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OCR
RECOGNISING ACHIEVEMENT

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Tuesday 22 January 2013 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A152/01 Modules B5 C5 P5 (Foundation Tier)

A135730113

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: 1 hour

A152201

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. 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

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page 2.
- A list of qualitative tests for ions is printed on page 3.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

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

Explaining motion

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

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

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

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

Electric circuits

power = voltage × current

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

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

Radioactive materials

energy = mass × [speed of light in a vacuum]^2

TWENTY FIRST CENTURY SCIENCE DATA SHEET

Qualitative analysis

Tests for ions with a positive charge

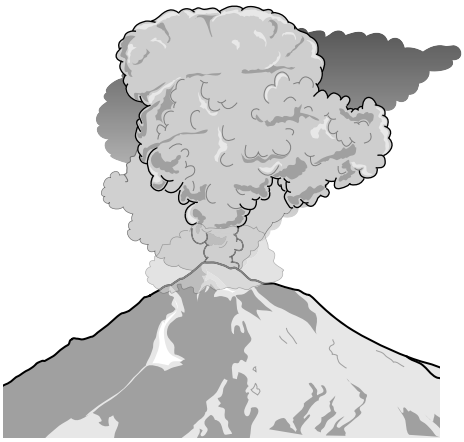
Ion	Test	Observation
calcium Ca^{2+}	add dilute sodium hydroxide	a white precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
copper Cu^{2+}	add dilute sodium hydroxide	a light blue precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(II) Fe^{2+}	add dilute sodium hydroxide	a green precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(III) Fe^{3+}	add dilute sodium hydroxide	a red-brown precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
zinc Zn^{2+}	add dilute sodium hydroxide	a white precipitate forms; the precipitate dissolves in excess sodium hydroxide

Tests for ions with a negative charge

Ion	Test	Observation
carbonate CO_3^{2-}	add dilute acid	the solution effervesces; carbon dioxide gas is produced (the gas turns lime water from colourless to milky)
chloride Cl^-	add dilute nitric acid, then add silver nitrate	a white precipitate forms
bromide Br^-	add dilute nitric acid, then add silver nitrate	a cream precipitate forms
iodide I^-	add dilute nitric acid, then add silver nitrate	a yellow precipitate forms
sulfate SO_4^{2-}	add dilute acid, then add barium chloride or barium nitrate	a white precipitate forms

Answer **all** the questions.

1 In 2010 a volcano erupted in Iceland.
Gases from the volcano pushed clouds of ash into the air.



(a) The gases inside the volcano were mainly carbon dioxide and steam.
Complete the table to show the formulas of these two gases.

carbon dioxide	
steam	

[2]

(b) Molten lava also came out of the volcano.
The lava contains a lot of silicon dioxide.
Suggest why the lava contains silicon dioxide.
Put a tick (✓) in the box next to the correct answer.

Silicon dioxide is present in large quantities in the Earth's crust. ☐

Silicon dioxide has a high melting point. ☐

All minerals are made of silicon dioxide. ☐

Silicon dioxide is only found in Iceland. ☐

[1]

(c) The clouds of ash spread thousands of miles.
Many flights across Europe were cancelled.

Information found on the internet says that:

- scientists think that the volcano gave off an estimated 150 000 tonnes of carbon dioxide each day
- about 17 000 flights were cancelled each day because of the volcano
- on average, a modern plane produces about 20 tonnes of carbon dioxide per flight.

(i) Some people say that the volcanic eruption meant that less carbon dioxide was put into the atmosphere each day.
Use the information above to explain if this is true. You should include a calculation in your answer.

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..... **[3]**

(ii) Look at the information above from the internet.
Some of the numbers may not be accurate.
Explain why some of the numbers may not be accurate.

The quality of written communication will be assessed in your answer.

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..... **[6]**

(d) Jet fuel is made of hydrogen and carbon.

The equation shows what happens when jet fuel burns.

jet fuel + oxygen $\longrightarrow$ carbon dioxide + water

The mass of the products is more than the mass of the fuel.
Explain why.

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

(e) Jet engines are hot enough to melt the silicon dioxide in the ash cloud from the volcano.
This damages the engines.
Silicon dioxide has a very high melting point.

Use your understanding of bonding and structure to suggest why silicon dioxide has a high melting point.

.....

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

[Total: 16]

2 There are several aluminium refineries in Iceland.

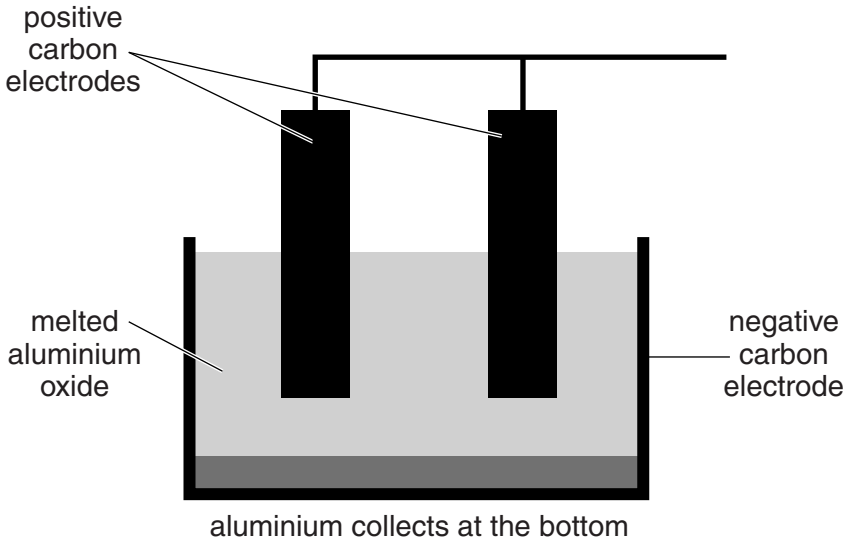
The refineries use an electric current to break down melted aluminium oxide.

(a) What do we call this process?
Put a (ring) around the correct answer.

electrolysis **electromagnetism** **precipitation** **solubility**

[1]

(b) The diagram shows a cell used in this process.



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

Melted aluminium oxide conducts electricity

better than	
the same as	
worse than	

solid aluminium oxide.

When the electric current is turned on, aluminium is formed at

the negative electrode.	
the positive electrode.	
both electrodes.	

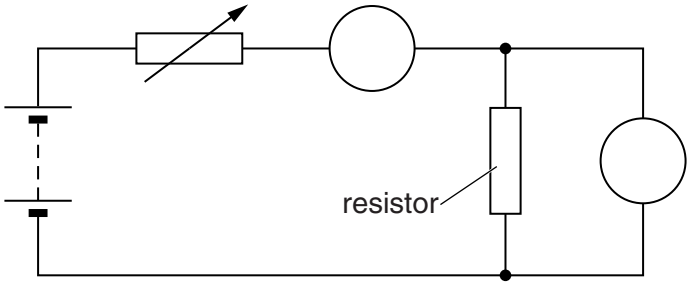
At the positive electrode

aluminium gas is formed.	
hydrogen gas is formed.	
oxygen gas is formed.	
the aluminium in the electrode dissolves.	

[3]

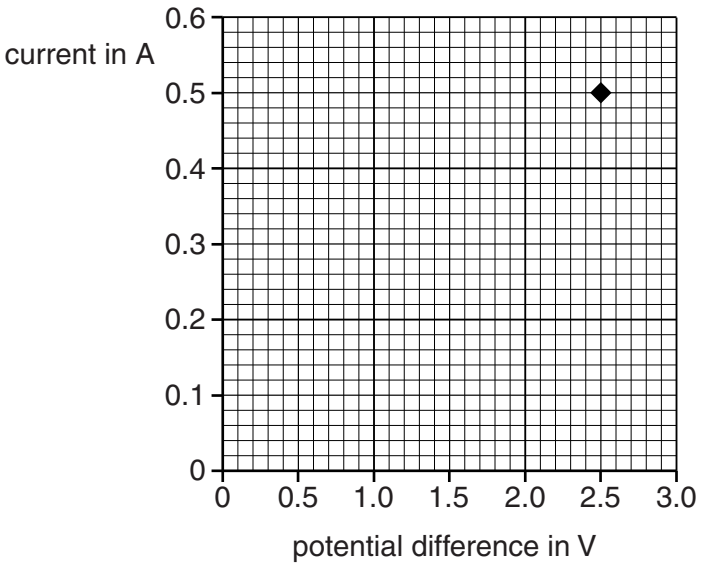
[Total: 4]

3 Jill uses this circuit to investigate a resistor.



(a) Both of the meter symbols are incomplete.
Complete the symbols for the two meters in the circuit. **[2]**

(b) Jill sets the current in the resistor to 0.50 A.
The potential difference across the resistor is 2.5 V.
Jill plots this first point on a current-voltage graph.



(i) Jill makes some more measurements with different values of current.
Draw the line on the graph that the remaining points should lie on. **[1]**

(ii) Jill notices the writing 4R7 on the resistor.
She thinks this means that its resistance is 4.7 Ω.
Does this agree with her measurement? Justify your answer.

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

(c) Jack is another student.
He repeats Jill's experiment immediately with the same resistor.
Jack's results give the resistance as 4.5 Ω.

(i) Suggest why this is **not** the same as Jill's value.

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..... **[1]**

(ii) What further evidence is needed to find the correct value of the resistance?

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

[Total: 8]

4 This question is about how an electric motor works.

Draw straight lines to link the **start** of each sentence about a simple electric motor to its correct **end**.

start	end
The coil spins ...	... the coil of wire.
The magnet provides ...	... a steady magnetic field.
The commutator reverses ...	... the current in the coil.
The current passes through ...	... as the field pushes on the wire.

[3]

[Total: 3]

5 Priyanka buys a generator to run her caravan lights.
She finds this information plate on the generator.

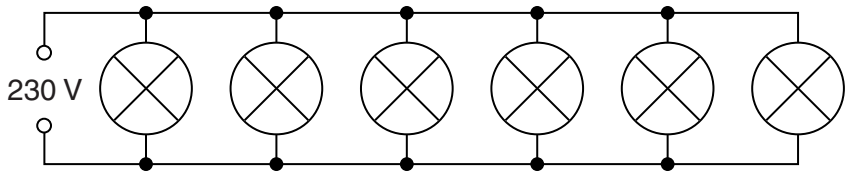
typical output 230 V
maximum current 4 A
frequency range 45 – 55 Hz

www.21Cgen.co.uk

(a) Calculate the maximum power output of the generator.

power = ... W **[1]**

(b) Priyanka's caravan has six lamps connected in parallel.



Each 230 V lamp needs a current of 0.5 A.
Will the generator be able to run the lamps? Justify your answer.

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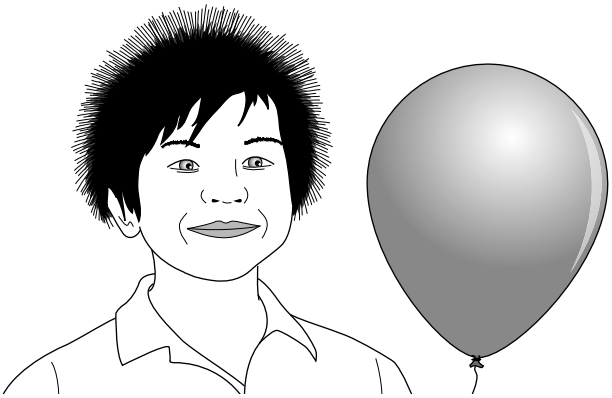
..... **[2]**

[Total: 3]

6 Jackie rubs a balloon against Sam's hair.
The hair sticks to the balloon.
When Jackie removes the balloon, Sam's hair stands on end for a few minutes.
His hair then slowly falls back down again.



Explain what happens to the balloon and the hair.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 6]

7 **(a)** This question is about DNA and the genetic code.

Complete the sentences.

Choose words from the list.

double **five** **four** **order** **single** **six**

size **structure** **triple**

DNA has a ..... helix structure.

Both strands of the DNA molecule are made of ..... different bases.

The genetic code is in the ..... of the bases.

[2]

(b) Which chemicals are made from the instructions in the genetic code?
Put a tick (✓) in the box next to the correct answer.

bases	☐
carbohydrates	☐
fats	☐
proteins	☐

[1]

(c) Ben reads about two different parts of an animal cell, part **A** and part **B**.

Part **A** contains DNA, but part **B** does not.

Copies of genes move from part **A** to part **B**.

What can you conclude about part **A** and part **B**?

Put a (ring) around the correct choice to complete each sentence.

Part **A** is the cell **cytoplasm / membrane / nucleus / vacuole**.

Part **B** is the cell **cytoplasm / membrane / nucleus / vacuole**.

[2]

[Total: 5]

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Question 8 begins on page 14

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8 Scientists are trying to use stem cells to treat multiple sclerosis, a disease that damages nerve cells.

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

Stem cells are

meiotic.	
specialised.	
unspecialised.	

Stem cells have

all	
none	
some	

of the same genes as damaged nerve cells.

Nerve cells have

all	
none	
some	

of their genes switched on.

[2]

(b) In multiple sclerosis the body's immune system attacks insulating cells in the brain and spinal cord.

Experiments in test tubes and on laboratory animals suggest that stem cells from bone marrow may offer an effective treatment.

The next stage is to try using stem cells in people with multiple sclerosis.

Some patients discuss this treatment.

Which patient makes an unreasonable statement?

Justify your answer.

Name .....

Justification .....

.....

[2]

(c) In the tests on laboratory animals there was one case where the stem cells did not work.

Does this mean that the treatment should not be tried on people?

Explain your answer.

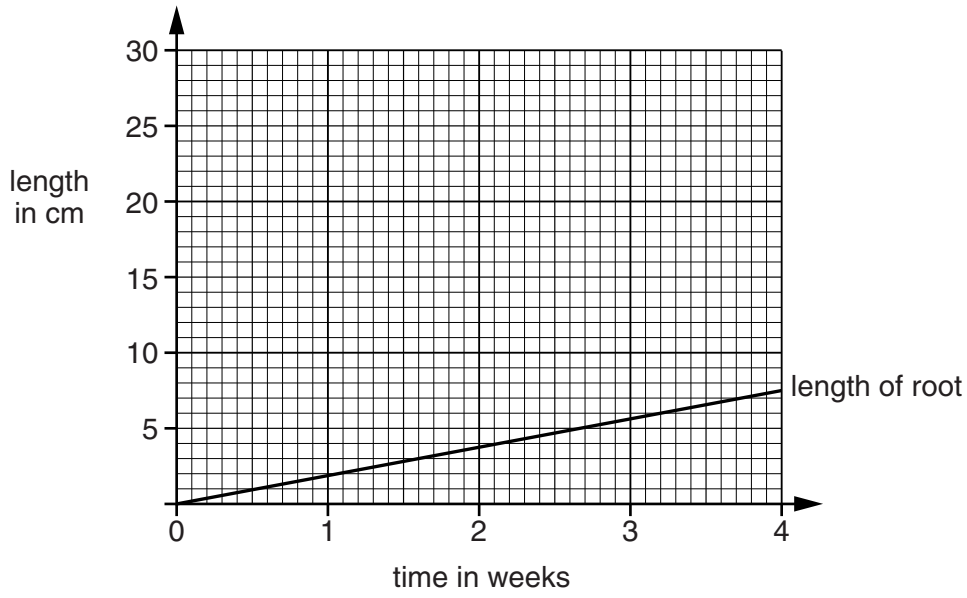
.....

..... **[1]**

[Total: 5]

9 Tony sees a bush in his friend's garden.
He takes a cutting to make a clone of the bush to grow in his own garden.

Tony measures the length of the root every week and plots his data on a graph.



He then measures the length of the **stem** every week so that he can plot a second line on his graph.

Week	Length of stem in cm
0	15
1	15
2	16
3	20
4	25

(a) Plot the length of the stem on the same graph and include a curve of best fit for the stem. **[2]**

(b) Tony concludes that this plant is **not** growing during the first week.

Explain how Tony came to this conclusion and explain why the conclusion is wrong.

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

[Total: 4]

10 In humans, sperm cells and skin cells are made by different types of cell division.

Sperm cells have a different number of chromosomes to skin cells.

Compare the types of cell division that make sperm cells and skin cells in order to explain why it is important for sperm cells to be formed by a different type of cell division.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 6]

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.