

# **Twenty First Century Science Biology A**

General Certificate of Secondary Education

Unit **A161/02**: Modules B1, B2, B3 (Higher Tier)

## **Mark Scheme for January 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:

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	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
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	no benefit of doubt

	reject
	correct response
	Allocate level of 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.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

<input checked="" type="checkbox"/>
<input type="checkbox"/>

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

<b>Edinburgh</b>	
<b>Manchester</b>	
<b>Paris</b>	
<b>Southampton</b>	

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

<b>Edinburgh</b>			✓			✓	✓	✓	✓	
<b>Manchester</b>	✓	x	✓	✓	✓				✓	
<b>Paris</b>				✓	✓		✓	✓	✓	
<b>Southampton</b>	✓	x		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

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

- f. 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	Marks	Guidance										
1	(a)	<table border="1"> <tr> <td>... genes ...</td> <td></td> </tr> <tr> <td>... number of cells ...</td> <td></td> </tr> <tr> <td>... describes the nuclei...</td> <td></td> </tr> <tr> <td>... characteristics ...</td> <td>✓</td> </tr> <tr> <td>... chromosomes ...</td> <td></td> </tr> </table>	... genes ...		... number of cells ...		... describes the nuclei...		... characteristics ...	✓	... chromosomes ...		1	<b>reject</b> if more than one box is ticked. <b>accept</b> any indication of correct response.
... genes ...														
... number of cells ...														
... describes the nuclei...														
... characteristics ...	✓													
... chromosomes ...														
	(b)		2	<b>reject</b> if more than two lines drawn from one box. treat each box independently.										
	(c) (i)	Gg;	1	<b>accept</b> gG										
	(ii)	gg;	1	<b>reject</b> g										
<b>Total</b>			<b>5</b>											

Question		Answer	Marks	Guidance
2	(a)	one; dominant	2	<b>reject</b> if more than one ring drawn around each set of responses.  treat each set of responses independently. <b>accept</b> any indication of correct response.
	(b)	<p><b>[Level 3]</b> Have one use and two or more implications described in detail and linked. Answers specifically relate to embryos or adults or children. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Have one use and one implication not necessarily linked but described in less detail. Answers just relate to a person. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Have a description of one use OR implication. Not related to a person or assume it is a person. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Uses may include:</b></p> <ul style="list-style-type: none"> <li>to find out if a (genetic) disorder / disease has been inherited / carrier</li> <li>to find out reaction to a drug</li> <li>paternity test</li> </ul> <p><b>If candidate only describes ‘implications’, limit to L1 If candidate only describes ‘uses’, limit to L1</b></p> <p><b>Implications may include:</b></p> <ul style="list-style-type: none"> <li>to decide whether to terminate a pregnancy</li> <li>decide whether to have children</li> <li>insurance implications</li> <li>employment implications</li> <li>unreliability of tests / false negs / false positives</li> <li>possible miscarriage</li> <li>stress / counselling</li> <li>tailor made treatments</li> <li>embryo selection / gene therapy</li> <li>who else should you tell in your family</li> <li>preparation for newborn / rest of life</li> <li>religious / ethical implications</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question		Answer	Marks	Guidance
2	(c)	any valid argument for; any valid argument against;	2	e.g. <b>for</b> can plan ahead make decisions the right to know have the correct treatment might become ill in the future  <b>ignore</b> save lives or cure disease  <b>ignore</b> reference to cost  <b>against</b> any ethical idea / unnatural / playing God / against religious beliefs insurance implications employment implications false pos and false neg possible miscarriage / damage embryo
		<b>Total</b>	<b>10</b>	

Question			Answer	Marks	Guidance										
3	(a)	(i)	8	1	<b>accept</b> "eight"										
		(ii)	shows halving of 4096 12 times; 4 hours;	2	<b>allow</b> 240 minutes  4 hours or 240 minutes only scores 2 marks <b>reject</b> 204 minutes										
		(iii)	<table border="1"> <tr> <td>The Petri dish is too large</td> <td></td> </tr> <tr> <td>There is a shortage of food</td> <td>✓</td> </tr> <tr> <td>They were left for too long</td> <td></td> </tr> <tr> <td>There were not enough bacteria to start with</td> <td></td> </tr> <tr> <td>The temperature has been reduced</td> <td>✓</td> </tr> </table>	The Petri dish is too large		There is a shortage of food	✓	They were left for too long		There were not enough bacteria to start with		The temperature has been reduced	✓	2	minus 1 mark for each additional incorrect response.  <b>accept</b> any indication of correct response
The Petri dish is too large															
There is a shortage of food	✓														
They were left for too long															
There were not enough bacteria to start with															
The temperature has been reduced	✓														
	(b)	(i)	Idea that number decreased; then idea that number increased;	2	<b>accept</b> idea that many bacteria died and then started to reproduce  up – down – up = 1 mark if no reference to when penicillin is added										
		(ii)	2; 4;	2	<b>accept</b> either way round.  minus 1 mark for each additional incorrect response.										
		(iii)	no because  <b>any three from:</b> some bacteria may be resistant; not all bacteria killed; we do not know if all non resistant bacteria were killed; maybe a bigger dose would have killed them; maybe a dose over a longer time would have killed them;	3	yes answers zero marks  if candidate does not imply "No" in their answer, then zero marks.										
			<b>Total</b>	<b>12</b>											

Question			Answer	Marks	Guidance
4	(a)	(i)	<p><b>[Level 3]</b> Demonstrates clear understanding of the immune response. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Can recall but not fully explain the mechanism of the immune response. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Shows limited knowledge of the immune response. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to A/A*</b></p> <p><b>Indicative scientific points at Level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• good explanation of memory cells</li> <li>• idea of rapid response</li> <li>• scientific detail of complementary fit between antibody and antigen</li> </ul> <p><b>Indicative scientific points at Level 2 may include:</b></p> <ul style="list-style-type: none"> <li>• antigens of cowpox and small pox are similar</li> <li>• antibodies against cowpox are also effective against smallpox</li> <li>• some explanation of immunity</li> <li>• idea that white blood cells engulf / produce antibodies</li> <li>• mention of memory cells</li> </ul> <p><b>Indicative scientific points at Level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• idea that cowpox and smallpox are similar</li> <li>• reference to immunity e.g. makes you immune</li> <li>• idea that white blood cells are involved</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question			Answer	Marks	Guidance
4	(a)	(ii)	idea that if you get cowpox you do not get smallpox;	1	
		(iii)	carrying out dangerous experiment (on young child); idea of consent;	2	idea that it is wrong or dangerous no consent or child too young to understand or child has no rights <b>ignore</b> reference to animals
		(iv)	only one person was put at risk and many people's lives were saved by not catching smallpox;	1	<b>ignore</b> benefits outweigh the risk
		(v)	idea of test on animals / cells;	1	
	(b)		less chance of coming into contact with the disease / herd immunity; idea that (more) infectious disease is more likely to be passed on / spread;	2	do not credit 'the more infectious the greater the percentage need vaccinating'
	(c)		side effects; all people are different; different levels of immunity; allergic response;	1	
			<b>Total</b>	<b>14</b>	

Question			Answer	Marks	Guidance
5	(a)	(i)	1000000 – (990000 + 9200); 800;	2	credit 2 marks for correct answer of 800  1 mark for adding reflected energy and wasted energy, and taking total from sum.
		(ii)	800 / 10000 x 100; 8(%)	2	<b>allow</b> ecf i.e. answer from (i) divided by 10000 x 100 credit 2 marks for correct answer (8%) without working. <b>reject</b> 8.6 or 8.7
	(b)		less steps in food chain; less energy lost; idea that vegetables will feed more people;	3	for first marking point they need to refer to food chains or trophic levels
			<b>Total</b>	<b>7</b>	

Question	Answer	Marks	Guidance
6	<p><b>[Level 3]</b> Demonstrates clear understanding of the nitrogen cycle. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Can recall some aspects of the nitrogen cycle. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Shows limited knowledge of the nitrogen cycle. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to A/A*</b></p> <p><b>Mark both diagram and written response as a whole</b></p> <p><b>Indicative scientific points at Level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• shows complete cycle with nitrogen, nitrates, nitrification, denitrification, nitrogen fixation included.</li> <li>• reference to appropriate bacteria</li> </ul> <p><b>Indicative scientific points at Level 2 may include:</b></p> <ul style="list-style-type: none"> <li>• refers to nitrogen and nitrogen compounds</li> <li>• plants absorb “nitrogen” from the soil</li> <li>• plants pass on “nitrogen” animals</li> <li>• reference to waste materials</li> <li>• reference to death and decay</li> </ul> <p><b>Indicative scientific points at Level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• refers to nitrogen and nitrogen compounds even if some are incorrectly used</li> <li>• shows that several processes are involved</li> <li>• includes the atmosphere and living organisms</li> <li>• includes lightning</li> <li>• fertilisers</li> <li>• idea that the process is cyclical</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <p>Full credit may be given without a diagram – Braille candidates will not be asked for diagram</p>
	<b>Total</b>	<b>6</b>	

Question		Answer	Marks	Guidance
7	(a)	<b>any two from:</b> number of species; named habitat; e.g. forest / stream / desert etc; (genetic) variety / different gene pools;	2	<b>ignore</b> Earth / world / planet
	(b)	idea that ecosystems are more stable e.g. loss of organism affects food chain or idea of more survive disasters / interdependence; idea of resources e.g. future crops / medicines;	2	idea of extinction must be linked to effect on food chain
	(c)	meeting the needs of people today; without damaging the Earth for future generations;	2	<b>ignore</b> examples unless explained
		<b>Total</b>	<b>6</b>	

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