

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

A216/01

Unit 2: Modules B5 C5 P5 (Foundation Tier)

Candidates answer on the question paper.
A calculator may be used for this paper.

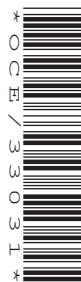
OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

**Tuesday 28 June 2011
Morning**

Duration: 40 minutes



Candidate forename		Candidate surname	
Centre number		Candidate number	

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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

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

3

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Question 1 starts on page 4

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4

Answer **all** the questions.

- 1 When the Romans came to Britain they extracted lead from mines in Somerset.

The chemical symbol for lead is **Pb**, which comes from its Roman name.

Lead ore contains lead sulfide.

Lead sulfide is a compound of lead and sulfur only.

- (a) Put a ring around the formula of lead sulfide.

Pbs**PBS****PbS****PbSO₄**

[1]

- (b) Lead ore contains impurities as well as the lead sulfide.

Roman lead ore contained 10 tonnes of lead in every 100 tonnes of ore.

Ores mined today do not have as much lead.

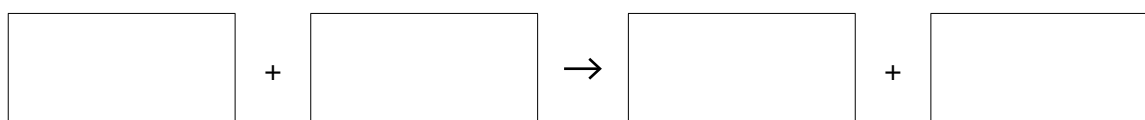
Suggest why modern ores have less lead than Roman ores.

.....

..... [2]

- (c) Lead oxide reacts with lead sulfide to make lead and sulfur dioxide.

Fill in the boxes to complete a word equation for this reaction.



[1]

5

- (d) Some substances are left over after the lead is extracted.

One of these is silicon dioxide – silicon dioxide is a solid.

Sulfur dioxide is also produced – sulfur dioxide is a gas.

Complete the table about solid silicon dioxide and sulfur dioxide gas.

For **each** description put **one** tick (✓) in the correct column to show whether it is true for **silicon dioxide only**, **sulfur dioxide only**, **both** or **neither**.

description	silicon dioxide only	sulfur dioxide only	both	neither
has a high melting point				
has a low melting point				
has covalent bonds				
has ionic bonds				
is a giant structure				
is a simple molecular compound				
has weak forces between molecules				

[4]

- (e) The Romans used lead to line water troughs because it could be bent so easily. They also used it to make heavy weights, and they would fill gaps between stones with melted lead.

Draw lines to link each **use** of lead to the **property** that makes it so useful.

use	property
line water troughs	lead has a low melting point
heavy weights	lead is dense
filling gaps in stones	lead is malleable

[2]

6

(f) World production of lead is about 8500 million tonnes a year.

Of this, about 4000 million tonnes are made from lead ore.

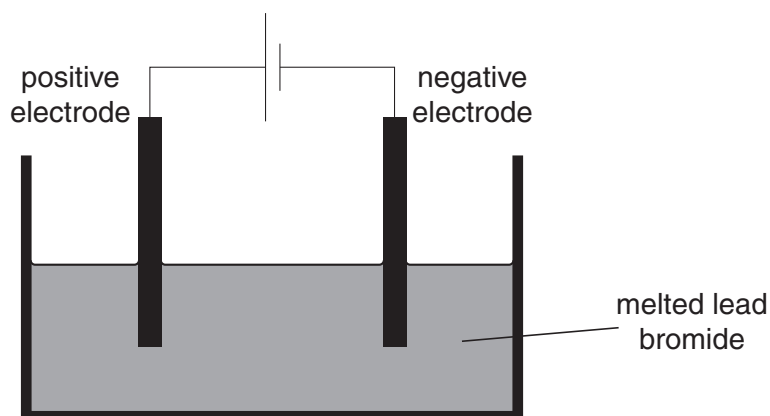
(i) What percentage of the world's lead is made from the ore?

Put a ring around the correct answer.

2.125% 47% 50% 53%

[1]

(ii) Mary knows that some compounds can be broken down by electrolysis.



She electrolyses melted lead bromide using carbon electrodes.

The lead bromide breaks down into a gas, bromine, and a dense liquid, lead.

State briefly

- how will she know that bromine gas is being formed
- where will the bromine be formed
- where will the lead be formed?

.....

.....

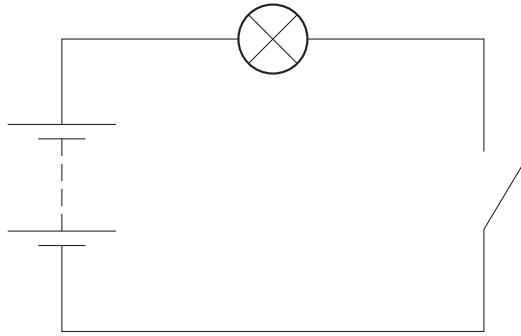
.....

..... [3]

[Total: 14]

7

2 Jo builds this circuit.



(a) She has a switch in her circuit.

Put a (ring) around the switch.

[1]

(b) Draw straight lines to link each **component** in the circuit to **its job in the circuit**.

component	its job in the circuit
lamp	pushes charge around the circuit
switch	heats up as charge flows through it
battery	changes resistance from very large to very low

[2]

(c) Jo presses the switch.

The lamp lights up.

Describe what is happening **in the circuit** when the lamp lights up.

Use the terms **charge** and **energy** in your answer.

.....

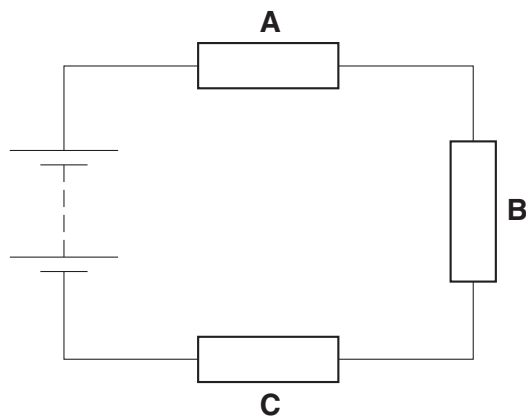
.....

..... [2]

[Total: 5]

8

- 3 This circuit has three identical resistors, **A**, **B** and **C**, in series with a battery.



- (a) Here are some statements about the circuit.

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

Resistor **B** has the greatest current.

☐

All three resistors have the same current.

☐

Resistor **C** has a larger current than resistor **A**.

☐

[1]

- (b) The battery provides a potential difference of 6V.

Which of these is another word for potential difference?

Put a ring around the correct word.

current

power

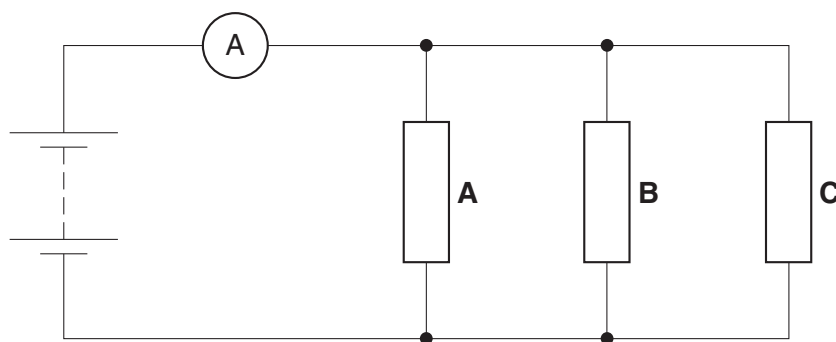
resistance

voltage

[1]

9

- (c) The three identical resistors are now connected in parallel to the battery.



The potential difference across the battery is 6V.

- (i) What is the potential difference across each resistor?

potential difference = V [1]

- (ii) The ammeter in the circuit reads 3A.

Calculate the power provided by the battery when the current is 3A.

power = W [1]

- (d) Complete the sentence below. Choose from these words.

force power speed

The battery delivers energy to the circuit.

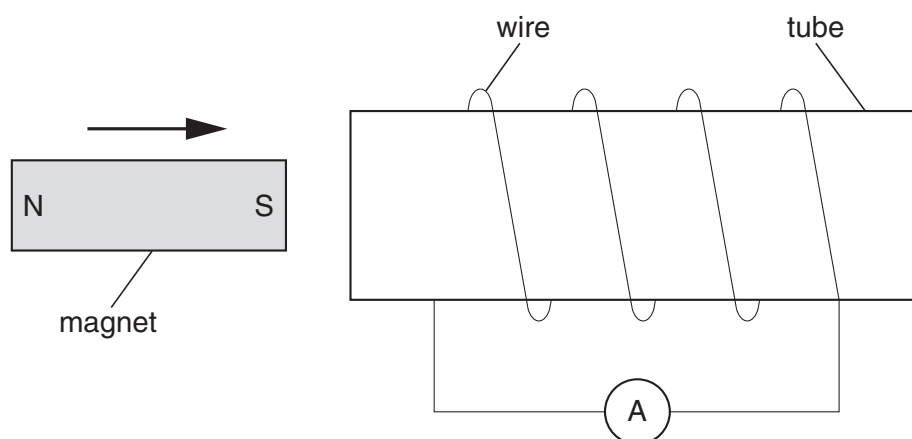
The rate at which it does this is called

[1]

[Total: 5]

10

- 4 Pete pushes a magnet into a tube.



- (a) There is a coil of wire around the tube.

Complete the sentences. Choose from these words.

charge**current****voltage****power**

As the magnet moves into the tube, a is induced across the ends of the coil.

This results in a in the ammeter.

[2]

- (b) Here are some ways of changing the reading of the ammeter.

Put ticks (✓) in the boxes next to the **two** ways which would **increase** the reading.

Increase the length of the tube.

☐

Decrease the length of the tube.

☐

Move the magnet more slowly into the tube.

☐

Move the magnet more quickly into the tube.

☐

Increase the number of turns of wire in the coil.

☐

Decrease the number of turns of wire in the coil.

☐

[2]

[Total: 4]

5 An animal cell contains proteins.

(a) DNA carries the instructions to make proteins.

Put a ring around the correct words to complete the sentences.

DNA molecules are made of **two** / **three** / **four** strands.

Each strand contains **two** / **three** / **four** different bases. [2]

(b) (i) Which part of the cell contains DNA?

..... [1]

(ii) Which part of the cell makes protein?

..... [1]

[Total: 4]

6 Labradors and poodles are breeds of dog.

A labrador mates with a poodle and produces a puppy.

The puppy has chromosomes from both the labrador and the poodle.



(a) The labrador has 78 chromosomes in each body cell.

The table shows chromosome numbers in each body cell of the labrador, the poodle and the puppy.

	chromosomes in labrador	chromosomes in poodle	chromosomes in puppy
A	78	78	156
B	78	78	78
C	78	46	46
D	78	39	39

Which row, **A**, **B**, **C** or **D**, is correct?

answer [1]

13

(b) The puppy cells have chromosomes from both parents.

Explain why the cells have chromosomes from both parents.

Include in your answer

- what type of cell division produces gametes
- what happens to the chromosome number when a gamete is formed
- what happens when the gametes fuse.

.....

.....

.....

..... [3]

[Total: 4]

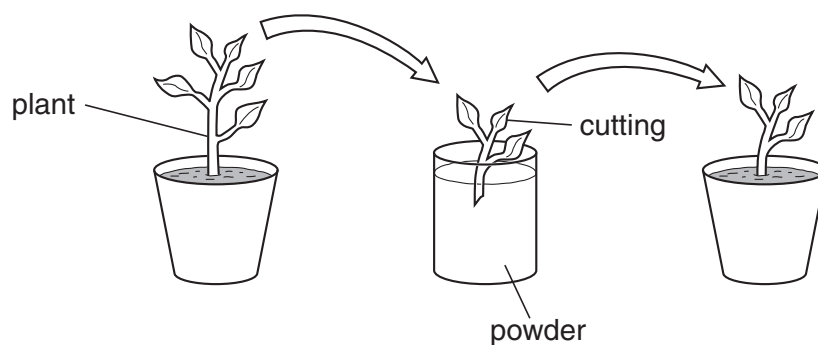
7 Ray grows plants for a garden centre.

He selects a healthy plant and takes a cutting.

He dips the cutting into a special powder.

The cutting grows into a clone of the original plant.

The diagram shows the process.



(a) Explain why he dips the cutting in special powder.

In your answer include

- what the powder contains
- what effect it has on the cutting.

.....

.....

..... [2]

15

(b) The cutting makes new cells when it grows.

Some cells can develop into different types of cells.

Draw **one** line from each **type of cell** to its correct **property**.

You should draw **three** lines only.

type of cell

phloem

meristem

xylem

property

can develop into
different types of cells

cannot develop into
different types of cells

[2]

(c) Both plants and animals grow.

Which statement is correct?

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

Animals and plants continue to grow in width and height all their lives.

☐

Animals and plants have some cells which continue to divide by mitosis.

☐

Animals and plants have only specialised cells.

☐

[1]

16

(d) What happens to chromosomes during mitosis?

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

Spare chromosomes die off.

☐

Chromosomes change their function.

☐

Chromosomes separate.

☐

Chromosomes link together.

☐

[1]

[Total: 6]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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1	2	Key										3	4	5	6	7	0						
		relative atomic mass atomic symbol name atomic (proton) number																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.