

## **Additional Science A**

General Certificate of Secondary Education

Unit **A151/02**: Modules B4, C4, P4

## **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
<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
<u>words</u>	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
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

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	reject
	correct response
 ,  , 	draw attention to particular part of candidate's response
	information omitted

**Subject-specific Marking Instructions**

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

Eg

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.

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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, eg 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, eg 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.

Eg 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>

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- e. For answers marked by levels of response:
- Read through the whole answer from start to finish**
  - Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
  - 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:

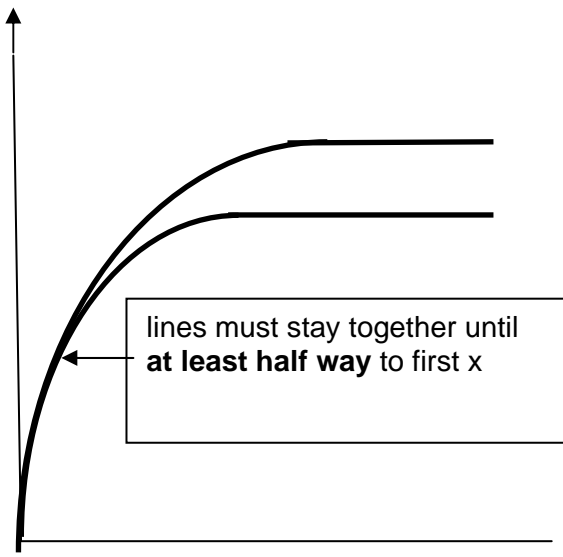
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question		Answer	Marks	Guidance
1	(a)	<p><b>[Level 3]</b>  <b>Names most structures</b> correctly and links <b>some</b> structures to their <b>functions in photosynthesis</b>.</p> <p>Quality of written communication does not impede communication of the science at this level.  (5 – 6 marks)</p> <p><b>[Level 2]</b>  <b>Names some structures</b> correctly and links some structures to correct <b>functions</b>.</p> <p>Quality of written communication partly impedes communication of the science at this level.  (3 – 4 marks)</p> <p><b>[Level 1]</b>  <b>EITHER names some structures</b> correctly OR gives a correct <b>function</b> for one structure.  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>Functions in photosynthesis</b></p> <ul style="list-style-type: none"> <li>nucleus (A) has genetic code for enzymes/proteins</li> <li>cell membrane (B) is where water/CO<sub>2</sub>/oxygen passes in/out of cell</li> <li>cytoplasm (<b>C</b>) contains substances (involved in photosynthesis) / the site where enzymes or proteins are made</li> <li>chloroplasts (D) (contain chlorophyll which) absorbs light</li> </ul> <p><b>General functions</b></p> <ul style="list-style-type: none"> <li>Nucleus or part A controls cell/contains DNA/chromosomes/genetic material</li> <li>Cell membrane or part B lets substances in/out / allows diffusion</li> <li>Cytoplasm or part C contains (dissolved) substances / where (cell) reactions take place</li> <li>Chloroplasts or part D contain chlorophyll / are where photosynthesis happens</li> </ul> <p><b>Allow</b> carbon dioxide and water are needed (by the cell) for photosynthesis as a general function.</p> <p><b>Correct Names:</b></p> <ul style="list-style-type: none"> <li>A = nucleus</li> <li>B = cell membrane</li> <li>C = cytoplasm</li> <li>D = chloroplast</li> </ul> <p>When looking for correct names, do not allow cell wall for cell membrane or chlorophyll for chloroplast, however allow correct function (from lists above).</p>

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Question			Answer	Marks	Guidance
	(b)	(i)	<p>any two from:</p> <p>links <u>increased</u> photosynthesis to <u>increased</u> mass; (1)</p> <p>links <u>increased</u> photosynthesis to <u>increased</u> growth; (1)</p> <p>(photosynthesis) makes glucose / glucose needed for growth; (1)</p>	2	<p><b>ignore</b> plants with a higher mass photosynthesise faster</p> <p><b>allow</b> reference to production of sugar / starch / cellulose / protein / chlorophyll in place of glucose</p>
		(ii)	 <p>lines must stay together until <b>at least half way</b> to first x</p>	1	<p>line follows first slope <b>then</b> levels off at higher level</p> <p><b>must</b> do both things for the mark</p>
		(iii)	<p>temperature (1)</p> <p>affects enzyme activity / enzymes denatured (at high temperatures); (1)</p>	2	<p><b>ignore</b> 'heat'</p> <p><b>allow</b> water (1) needed for photosynthesis (1)</p> <p><b>ignore</b> enzymes destroyed / killed</p> <p><b>accept</b> enzymes damaged</p>
			<b>Total</b>	<b>11</b>	



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Question			Answer	Marks	Guidance												
3	(a)		<p>ignore 'yes' or 'no', look for reasons:</p> <p><i>any 3 from:</i></p> <p>optimum pH for enzyme Y is 7.5 (1)</p> <p>pH in stomach is below pH range for enzyme / too low / too acidic; (1)</p> <p>idea of <u>shape</u> of active site changes / bonds in active site break; (1)</p> <p>(substrate) molecules do not fit (in the active site); (1)</p> <p>enzyme-substrate complex cannot form; (1)</p>	3	<p><b>allow</b> values between 7 and 8;</p> <p><b>allow</b> 'enzyme denatured' if it is clear that this happens either at low pH or in the stomach</p> <p><b>allow</b> idea that pill / enzyme could be digested/damaged in the stomach / enzyme should be protected with a coating to prevent digestion/denaturation in stomach</p> <p><b>ignore</b> 'destroyed' / 'killed'</p> <p><b>ignore</b> 'active site changes' alone</p> <p><b>ignore</b> bonds in enzyme break</p>												
	(b)		<table><tr><td></td><td></td></tr><tr><td>The work has not been peer reviewed.</td><td>✓</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>The test has not been repeated by other scientists.</td><td>✓</td></tr></table>			The work has not been peer reviewed.	✓							The test has not been repeated by other scientists.	✓	1	
The work has not been peer reviewed.	✓																
The test has not been repeated by other scientists.	✓																
			<b>Total</b>	<b>4</b>													

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Question			Answer	Marks	Guidance
4	(a)		88-145	1	
	(b)		<p><b>One mark;</b> Solid (at room temperature) / needs to be melted / needs to be a liquid / needs to be kept hot; (1)</p> <p><b>Plus any two from:</b> idea of sodium being (very) reactive; (1)</p> <p>sodium reacts with water; (1)</p> <p>hydrogen produced; (1)</p> <p>consequence of hydrogen gas eg explosions; (1)</p>	3	<p><b>accept</b> sodium needs to be heated <b>ignore</b> <u>pipes</u> will melt / get damaged / <u>pipes</u> react</p> <p><b>ignore</b> 'it explodes', must be idea that hydrogen explodes</p>
	(c)		Lose electron / lose electrons/ lose e / lose e <sup>-</sup>	1	
			<b>Total</b>	<b>5</b>	

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Question			Answer	Marks	Guidance																					
5	(a)		$2\text{Na} + \text{Cl}_2 = 2\text{NaCl}$	2	formulae = 1,  <b>formulae must be correct</b> for balancing mark to score balancing = 1  <b>do not allow</b> sodium represented as NA or Na or Na, or clear capital L in chlorine (CL)																					
	(b)		<table><tr><td></td><td>true</td><td>false</td></tr><tr><td>... the ions move freely</td><td>✓</td><td></td></tr><tr><td>... the ions turn into atoms</td><td></td><td>✓</td></tr><tr><td>.. .hydrogen gas is produced</td><td></td><td>✓</td></tr><tr><td>...the solution conducts electricity</td><td>✓</td><td></td></tr><tr><td>... the ions separate</td><td>✓</td><td></td></tr><tr><td>... float on the surface and react</td><td></td><td>✓</td></tr></table>		true	false	... the ions move freely	✓		... the ions turn into atoms		✓	.. .hydrogen gas is produced		✓	...the solution conducts electricity	✓		... the ions separate	✓		... float on the surface and react		✓	2	all rows correct = 2 5 or 4 rows correct = 1
	true	false																								
... the ions move freely	✓																									
... the ions turn into atoms		✓																								
.. .hydrogen gas is produced		✓																								
...the solution conducts electricity	✓																									
... the ions separate	✓																									
... float on the surface and react		✓																								
	(c)		<p>any three from: see <u>lines</u>;</p> <p>each element gives unique lines/colours/spectra/pattern;</p> <p>sodium can be identified by lines in the same place as known sodium compounds;</p> <p>(salt crystals would give) extra lines to show more elements;</p> <p>(to identify elements) compare results with known elements;</p>	3	<p><b>accept</b> 'frequencies' or 'wavelengths' for 'lines'</p>   																					

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Question			Answer	Marks	Guidance											
	(d)		<table><tr><td>particle</td><td>number in an atom of sodium</td><td rowspan="3">} (1)</td></tr><tr><td>electron</td><td>11</td></tr><tr><td>proton</td><td>11</td></tr><tr><td colspan="2">neutron</td><td>12</td><td>(1)</td></tr></table>	particle	number in an atom of sodium	} (1)	electron	11	proton	11	neutron		12	(1)	2	
particle	number in an atom of sodium	} (1)														
electron	11															
proton	11															
neutron		12	(1)													
			Total	9												

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Question	Answer	Marks	Guidance
6	<p><b>[Level 3]</b> Explains the <b>specific decisions about A and B and Te and I</b>. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Makes <b>statements</b> about both A and B and Te and I OR gives a <b>statement</b> and <b>explanation</b> for EITHER A and B or Te and I. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes some <b>properties of elements in the table</b> or ideas about <b>general decisions</b> OR makes a <b>statement</b> about EITHER A and B OR Te and I. 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>This question is targeted at grades up to A</p> <p><b>Indicative scientific points may include:</b></p> <p><b>Properties of elements in the table</b></p> <ul style="list-style-type: none"> <li>elements are arranged in groups with similar properties</li> <li>elements show trends in properties</li> <li>can predict properties of (new) elements</li> </ul> <p><b>General decisions</b></p> <ul style="list-style-type: none"> <li>Mdv put all elements in order of RAM</li> <li>some elements did not 'fit'</li> <li>put some elements in different places to make them fit</li> <li>knew that not all elements had been discovered</li> <li>left gaps for undiscovered elements</li> <li>reversed some elements</li> <li>Mdv did not know about proton numbers / atomic structure</li> </ul> <p><b>Specific decisions about A and B, Te and I</b></p> <p><b>Statements:</b></p> <ul style="list-style-type: none"> <li>A and B are gaps</li> <li>reversed positions of Te and I (by their RAM)</li> </ul> <p><b>Explanations:</b></p> <ul style="list-style-type: none"> <li>because A and B are undiscovered</li> <li>Mendeleev predicted properties for A and B</li> <li>A and B are Ga and Ge</li> <li>new elements fitted properties he had predicted</li> <li>so that Te and I 'fit'</li> <li>so that properties of Te / I are similar to their group</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	

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Question			Answer	Marks	Guidance
7	(a)	(i)	<p>speed = 0.510 m/s; (1)</p> <p>average = 0.505 m/s (1)</p>	2	<p>speed: <b>accept</b> 0.51</p> <p>average:  <b>accept</b> 0.5047 / 0.5046 r / 0.5046            (i.e. 6 recurring, shown by r or dot over number 6)</p> <p><b>do not accept</b> 0.504 / 0.51 / answers with more than 4 decimal places</p>
		(ii)	<p>EITHER            (Jim is wrong / speed must change as it falls because) increasing height increases speed;</p> <p>OR            (Jim is right cases fall at a steady speed OR difficult to tell because)            averages are inside each others ranges / data ranges overlap owtte;</p>	1	<p>answer should indicate whether or not Jim is correct</p> <p><b>accept</b> values or (average) speeds are close together idea</p> <p><b>do not accept</b> <u>times</u> are similar</p>
	(b)		<p><i>any two from:</i></p> <p>draughts / air currents; (1)</p> <p>air temperature / pressure; (1)</p> <p>how the case is released; (1)</p> <p>shape of cake case might change; (1)</p> <p>idea difficult for Jim to measure (short) times accurately; (1) owtte</p> <p>cake case does not travel straight down idea; (1)</p>	2	<p><b>ignore</b> height of release / differences in cake case (the same cake case is used)</p> <p><b>ignore</b> air resistance</p> <p><b>ignore</b> stop watch is not accurate</p>
			<b>Total</b>	<b>5</b>	

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Question	Answer	Marks	Guidance
8	<p><b>[Level 3]</b> Discusses <b>energy transfer in terms of KE at steady speed</b>. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Describes <b>forces acting</b> and an explanation of <b>during the fall</b> in terms of EITHER balanced forces OR loss of GPE. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes <b>forces acting</b> OR describes what happens <b>during the fall</b>. 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*</b></p> <p><b>Forces acting (check diagram for labels)</b></p> <ul style="list-style-type: none"> <li>gravity/weight causes parachute to fall</li> <li>gravity/weight acts downwards / causes downward motion</li> <li>but air resistance / friction / drag slows descent</li> <li>air resistance / friction acts upwards (on parachute)</li> <li>large surface area of parachute increases air resistance</li> </ul> <p><b>ignore</b> upthrust</p> <p><b>During the fall</b> <b>Balanced forces:</b></p> <ul style="list-style-type: none"> <li>forces are balanced or equal and opposite <u>at steady speed</u></li> </ul> <p><b>Loss of GPE:</b></p> <ul style="list-style-type: none"> <li>Ben has GPE</li> <li>GPE is lost (during the fall)</li> <li>lost GPE should be converted to KE / KE should increase</li> </ul> <p><b>accept</b> GPE <i>is</i> converted to KE <b>ignore</b> GPE = KE</p> <p><b>Energy transfer in terms of KE at steady speed</b></p> <ul style="list-style-type: none"> <li>but KE does not increase / KE is constant</li> <li>energy is conserved (<u>loss</u> of GPE = <u>gain</u> in KE)</li> <li>parachute prevents KE from increasing</li> <li>but work done on parachute</li> <li>transfers lost GPE to heat instead of KE</li> </ul> <p><b>ignore</b> references to momentum and acceleration</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	



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Question			Answer	Marks	Guidance
9	(a)		6 000 (2 marks) 12 000 (1 mark)	2	
	(b)	(i)	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <b>force</b>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">A</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">B</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">C</div> </div> <div style="text-align: center;"> <b>name</b>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">mass</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">weight</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">friction</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">reaction</div>  <div style="border: 1px solid black; padding: 2px; margin: 5px;">force</div> </div> </div>	2	correct pattern for [2] one mistake for [1]
		(ii)	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <math>B - C = A</math>  <math>B - 4C = 0</math>  <math>B + C = A</math>  <math>A + B + C = 0</math> </div> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <div style="height: 20px; width: 30px;"></div>  <div style="height: 20px; width: 30px; display: flex; align-items: center; justify-content: center;">✓</div>  <div style="height: 20px; width: 30px;"></div>  <div style="height: 20px; width: 30px;"></div> </div> </div>	1	
	(c)		A	1	
			<b>Total</b>	<b>6</b>	

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Question			Answer	Marks	Guidance
10	(a)		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <div style="text-align: center;">✓</div> <div style="border: 1px solid black; height: 15px; margin: 2px;"></div> <div style="border: 1px solid black; height: 15px; margin: 2px;"></div> <div style="border: 1px solid black; height: 15px; margin: 2px;"></div> </div>	1	
	(b)		<p>smaller impact force; (1)</p> <p>time taken to stop the ball increases / increases time for ball's momentum to change / increases time force acts / increases time for ball to slow down; (1)</p>	2	
			<b>Total</b>	<b>3</b>	

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