OCR
RECOGNISING ACHIEVEMENT

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A216/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A
UNIT 2 – Modules B5 C5 P5 (Higher Tier)
SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Time: 40 minutes

Candidates answer on the question paper
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name 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 you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATE

- The number of marks for each question 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 two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**5**	
2	**4**	
3	**5**	
4	**3**	
5	**2**	
6	**6**	
7	**2**	
8	**1**	
9	**6**	
10	**5**	
11	**3**	
TOTAL	**42**	

This document consists of **18** printed pages and **2** blank pages.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

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

work done by a force = force x distance moved by the force

change in energy = work done

change in GPE = weight x vertical height difference

kinetic energy = ½ × mass x [velocity]2

Electric Circuits

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

$$\frac{\text{Voltage across primary coil}}{\text{Voltage across secondary coil}} = \frac{\text{Number of turns in primary coil}}{\text{Number of turns in secondary coil}}$$

energy transferred = power x time

power = potential difference x current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

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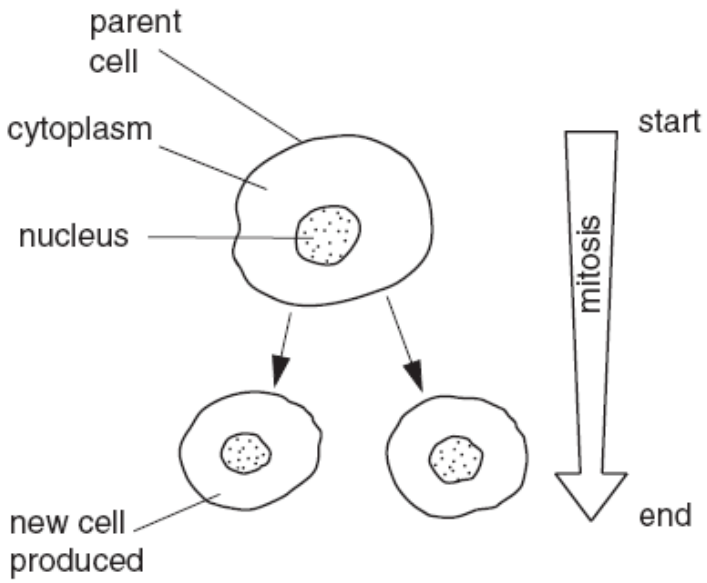
Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 James is studying cells which are undergoing mitosis.



(a) James counts the number of chromosomes in the nuclei at the start and at the end of mitosis.

What does he notice about the number of chromosomes in each nucleus?

Put a tick (✓) in the correct box.

The chromosome number had decreased at the end of mitosis.	☐
The chromosome number had increased at the end of mitosis.	☐
The chromosome number had stayed the same at the end of mitosis.	☐

[1]

(b) What happens to the number of organelles in the cytoplasm **before** the start of mitosis?

Put a ring around the correct answer.

decreases **increases** **stays the same** **[1]**

(c) (i) Here are some statements about mitosis.

Some statements are true and some are false.

Write **true** or **false** in the box next to each statement.

statement	**true** or **false**
The new cells produced are gametes.	
The new cells produced are identical to each other.	
There are four new cells produced from each complete mitosis.	
The new cells produced are identical to the parent cell.	

[2]

(ii) Which **cell** contains a set of chromosomes from each parent?

Put a ring around the correct answer.

egg **sperm** **zygote** **[1]**

[Total: 5]

2 Genes are made of DNA. The DNA contains four different bases (**A, T, C** and **G**)

The order of these bases makes a code which controls the order of amino acids in a protein made by a gene.

A **triplet** (sequence of three bases) is needed to code for each amino acid. Examples of this code are shown in the table.

amino acid	triplet base order
1	T G A
2	A A C
3	C G T
4	T A T

(a) Which one of the four amino acids (**1**, **2**, **3** or **4**) will **not** be found in the protein produced by the following order of bases?

A G C T G A T A T C G T G G C

start code

end code

Put a (ring) around the correct answer.

1 **2** **3** **4** **[1]**

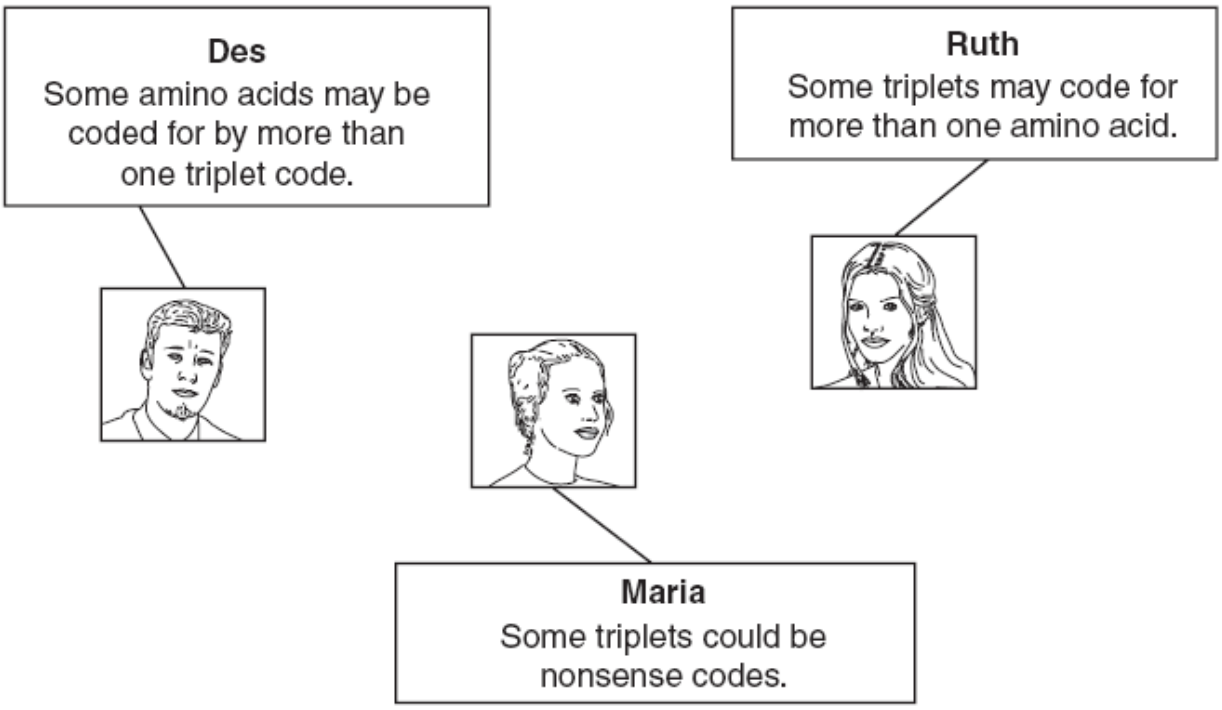
(b) What is the maximum number of triplets produced by the four bases?

Put a (ring) around the correct answer.

32 **64** **128** **256** **[1]**

(c) The number of different amino acids is less than the number of triplet codes available.

Three students were asked to explain this.



Who is most likely to be **wrong**?

Put a (ring) around the name of this student.

Des **Maria** **Ruth** **[1]**

(d) The DNA molecule contains two strands of bases held together in pairs.

Which bases pair together?

Draw a straight line to join each **base** to its **pair base**.

base	pair base
T	T
A	A
C	C
G	G

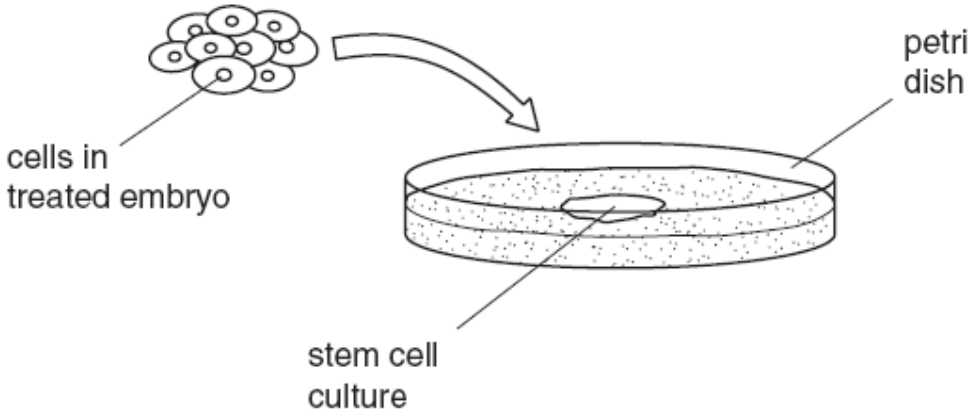
[1]

[Total: 4]

3 Rosie is a scientist working in a tissue culture laboratory. She carries out the following steps to grow tissues for transplanting into a particular patient.

A human embryo is grown from an egg cell with the original nucleus replaced with the nucleus from one of the patient's cells.

Cells are removed from the treated embryo to produce a stem cell culture.



(a) Explain why cells from the culture are injected into the patient.

.....

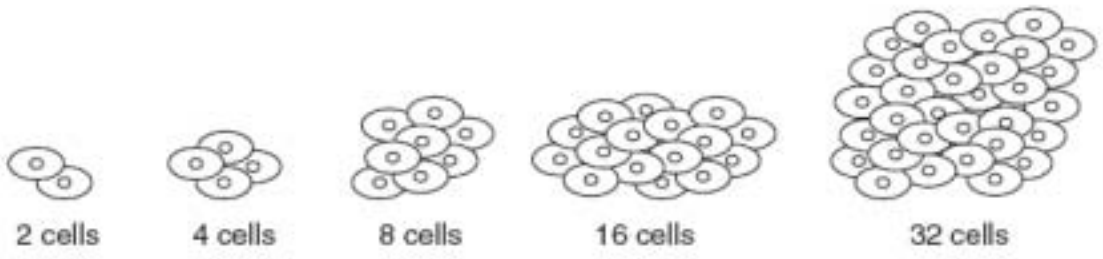
.....

.....

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

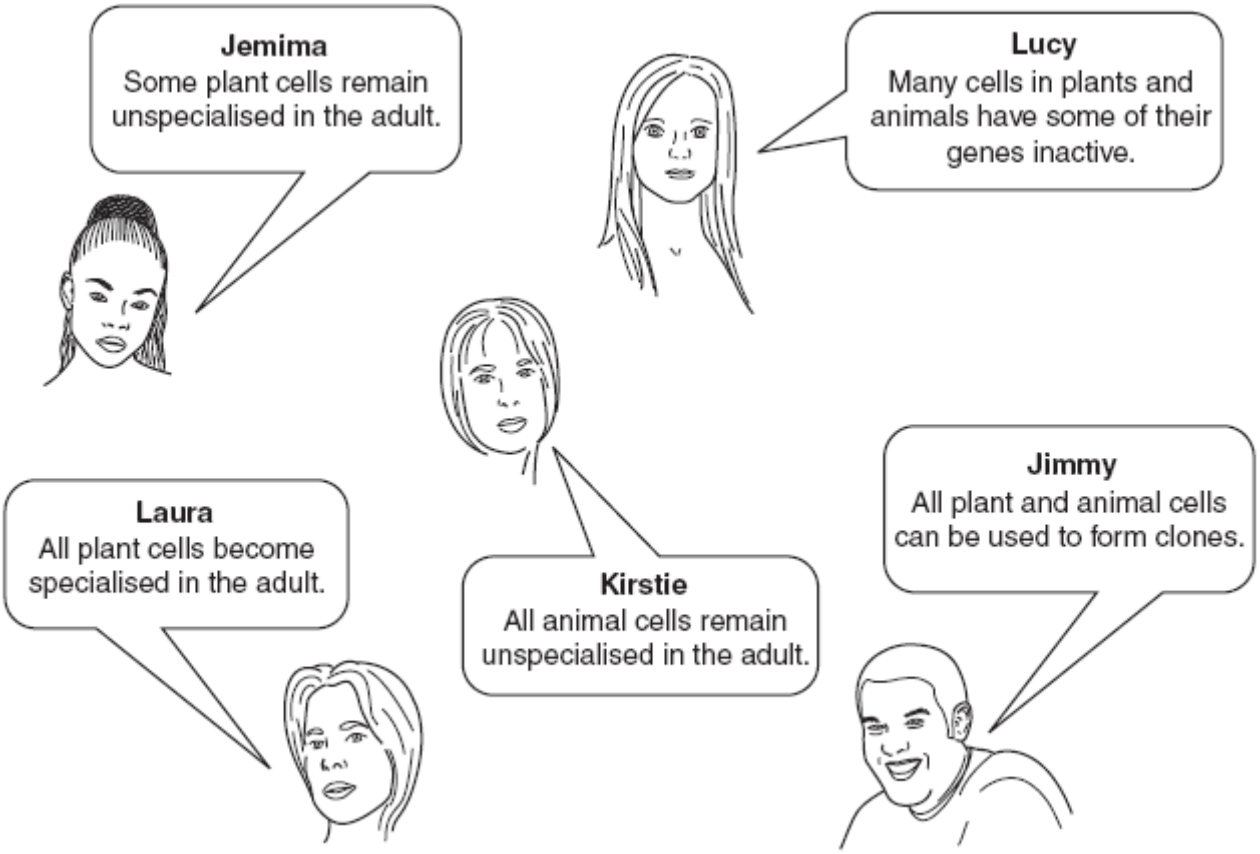
(b) Which stages of development can be used successfully for collecting stem cells?

Put a (ring) around the latest stage that can be used successfully for collecting stem cells.



[1]

(c) Rosie asks a group of her friends to compare human cells with plant cells.

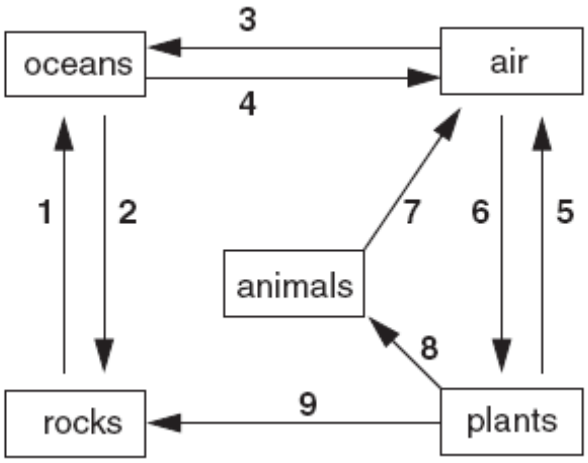


Which **two** people gave correct answers?

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

[Total: 5]

4 (a) Wilhelmina draws part of the carbon cycle.



(i) Which stage of the cycle (**1 to 9**) shows carbon being transferred to animals?

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

(ii) Carbon can get from the **air** into the **rocks** by two different routes.

Put **numbers** from the carbon cycle in the boxes to show **both** of these routes.

	first stage	**second stage**
Route A		
Route B		

[1]

(b) Wilhelmina finds out the composition of some of the molecules involved in the carbon cycle.

	% composition by mass			
	carbon	hydrogen	oxygen	nitrogen
fat	76.9	12.4	10.7	-
carbohydrate	40	6.7	53.3	-
DNA	33.2	4	44.3	8.6
protein	32	6.7	42.7	18.6

Which **two** types of molecules contain **only** carbon, hydrogen and oxygen?

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

[Total: 3]

5 These are the chemical symbols for some ions.

Br^- Cl^- K^+ Mg^{2+} Na^+ O^{2-} S^{2-} SO_4^{2-}

(a) What is the formula of **magnesium bromide?**

Put a ring around the correct answer.

Mg2Br Mg_2Br MgBr $MgBr_2$

[1]

(b) What is the formula of **sodium sulfate?**

Put a ring around the correct answer.

Na_2SO_4 $NaSO_4$ $Na(SO_4)_2$ NaS Na_2S

[1]

[Total: 2]

6 Aluminium is obtained from its ore by **electrolysis**.

(a) Here are some statements about electrolysis.

Some statements are correct, some are incorrect.

Put a tick (✓) in the best box for each statement.

	correct	**incorrect**
Ions are produced when the ore melts.		
Ions are present in the solid ore.		
Ions in the solid move to the electrodes.		
Negative ions move towards the anode during electrolysis.		
Metals are discharged when their ions gain electrons.		
Positive ions move towards the cathode during electrolysis.		
Ions in the liquid move to the electrodes.		

[3]

(b) Aluminium ore is made of aluminium oxide, $\mathbf{A}\mathbf{\mathit{l}}_2\mathbf{O}_3$.

Explain why 100 tonnes of pure aluminium oxide yields 53 tonnes of aluminium metal.

[Relative atomic mass **O** = 16 ; **A*****l*** = 27]

.....

.....

.....

.....

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

[Total: 6]

7 A sample of copper ore is made of crystals.

In the space below, draw a picture to show the typical arrangement of nine ions in a crystal.

Your answer should include the charge on each ion.

[2]

[Total: 2]

8 Which statement is the **best** explanation of why air is a gas?

A Air is made of several substances.

B The forces inside each molecule are weak.

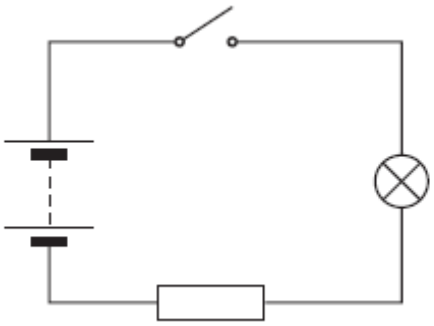
C The forces between molecules are weak.

D Air has a low density.

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

[Total: 1]

9 Karen makes this electric circuit.



(a) She completes the circuit by closing the switch.

This action makes the filament lamp glow.

Explain how closing the switch makes the lamp glow.

.....

.....

.....

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

(b) The lamp only glows dimly when Karen presses the switch.

Describe **three** changes to the circuit which would allow the same lamp to glow more brightly.

.....

.....

.....

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

[Total: 6]

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Question 10 starts on page 16

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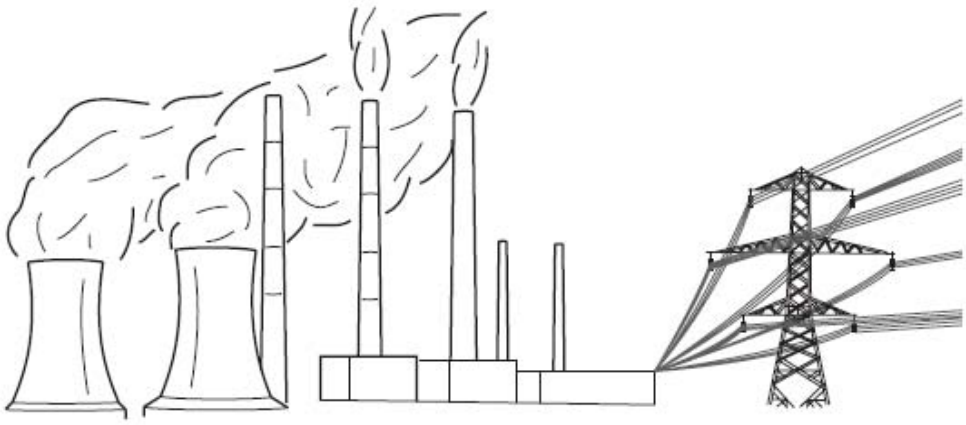
10 Most of our electricity is made in power stations.



(a) The generator in a power station produces an alternating voltage.

What is the name of the process used to generate electricity?

Put a (ring) around the correct answer.

metallic conduction

electrostatic induction

electromagnetic induction

[1]

(b) The sentences explain how electricity is produced in a power station and transferred to our homes.

A The voltage is stepped up by a transformer.

B There is an alternating voltage across the coil.

C The voltage is stepped down by a transformer.

D Alternating current is carried by the National Grid.

E Alternating current transfers energy in our homes.

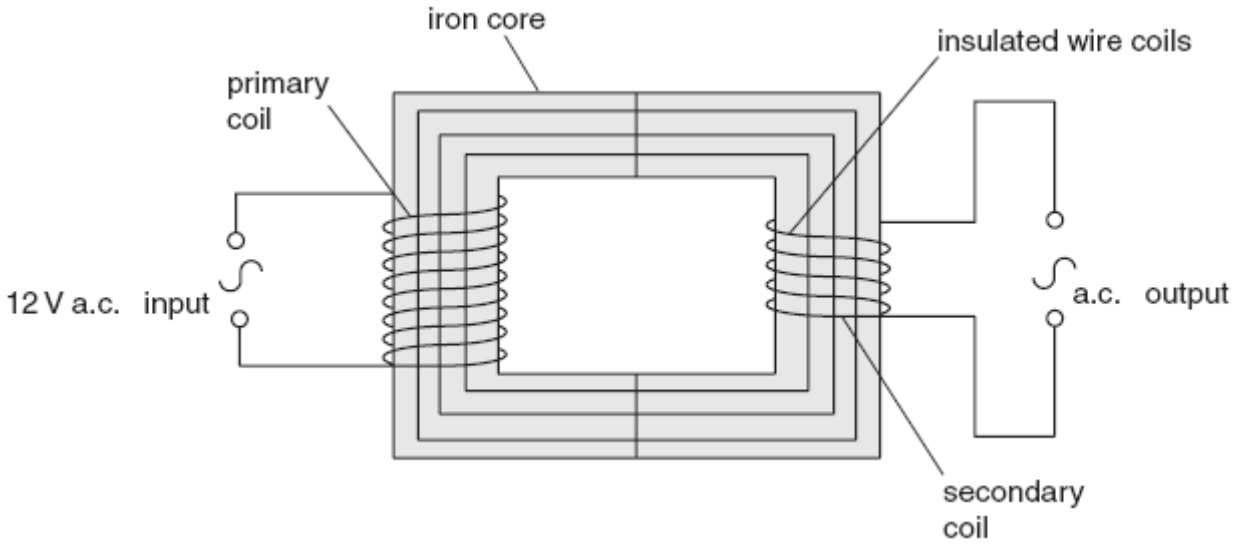
F A magnet spins around a coil of wire in the generator.

Complete the table to show the correct order of the sentences.

F					E

[3]

(c) The primary coil of a transformer is connected to a 12 V a.c. input.



Which **one** of these is the correct calculation for the voltage of the a.c. output?

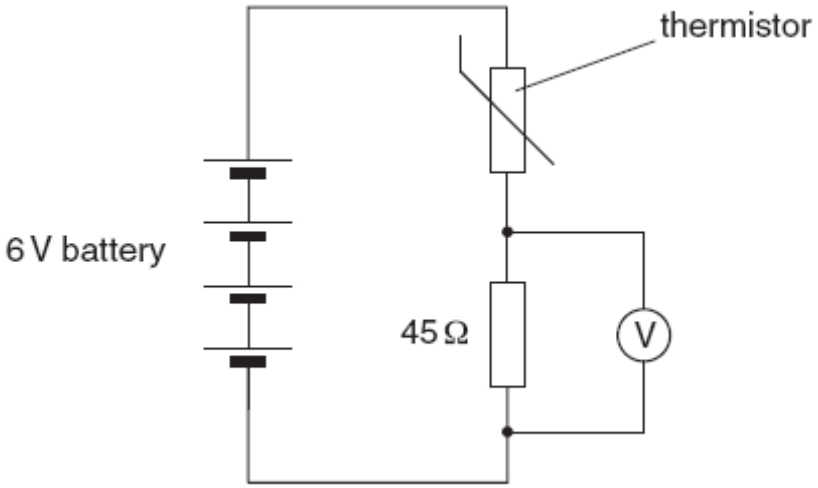
Put a ring around the correct calculation.

$12 \times 9 \times 5$ $\quad$ $12 \times \frac{9}{5}$ $\quad$ $12 \times \frac{5}{9}$ $\quad$ $5 \times \frac{9}{12}$

[1]

[Total: 5]

11 This circuit contains a thermistor.



(a) The temperature increases.

The sentences explain the change in the voltmeter reading.

They are in the **wrong** order.

A The potential difference across the resistor increases.
B The resistance of the thermistor decreases.
C The current in the circuit increases.

Show the correct order by writing **A**, **B** or **C** in each box.

[2]

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

At a certain temperature the current in the 45Ω resistor is 0.08 A.

Which is the correct calculation for the potential difference across the **thermistor**?

Put a ring around the correct calculation.

$6 - (0.08 \times 45)$ $6 + (0.08 \times 45)$ 0.08×45 $\frac{45}{0.08}$

[1]

[Total: 3]

END OF QUESTION PAPER

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** berylliu m 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitroge n 7	16 **O** oxygen 8	19 **F** fluorin e 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magne sium 12											27 **Al** alumini um 13	28 **Si** silicon 14	31 **P** phosp horus 15	32 **S** sulfur 16	35.5 **Cl** chlorin e 17	40 **Ar** argon 18
39 **K** potassi um 19	40 **Ca** calciu m 20	45 **Sc** scandi um 21	48 **Ti** titaniu m 22	51 **V** vanadi um 23	52 **Cr** chromi um 24	55 **Mn** manga nese 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** germa nium3 2	75 **As** arsenic 33	79 **Se** seleniu m 34	80 **Br** bromin e 35	84 **Kr** krypto n 36
85 **Rb** rubidiu m 37	88 **Sr** stronti um 38	89 **Y** yttrium 39	91 **Zr** zirconi um 40	93 **Nb** niobiu m 41	96 **Mo** molybd enum 42	[98] **Tc** techne tium 43	101 **Ru** rutheni um 44	103 **Rh** rhodiu m 45	106 **Pd** palladi um 46	108 **Ag** silver 47	112 **Cd** cadmiu m 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimo ny 51	128 **Te** telluriu m 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesiu m 55	137 **Ba** barium 56	139 **La*** lantha num 57	178 **Hf** hafniu m 72	181 **Ta** tantalu m 73	184 **W** tungst en 74	186 **Re** rheniu m 75	190 **Os** osmiu m 76	192 **Ir** iridium 77	195 **Pt** platinu m 78	197 **Au** gold 79	201 **Hg** mercur y 80	204 **Tl** thalliu m 81	207 **Pb** lead 82	209 **Bi** bismut h 83	[209] **Po** poloniu m 84	[210] **At** astatin e 85	[222] **Rn** radon 86
[223] **Fr** franciu m 87	[226] **Ra** radium 88	[227] **Ac*** actiniu m 89	[261] **Rf** rutherf ordium 104	[262] **Db** dubniu m 105	[266] **Sg** seabor gium 106	[264] **Bh** bohriu m 107	[277] **Hs** hassiu m 108	[268] **Mt** meitne rium 109	[271] **Ds** darmst adtium 110	[272] **Rg** roentg enium 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

RECOGNISING ACHIEVEMENT

CONFIDENTIAL

GCSE Unit

MARK SCHEME

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Additional Science A (J631)
Modules B5, C5 and P5
Higher Tier

A216/02

Maximum Mark: 42

Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant - applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   <u>words</u> = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ORA = or reverse argument

   E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.
7. The list principle:
   If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

8. Marking method for tick boxes:

   Always check the additional guidance.

   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

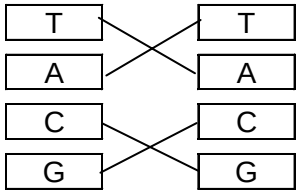
   E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected Answers	Marks	Rationale
1	a		number had stayed the same ✓	1	If more than one response = 0 marks
	b		increases	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
	c	i	new cells produced are gametes – false new cells produced are identical – true four new cells produced – false identical to the parent cell – true	2	Accept F and T In this case, accept ✓ = true and X = false 4 correct (2) 3 / 2 correct (1) 1 correct (0)
		ii	zygote	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
			Total	**5**	

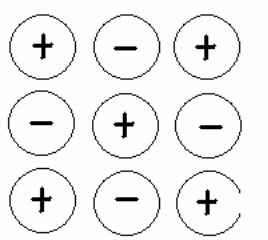
Question			Expected Answers	Marks	Rationale
2	**a**		2	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
	b		64	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
	c		Ruth	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
	d			1	**all** correct for one mark
			Total	**4**	

Question			Expected Answers	Marks	Rationale
3	**a**		For answers where there is no clear hierarchical response. [2 marks] The candidate shows understanding of the whole argument and covers both the necessary components. The answer is expressed clearly and logically. [1 mark] The candidate shows a partial understanding of the argument and covers only one of the necessary components. The answer is expressed clearly and logically.	2	Necessary components – the cells are unspecialised; so they can repair damaged tissues;
	b		8 cells	1	more than 2 responses = 0 marks Accept any other clear response eg. underline or ✓
	c		Jemima Lucy	2	2 correct responses = 2 marks 1 correct response = 1 mark accept either order for responses if no responses on dotted lines, look for a clear response on the diagram eg. ✓, ring or shading
			Total	**5**	

Question			Expected Answers	Marks	Rationale
4	**a**	**i**	8	1	If more than one response = 0 marks
		ii	<table><tr><th></th><th>first stage</th><th>second stage</th></tr><tr><td>route A</td><td>3</td><td>2</td></tr><tr><td>route B</td><td>6</td><td>9</td></tr></table> **OR** <table><tr><th></th><th>first stage</th><th>second stage</th></tr><tr><td>route A</td><td>6</td><td>9</td></tr><tr><td>route B</td><td>3</td><td>2</td></tr></table>	1	**all** correct for one mark
	b		fat **and** carbohydrate	1	**Both** correct = 1 mark Accept any order 'Hydrocarbon' is incorrect
			Total	**3**	

Question			Expected Answers	Marks	Rationale
5	**a**		$MgBr_2$	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
	b		Na_2SO_4	1	If more than one response = 0 marks Accept any other clear response eg. underline or ✓
			Total	**2**	

Question			Expected Answers	Marks	Rationale
6	a		<table><tr><td>ions produced when ore melts</td><td></td><td>✓</td></tr><tr><td>ions present in solid ore</td><td>✓</td><td></td></tr><tr><td>ion in solid move to electrodes</td><td></td><td>✓</td></tr><tr><td>negative ions move towards anode</td><td>✓</td><td></td></tr><tr><td>metals are discharged</td><td>✓</td><td></td></tr><tr><td>positive ions move towards cathode</td><td>✓</td><td></td></tr><tr><td>ions in liquid move to the electrodes</td><td>✓</td><td></td></tr></table>	3	7 correct = 3 marks 5 or 6 correct = 2 marks 3 or 4 correct = 1 mark 2 correct or less = 0 marks accept a clear response eg. X or shading etc. ignore X if combination of ✓ and X used if more than 7 ticks – **deduct** 1 mark for each additional tick
	b		Relative formula mass of Al_2O_3 = 2×27 + 3×16 = <u>102</u>, of 2Al = 2×27 = <u>54</u> [1] 102 tonnes of ore = 54 tonnes of metal [1], 100 tonnes of ore = (54/102)×100 (= 53 tonnes) [1]	3	
			Total	**6**	

Question			Expected Answers	Marks	Rationale
7			For answers where there is no clear hierarchical response. [2 marks] The candidate shows understanding of the whole argument and covers both the necessary components. The answer is expressed clearly and logically. [1 mark] The candidate shows a partial understanding of the argument and covers only one of the necessary components. The answer is expressed clearly and logically.	2	Necessary components – regular array of particles in two dimensions; nearest neighbours have opposite charges; e.g. 
			Total	**2**	

Question			Expected Answers	Marks	Rationale
8			C	1	If more than one response = 0 marks if no response on dotted line, look for a clear response on the list in the question eg. ✓, ring or shading
			Total	**1**	

Question			Expected Answers	Marks	Rationale
9	a	i	For answers where there is no clear hierarchical response. [3 marks] The candidate shows a good understanding of the whole argument, and covers all the necessary components. The answer is expressed clearly and logically. [2 marks] The candidate shows a partial understanding of the argument and covers two of the necessary components. The answer is expressed clearly and logically. [1 mark] The candidate shows a limited understanding of the argument and covers only one of the necessary components. The answer may not be expressed in a logical sequence.	3	closing switch allows current / flow of charge; current passes through the filament; heats the filament causing it to glow NOT connects lamp to battery / allows voltage to lamp
	b		any three of the following, (1) each: • remove the resistor / connect the lamp directly to the battery • connect a wire in parallel with the resistor • increase the voltage / p.d. of the battery (NOT larger battery) • decrease the resistance of the resistor	3	
			Total	**6**	

Question			Expected Answers	Marks	Rationale
10	**a**		electromagnetic induction	1	If more than one response = 0 marks accept a clear response eg. X or shading etc.
	b		(F) B A D C (E)	3	B somewhere before A = 1 mark A somewhere before D = 1 mark D somewhere before C = 1 mark
	c		$12 \times \frac{5}{9}$	1	If more than one response = 0 marks accept a clear response eg. X or shading etc.
			Total	**5**	

Question			Expected Answers	Marks	Rationale
11	**a**		B C A	2	B somewhere before C = 1 mark C somewhere before A = 1 mark
	b		6 - (0.08 x 45)	1	If more than one response = 0 marks **Allow** a clear response eg. X or shading etc.
			Total	**3**	

			Paper Total	**42**	