OCR
RECOGNISING ACHIEVEMENT

GCSE

Science A

General Certificate of Secondary Education

Unit **A141/02:** Unit 1: Modules B1, C1, P1 (Higher Tier)

Mark Scheme for June 2012

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	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
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt

R	reject
✓	correct response
L1 , L2 , L3	draw attention to particular part of candidate's response
^	information omitted

Subject-specific Marking Instructions

a. If a candidate alters his/her response, examiners should accept the alteration.

b. 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.

E.g.

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

This would be worth 1 mark.

c. 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.

d. 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**

e. For answers marked by levels of response:

i. **Read through the whole answer from start to finish**

ii. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

iii. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

iv. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer	Mark	Guidance
grey shading in first column indicates overlap with A141/01; shading in 3rd column indicates IG1					
1	(a)		egg cells fertilised embryos	2	All 3 correct = 2 marks 2 correct (only one error) = 1 mark 1 correct = 0 marks
	(b)		*any two from:* should / should not be allowed to choose the characteristics of our children (1); difficult to decide when it is and isn't acceptable (1); lots of embryos are not used / will be destroyed (1); interfering with the course of nature/playing God (1)	2	e.g. choice of gender
	(c)		*for:* find out if the baby has the disease (1); find out if the baby is a carrier (1); enables parents to plan (1); may decide to terminate the pregnancy (1) *against:* risk of miscarriage/damage to fetus/damage to mother (1); results may not be reliable / idea of false positives or false negatives (1); it's better not to know (1); interfering with the course of nature/playing God (1)	3	max 2 for each argument may have two points in a single sentence, e.g. 'be prepared if the baby has the disease' = 2 marks 'so they can terminate if it has the disease' = 2 marks e.g. "it's better to know" this could imply '' you should have the baby whether or not it has c.f." or " it would be too stressful to find out that the baby has it"
			Total	**7**	

Question			Answer	Mark	Guidance
2			**(Level 3)** Describes cloning with correct science and with the steps in a logical sequence. Candidate suggests more than one use for cloned embryos, or suggests and develops one use for cloned embryos. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Describes cloning process without misuse of terms such as nucleus, egg cell, but description is incomplete or confused. Candidate suggests a use for cloned embryos. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Describes cloning process but sequence is poorly understood, steps are missing and terms e.g. nucleus, egg cell are misused. Candidate may suggest a use for the cloned embryos. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A/A*** Candidate may choose to answer without reference to stem cells and focus on a different application of clones: this is acceptable. **Indicative scientific points about the process may include:** • egg cell removed from female • nucleus removed from egg cell • nucleus taken from adult body cell which is to be cloned • inserted into the unfertilised empty egg cell • cells divide to form embryo **accept** electric shock [or other stimulus] applied to trigger cell division (not in Spec) **accept** either in vitro growth of embryo or implantation in suitable female **Indicative scientific points about the uses may include:** • embryos are a source of embryonic stem cells • stem cells can be used to treat disease • this is because they are unspecialised • may be used to clone e.g. endangered species, valuable stock or sporting animals **accept** application to human embryos, even where illegal **reject** implausible 'Jurassic Park' style ideas **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td><table><tr><td>alleles</td><td>✓</td></tr><tr><td>genes</td><td></td></tr><tr><td>shape</td><td></td></tr><tr><td>size</td><td></td></tr></table>(1)</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><td colspan="2"></td><td colspan="2">Mother</td></tr><tr><td colspan="2"></td><td>X</td><td>X</td></tr><tr><td rowspan="2">Father</td><td>X</td><td>XX</td><td>XX</td></tr><tr><td>Y</td><td>XY</td><td>XY</td></tr></table>(1)</td><td>1</td><td>one mark for correctly completed Punnett square
accept also
<table><tr><td colspan="2"></td><td colspan="2">Mother</td></tr><tr><td colspan="2"></td><td>X</td><td>X</td></tr><tr><td rowspan="2">Father</td><td>Y</td><td>XY</td><td>XY</td></tr><tr><td>X</td><td>XX</td><td>XX</td></tr></table>And allow x for X, y for Y</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>50:50</td><td>1</td><td>Accept also 1:1 or 2:2.
No e.c.f. from (b)(i)</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>1 : 1 (1)</td><td>1</td><td>allow 50:50
do not allow 350:350 or any other ratio</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>evidence of some calculations to show the ratios (1);

ratio girls:boys gets further away from expected as total number of babies decreases (1);

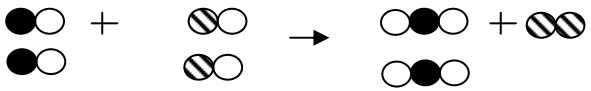
smaller sample means that the estimate is less accurate and hence further from expected (1)</td><td>3</td><td>needs evidence of comparison of ratios in at least two hospitals – can refer to fractions

Or reverse argument. This mark is for describing the differences in ratios.

Idea of larger sample size gives better results. This mark is for explaining why the ratio approaches the expected value as the number increases.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
4	(a)		<table><tr><th>T</th><th>F</th></tr><tr><td></td><td>✓</td></tr><tr><td></td><td>✓</td></tr><tr><td>✓</td><td></td></tr><tr><td>✓</td><td></td></tr><tr><td>✓</td><td></td></tr></table>	2	all choices correct = 2 marks one **or** two errors = 1 mark NB This is different marking system from the one used in 1(a) and 6(a) which both allow only one error for 1 mark. This question has been eased at the one-mark level because there are more choices, and also because the judgement needed for the second row is difficult.
	(b)		get data for electricity generated (per year) (1); plot graph or chart of electricity generated per yr and compare shape with graph in question / plot scattergram of electricity generated against sulfur dioxide made – decide if there is a correlation (1)	2	may be implied in e.g. 'plot a graph for electricity use…' Can imply comparison by e.g. 'see if there's a correlation' for the 2nd mark.
	(c)		any value between 0.3 -0.5 Mark given for justification rather than the suggested value.	1	justification can be any indication of having used the data in the chart and tried to extrapolate, e.g. 'follow the pattern of the graph'
	(d)		sulfur removed from fuels before burning (1); sulfur removed from flue gases (1)	2	**accept** increased use of low-sulfur fuels can describe details of flue-gas desulfurisation, even if not correct, such as 'mixing with lime' if done in terms of vehicles, can gain a mark for greater fuel efficiency, or use of electric cars, or use of public transport
			Total	**7**	

Question			Answer	Mark	Guidance
5	(a)		N (from the air) reacts with O (from the air) (1); at high temperature of engine (1)	2	Look for idea that engine is hot/warm
	(b)		**(Level 3)** Applies data in the table **either** to explain damage caused by pollutants **or** to describe chemical changes in the converter, and answer is full and accurate. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Applies data in the table **either** to explain damage caused by pollutants **or** to describe chemical changes in the converter, but answer is incomplete or inaccurate. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Comments on data in table. May refer to damage/harm, but in an unqualified manner. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to C** This answer can be tackled either by discussion of the damage caused by the pollutants or by discussion of the chemical changes in the catalytic converter. **Indicative scientific points related to damage caused by the pollutants may include:** • CO is poisonous • CO reduces the oxygen-carrying capacity of the blood • NO causes breathing problems • NO reacts with more oxygen to make NO_2 which dissolves in water in the air to give acid rain. Acid rain damages buildings/plants/fish • CO_2 is a greenhouse gas • CO_2 is less harmful than CO / NO **Indicative scientific points related to chemical changes in the catalytic converter may include:** • CO can be oxidised • this changes it to CO_2 • NO can be reduced • this converts it to $N_{(2)}$ • CO is oxidised by the oxygen removed from the NO/ CO reacts with NO **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>(c)</td><td></td><td> 
Allow white blob for carbon and black blob for oxygen if done consistently.</td><td>3</td><td>1 mark for correct diagrams of nitrogen monoxide and carbon dioxide molecule; symbols may not be identical to those given, but award marks if candidate's intentions are clear. Allow CO_2 molecule with C at the end.
1 mark for correct number of carbon dioxide molecules
1 mark for correct number of nitrogen monoxide molecules
Do not give 3 marks if any other atoms present</td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><th></th><th>biof.</th><th>batt.</th><th>both</th><th>neither</th></tr><tr><td>air quality ↑</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>fossil fuels ↓</td><td></td><td></td><td>✓</td><td></td></tr></table>(1);
(1)</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>13</td><td></td></tr>
<tr><td>6</td><td>(a)</td><td></td><td><table><tr><td>Dr Adams</td><td>✓</td></tr><tr><td>Dr Baker</td><td></td></tr><tr><td>Dr Curtis</td><td>✓</td></tr><tr><td>Dr Das</td><td></td></tr><tr><td>Professor Eddington</td><td>✓</td></tr></table>(2)</td><td>2</td><td>All 3 correct = 2 marks
2 correct (only one error) = 1 mark
1 correct = 0 marks

'One error' could be an extra tick, or a tick missing, or a tick in the wrong box.</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>less than 3.8 thousand Myears old</td><td></td></tr><tr><td>between 3.8 and 5 thousand Myears old</td><td></td></tr><tr><td>between 5 and 8 thousand Myears old</td><td>✓</td></tr><tr><td>between 8 and 12 thousand Myears old</td><td></td></tr><tr><td>between 12 and 13.7 thousand Myears old</td><td></td></tr></table>(1)</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><td>Dr Adams</td><td>✓</td></tr><tr><td>Dr Baker</td><td></td></tr><tr><td>Dr Curtis</td><td></td></tr><tr><td>Dr Das</td><td></td></tr><tr><td>Professor Eddington</td><td></td></tr></table>(1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
7	(a)		50 cm = 10 wavelengths (1); wavelength = 5 (cm) (1)	2	5 (cm) gets 2 marks with or without working if answer is wrong, but candidate has divided 50 by a number other than 10, give 1 mark
	(b)		3 waves generated in that time (1); 3 waves in 1.2 s ⇒ 30 waves in 12 s ⇒ 2.5 per second i.e. *f* = 2.5 Hz (1) *alternative approach:* speed = 3 wavelengths/ 1.2 s (1); = 3 × 5 cm/ 1.2 s = 12.5 cm/s *f* = speed / wavelength = 12.5 cm/s / 5 cm = 2.5 Hz (1)	2	2.5 (Hz) gets 2 marks with or without working If candidate has counted 3 waves in the time given but not got correct frequency, give 1 mark if answer is wrong, but candidate has attempted to divide 3 × his/her answer to 7(a) by 1.2, give 1 mark
	(c)		stays the same (1); justifying answer using formula speed = freq x wavelength OR inversely proportional relationship between freq and wavelength (1) candidate may interpret question as 'calculate the speed of the new waves' and can gain full credit as follows: uses double frequency of 7(b) & half wavelength of 7(a) (1); multiplies together correctly and gives correct units (1)	2	'frequency doubles and the wavelength halves' is not enough justification by itself, as it just repeats the question stem. Please look at calculation in part (b) above, with answer quoted for (a), to see if the candidate has justified the fact that speed has not changed. Can use calculations, possibly with invented values, to show speed is constant. e.g. if 7(a) answer is 10 cm and 7(b) is 3 Hz, then 5 x 6 gets the first mark, and = 30 cm / s gets the second mark
			Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>8</td><td>(a)</td><td>(i)</td><td>10 000 000</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>current spreading rate not likely to have been constant over 10 million years (1);
stripe separation difficult to determine due to irregular nature of stripes (1)</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table><tr><td>Different sedimentary rocks have different magnetic properties.</td><td></td></tr><tr><td>Rocks change their magnetism after some time on the sea floor.</td><td></td></tr><tr><td>The black and white stripes show different magnetic strengths.</td><td></td></tr><tr><td>The Earth’s magnetic field changes direction from time to time.</td><td>✓</td></tr></table>(1)</td><td>1</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
8	(b)		**(Level 3)** Describes evidence against continental drift in W's time, including lack of a proper mechanism for the movement. Explains that more recent discoveries, possibly directly related to sea-floor spreading, indicate continental movement whose origin can be explained. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Gives at least one reason for rejection of continental drift related to the evidence for it at the time it was proposed. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Has idea of continental drift and attempts at least one reason for its rejection. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** • Wegener's theory is that continents have moved • Candidate **may** give supporting facts for W's theory (not directly asked for in the question) – jigsaw fit of continents – similar fossils in different continents – similar rock layers in different continents • Reasons for lack of acceptance **at the time** include – continental movement not observable – no known mechanism for movement – other explanations for the evidence, e.g. land bridges – Wegener was an outsider to the community of geologists (a meteorologist, in fact) but note that by itself would not give level 2 • Recent discoveries include – magnetic stripes indicate seafloor spreading – seafloor spreading provided evidence of movement – seafloor spreading can be explained by movements in the Earth's mantle **accept** diagrams showing any of the above **ignore** religious reasons for not believing Wegener **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**10**	

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