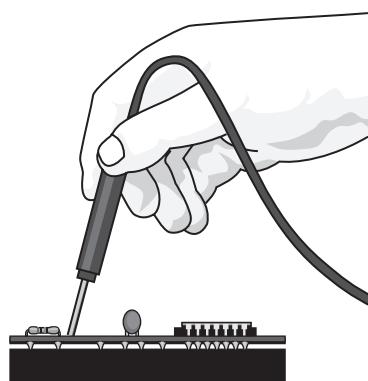


The circuit includes a switch to turn on the motor in the toothbrush.

Put a (ring) around the switch. [1]

[Total: 5]

6 Joe tests a circuit from his computer.



He needs to be careful. The chips in the circuit are easily damaged by static electricity.

(a) The sentences describe how Joe becomes charged as he walks across the floor towards his circuit.

They are in the **wrong** order

- A Joe sets off towards the circuit.
- B This makes Joe electrically charged.
- C His shoes rub against the floor as he walks.
- D This transfers electrons from Joe to the floor.

Put the sentences in the correct order. The last one has been done for you.

			B
--	--	--	---

[1]

15

(b) Electrons are transferred from Joe to the floor.

Use straight lines to join the **start** and **end** of the sentences.

start**end**

Joe now has ...

... opposite charges.

The electrons have ...

... a positive charge.

Joe and the floor end up with ...

... a negative charge.

[2]

(c) Joe gets rid of any static electricity by touching a metal water pipe.

Which statement below explains this?

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

Metals contain no electrons at all.

Metals and people always have different charge.

Metals have lots of electrons which are firmly held.

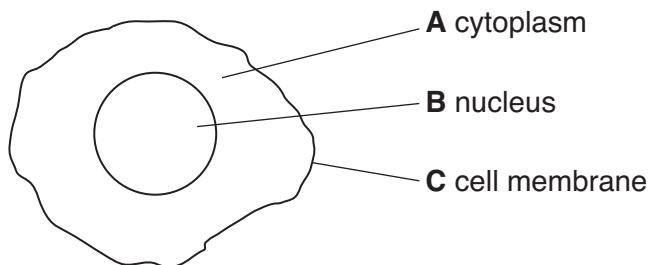
Metals have lots of electrons which can move freely.

[1]

[Total: 4]

7 Cells contain the genetic code for making proteins.

Look at this diagram of a cell.



(a) (i) Which part of the cell, **A**, **B**, or **C**, contains the genetic code?

answer [1]

(ii) In which part of the cell, **A**, **B** or **C**, are proteins made?

answer [1]

(b) The genetic code is made of DNA.

Which of these statements is the best description of DNA?

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

a ladder with rungs made from amino acids

two strands twisted into a double helix

a protein molecule that can copy itself

a bundle of tightly wrapped fibres

[1]

[Total: 3]

8 (a) The cell cycle can be divided into **cell growth** and **mitosis**.
Here are some statements about the cell cycle.

- A The number of organelles increases.
- B DNA molecules split into two strands.
- C The cell divides and becomes two separate cells.
- D Copies of the chromosomes separate.
- E The newly formed DNA strands are copied.

Put the letters **A**, **B**, **C**, **D** and **E** into the correct column of the table to show where in the cell cycle the processes take place.

cell growth	mitosis

[3]

(b) **Meiosis** is another way that cells can divide.

Here are some statements about the results of mitosis and meiosis.

Put **one** tick (✓) in each row in the correct box.

statement	true for mitosis	true for meiosis	true for both
number of chromosomes in daughter cells decreases			
daughter cells are identical to parent cell			
can produce gametes			
the number of cells increases			
daughter cells are identical to each other			

[4]

[Total: 7]

9 Many plants can be grown from seeds or from cuttings.

(a) Why are cuttings preferred by some gardeners?

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

They can be grown in a greenhouse.

The features of the new plant are known.

They are more expensive than buying seeds.

There is more variety in the plants that grow.

[1]

(b) Which cells in a plant can develop into any other kind of plant cell?

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

phloem cells

root hair cells

unspecialised cells

xylem cells

[1]

(c) When a cutting is taken, it can be dipped into a powder.

This helps it to develop roots.

(i) What does this powder contain?

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

nutrients

hormones

enzymes

[1]

19

(ii) How is the cutting able to produce new leaves, roots and flowers?

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

All plant cells can change from one type to another.

There are always some unspecialised cells in the plant.

All the cells in a plant are identical.

Plant stems contain all the different types of plant cell.

[1]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0
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 aluminum 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
85 Rb rubidium 37	88 Sr strontium 38	91 Y yttrium 39	93 Nb niobium 40	96 Mo molybdenum 42	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	190 Re rhenium 75	192 Ir iridium 77
[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	[268] Mt meitnerium 109
[277] Hs hassium 108	[277] Ds darmstadtium 110	[271] Rg roentgenium 111					

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1	H	hydrogen
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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.