

**Science A**

General Certificate of Secondary Education

Unit **A141/01**: Unit 1: Modules B1, C1, P1 (Foundation 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
L1 , L2 , L3	Allocate level of 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.

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

- d. 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)	tremor / clumsiness / memory loss / inability to concentrate / mood changes	1	<b>accept</b> any other valid symptom, eg lack of coordination, lack of body control, lack of balance, dementia  <b>ignore</b> muscle problems, disability, dizziness,												
	(b) (i)	<div style="text-align: center;"> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="2" style="text-align: center;">Alesha's mother</td> </tr> <tr> <td style="text-align: center;">h</td> <td style="text-align: center;">h</td> </tr> <tr> <td style="text-align: center;">Alesha's father</td> <td> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">Hh</td> <td style="text-align: center;">Hh</td> </tr> <tr> <td style="text-align: center;">h</td> <td style="text-align: center;">hh</td> <td style="text-align: center;">hh</td> </tr> </table> </td> </tr> </table> </div>	Alesha's mother		h	h	Alesha's father	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">Hh</td> <td style="text-align: center;">Hh</td> </tr> <tr> <td style="text-align: center;">h</td> <td style="text-align: center;">hh</td> <td style="text-align: center;">hh</td> </tr> </table>	H	Hh	Hh	h	hh	hh	2	mother hh (1)  father H h (1)
Alesha's mother																
h	h															
Alesha's father	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">Hh</td> <td style="text-align: center;">Hh</td> </tr> <tr> <td style="text-align: center;">h</td> <td style="text-align: center;">hh</td> <td style="text-align: center;">hh</td> </tr> </table>	H	Hh	Hh	h	hh	hh									
H	Hh	Hh														
h	hh	hh														
	(b) (ii)	0.5	1													
	(c)	for: enable her to plan future / decide whether to have children / may qualify for help (1)  against: stressful / results not 100% reliable / may not want to know / may lead to discrimination against her (1)	2	<b>ignore</b> 'to see if she has it' [= stem] / damages the embryo  for - so she can look for treatment  anti - any reasonable suggestion [spec makes no reference to details of the testing] - accept 'testing may have side effects' - so she can live a normal life - so she can just deal with it if it comes - ethically wrong eg believes it is against God's will  if the 'for' and the 'anti' are not stated, use the context of the answer to decide.												
<b>Total</b>			<b>6</b>													

Question			Answer	Marks	Guidance
2	(a)	(i)	3:2 3 to 2	1	do <b>not</b> credit 6:4 <b>allow</b> to or / or – in place of the colon <b>NOT</b> 2:3 or 2/3 <b>ignore</b> 1.5 by itself, but accept 1.5:1
		(ii)	76%	1	
	(b)		<b>any two from:</b> fewer [short plants] stated or implied (1) neither parent was short (1) parents were carriers (of short allele) (1) need two short alleles to be short (1) tall plants are dominant (1)	2	assume unspecified plants are short plants.
	(c)		closer to (1) more plants (1)	2	
			<b>Total</b>	<b>6</b>	




Question	Answer	Marks	Guidance
3 (a)	<p><b>[Level 3]</b> Recognises that Thomas and James have identical genes. Describes and explains at least one difference due to environmental effects. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> States that Thomas and James inherit the same genes from both parents, but may confuse identical and non-identical twins. Links at least one difference to environmental effects, even if the word ‘environment’ is not used. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> May identify only similarities or differences between Thomas and James, possibly without explanation. May refer to genes/DNA but probably not related to the boys’ similarities; may refer to similarities to one or other parent. 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>Indicative scientific points at Level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• correct use of the terms gene and embryo</li> <li>• genes are identical</li> <li>• same genetic information</li> <li>• describes one heritable factor</li> <li>• twins came from same original embryo (one egg and one sperm) which split</li> <li>• genetic features include eye colour, nose shape</li> <li>• some features are controlled by the environment</li> <li>• influence of environment is different for each person</li> <li>• environmental features include hairstyle, scar, weight</li> <li>• suggested lifestyle differences responsible for these differences</li> </ul> <p><b>Indicative scientific points at Level 2 may include:</b></p> <ul style="list-style-type: none"> <li>• some genes from father, some from mother</li> <li>• genetic features include eye colour, nose shape</li> <li>• features inherited from either father or mother</li> <li>• embryos produced by paternal sperm and maternal egg</li> <li>• uses the term ‘environmental’ for the relevant factor(s)</li> <li>• influence of environment is different for each person</li> <li>• environmental features include hairstyle, scar, weight</li> </ul> <p><b>Indicative scientific points at Level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• some features inherited from parents</li> <li>• recognises an (environmental) difference</li> </ul> <p><b>accept</b> hair colour as either genetic or environmental</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question		Answer	Marks	Guidance
	(b)	XY XX X	2	3 correct = 2 marks 1 or 2 correct = 1 mark
<b>Total</b>			<b>8</b>	

4	(a)	<table border="1"> <tr> <td>The car is heavier...</td> <td></td> </tr> <tr> <td>The battery stops polluting gases...</td> <td></td> </tr> <tr> <td>The electric motor means less petrol is burned.</td> <td>✓</td> </tr> <tr> <td>The battery stores energy that would otherwise...</td> <td>✓</td> </tr> </table>		The car is heavier...		The battery stops polluting gases...		The electric motor means less petrol is burned.	✓	The battery stores energy that would otherwise...	✓	1	<b>both</b> answers correct for 1 mark tick in any other box = 0	
		The car is heavier...												
		The battery stops polluting gases...												
		The electric motor means less petrol is burned.	✓											
The battery stores energy that would otherwise...	✓													
(b)	(i)	1200 x 2.1 (= 2520)	1	<b>accept</b> explanation in words provided that multiplication is clear. 2520 kg is in the question: this question is about the logic. <b>accept</b> reverse working, i.e. 2520/2.1 = 1200										
	(ii)	16000 x 90 (= 1440000 (g)) (1); = 1440000/ 1000 = 1440 kg 2520 – 1440 = 1080kg (1)	2	if you see 1440000 or 1440, award the first mark. correct numerical answer of 1080 gets both marks even with no working. no ecf from incorrect mass in first calculation.										
(c)	<table border="1"> <tr> <td>It reacts with oxygen...</td> <td></td> </tr> <tr> <td>It is used by plants in photosynthesis.</td> <td>✓</td> </tr> <tr> <td>It is dependant on surfaces.</td> <td></td> </tr> <tr> <td>It is used by animals in respiration.</td> <td></td> </tr> <tr> <td>It dissolves in sea water.</td> <td>✓</td> </tr> </table>		It reacts with oxygen...		It is used by plants in photosynthesis.	✓	It is dependant on surfaces.		It is used by animals in respiration.		It dissolves in sea water.	✓	2	
It reacts with oxygen...														
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It dissolves in sea water.	✓													

Question	Answer	Marks	Guidance
(d)	<p><b>[Level 3]</b> Can give at least two methods, each with a different explanation that shows why the pollution is less. OR two methods plus, for one of them, explanation that shows why the pollution is less plus further detail. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Can give at least two methods, with explanation of one of them. There may be examples of incorrect science alongside the credit-worthy material. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Can give two methods with no explanation or one method and an explanation OR discusses detail of hybrid cars only. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Irrelevant or no science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to E</b> <b>Ignore</b> “pollution is less” [stem]</p> <p><b>Indicative scientific points may include:</b> <b>Scientific points indicative of level 3 are</b></p> <ul style="list-style-type: none"> <li>• catalytic converters – removes pollutants [ie more than lowers pollution]/ removes named pollutant [nitrogen oxide[s] or carbon monoxide]</li> <li>• convert nitrogen oxide[s] to nitrogen</li> <li>• convert carbon monoxide to carbon dioxide</li> <li>• low sulfur fuels makes less sulfur dioxide</li> </ul> <p><b>Scientific points indicative at any level may include:</b></p> <ul style="list-style-type: none"> <li>• go on foot – reduces car use</li> <li>• go by bike – reduces car use</li> <li>• use public transport - carries more people / fewer cars on the road / pollution <i>per person</i> is less</li> <li>• introduction of initiatives [‘bike to work’, park and ride] - reduces car use</li> <li>• legal limits / MOT tests - makes people service their cars</li> <li>• Use vegetable oil as fuel – less pollutants</li> <li>• Electric /solar / hydrogen cars – don’t use petrol</li> <li>• More efficient engines / drive more slowly / carry less in car /turn off air conditioning/ smaller car – use less fuel</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>12</b>	

Question		Answer	Marks	Guidance
5	(a)		1	
	(b)	carbon in the fuel (1) with oxygen from the air (1) not enough oxygen / incomplete combustion (1)	3	<b>allow</b> 'oxygen comes from photosynthesis'
		<b>Total</b>	<b>4</b>	

Question		Answer	Marks	Guidance										
6	(a)	<table border="1"> <tr> <td>As the amount of coal burned increases the...</td> <td>✓</td> </tr> <tr> <td>Between 1990 and 2005...</td> <td></td> </tr> <tr> <td>More power stations are built...</td> <td></td> </tr> <tr> <td>Burning coal has no effect...</td> <td></td> </tr> <tr> <td>Modern power stations put less...</td> <td></td> </tr> </table>	As the amount of coal burned increases the...	✓	Between 1990 and 2005...		More power stations are built...		Burning coal has no effect...		Modern power stations put less...		1	
As the amount of coal burned increases the...	✓													
Between 1990 and 2005...														
More power stations are built...														
Burning coal has no effect...														
Modern power stations put less...														
	(b)	<p>Coal contains sulfur/produces sulfur dioxide / sulfur dioxide [per ton of coal] is less (1)</p> <p><b>and any two from:</b></p> <p>realises that there has been a change in the power station or the coal (1)</p> <p>specifies the change</p> <ul style="list-style-type: none"> <li>power station has installed filters (1)</li> <li>coal contains less sulfur (1)</li> <li>sulfur removed from flue gases (1)</li> <li>sulfur removed from coal (1)</li> </ul> <p><b>Allow</b> figures quoted from the graph, but they must apply to 2005 onwards (1)</p>	3	<p><b>ignore</b> 'The more coal, the more SO<sub>2</sub>' - the correlation between coal burning and levels of SO<sub>2</sub> is tested in the previous question.</p> <p><b>accept</b> 'sulfur' for 'sulfur dioxide'</p> <p><b>NOTE</b> any change which is specified shows the understanding that a change has been made, so also gains the recognition of change mark.</p>										
		<b>Total</b>	<b>4</b>											

Question		Answer	Marks	Guidance
7	(a)	A	1	
	(b)	(i) 400 (km)	1	
		(ii) P-waves will arrive first (1) P-waves travel faster than S-waves (1)	2	AW no ecf "P-waves get to the detector faster" = 2 [bod]
	(c)	(i) selects equation: speed = frequency x wavelength or 400 x 10 (1) 4000 (1)	2	correct numerical answer of 4000 gets both marks, even with no working.
		(ii) Has considered which speed matches best  4000 m/s = 4 km/s [hence S-wave]/ because a P-wave would be 6000 m/s / because it is slower than a P-wave	1	the mark is for the reason, not for the choice of wave.  <b>Ignore</b> "an S-wave because of its speed"
		<b>Total</b>	<b>7</b>	

Question	Answer	Marks	Guidance
8	<p><b>[Level 3]</b> Explains W's theory in terms of the movement apart of continents and the evidence it explains. Plate tectonics does not form part of the explanation. Gives two or more reasons for its rejection. Reasons for rejection are made within a clear context. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Describes the theory with some lack of clarity. Points may be stated but not integrated into the candidate's overall answer. May not understand the difference between the theory and the evidence for it, so gives evidence for the theory instead of the description of the theory itself. May include several aspects of plate tectonics. May give a clear description of the theory and one reason for its rejection or limited description of the theory and at least two reasons for its rejection. Quality of written communication partly impedes communication of the science at this level eg uses the term 'plates' instead of 'continents'. (3 – 4 marks)</p> <p><b>[Level 1]</b> Discusses one or two simplistic aspects at most, eg the theory, reason for rejection, the evidence for it. 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>indicative scientific points at level 3 may include:</b> Continents have moved apart Land bridges linked to the fossil record</p> <p><b>indicative scientific points at level 2 may include:</b> There are land bridges Continents were joined OR continents move</p> <p><b>general indicative scientific points may include:</b> The theory</p> <ul style="list-style-type: none"> <li>• the continents have moved / separated</li> <li>• the continents were joined/ fitted together / were a supercontinent</li> </ul> <p>things which it explains</p> <ul style="list-style-type: none"> <li>• shape/ match/ jigsaw fit of continents</li> <li>• similar fossils in different continents</li> <li>• similar rock layers in different continents</li> <li>• mountain building</li> </ul> <p>reasons for lack of acceptance include</p> <ul style="list-style-type: none"> <li>• no known mechanism for movement</li> <li>• continental movement not observable</li> <li>• evidence limited / he didn't have enough proof</li> <li>• too big an idea [from limited evidence]</li> <li>• other explanations existed [for some of the evidence] eg land bridge</li> <li>• Wegener was an outsider / not a geologist</li> </ul> <p><b>ignore</b> 'Wegener was not a scientist' <b>ignore</b> 'you can't feel the Earth move'</p>

Question			Answer	Marks	Guidance
					Plate tectonic aspects to watch out for: <ul style="list-style-type: none"> <li>• sea floor spreading</li> <li>• convection</li> <li>• subduction</li> <li>• plates</li> </ul> <b>accept</b> diagrams showing any of the above  <b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b>
			<b>Total</b>	<b>6</b>	

Question			Answer	Marks	Guidance								
<b>9</b>	(a)		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>Ann</td><td style="text-align: center;">✓</td></tr> <tr><td>Ben</td><td></td></tr> <tr><td>Collin</td><td></td></tr> <tr><td>Diana</td><td></td></tr> </table>	Ann	✓	Ben		Collin		Diana		1	
Ann	✓												
Ben													
Collin													
Diana													
	(b)		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>Ann</td><td style="text-align: center;">✓</td></tr> <tr><td>Ben</td><td></td></tr> <tr><td>Collin</td><td></td></tr> <tr><td>Diana</td><td style="text-align: center;">✓</td></tr> </table>	Ann	✓	Ben		Collin		Diana	✓	2	
Ann	✓												
Ben													
Collin													
Diana	✓												
			<b>Total</b>	<b>3</b>									



Question		Answer	Marks	Guidance
10	(a)	5 (million light-years)	1	<b>allow</b> 4.5 to 5.5
	(b)	galaxies that are further away are moving (away) faster / distance and speed are positively correlated (1)	1	either approach direction of correlation must be explicit
	(c)	realises that not all the data has been used / recognises the outlier (1);  <b>Either</b> (YES because) reason for exclusion e.g. it gives a value for <b>B</b> that fits the pattern on the graph / the 6.6 is very different from other values <b>or</b> (NO because) there is no valid reason for excluding it / data needed further investigation (1)	2	
		<b>Total</b>	<b>4</b>	

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