

# **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:

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

**Subject-specific Marking Instructions**

- a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- 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 the third and fourth boxes are required for the mark:

✗
✗

*This would be worth  
1 mark.*

✓
✗

*This would be worth  
0 marks.*

✗
✗
✓
✓

*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-box questions:

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 and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. 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 cities in England:

Edinburgh	
Manchester	
Paris	
Southampton	

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).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	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

- 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
1	(a)	2.0	1	if two or more answers circled = 0
	(b)	(i) 0.9	1	
		(ii) 72 000 (2)	2	<b>if answer is incorrect, look for correct working:</b>  1 x 60 x 1200 (1) <b>OR</b> 60 x 1200 (1)  <b>allow</b> 72 as the answer (1)
<b>Total</b>			<b>4</b>	

Question		Answer	Mark	Guidance
2	(a)	<b>A</b> (nuclear) <u>reactor/boiler</u> <b>B</b> <u>turbine</u> <b>C</b> <u>generator</u> <b>D</b> <u>transformer</u>	3	all correct = 3 marks 3 correct = 2 marks 2 correct = 1 mark 1 correct = 0 marks  <b>do not allow</b> furnace
	(b)	definition of contamination <b>OR</b> irradiation (1)  idea that risk depends on duration of exposure / intensity of exposure / half-life of source / type of radioactive source (alpha, beta, gamma) / distance to source (1)	2	contamination = radioactive materials in/on the body/clothes irradiation = exposure to radioactive materials from an external source  <b>ignore</b> unqualified ref to contamination being more dangerous
<b>Total</b>			<b>5</b>	



Question		Answer	Mark	Guidance
3	(a)	<p>21% OR 180 (1)</p> <p>a conclusion which is linked to the correct calculation (1)</p>	2	<p>this question requires candidates to do a <b>calculation</b> and make a <b>conclusion</b> based on that calculation</p> <p><b>allow</b> 21.1% or 21.111111%</p> <p>21% comes from <math>190/900 \times 100</math></p> <p>180 comes from <math>20/100 \times 900</math></p> <p>examples include:</p> <p>yes (statement is correct) as 21% is nearly 20% / 180 is nearly 190</p> <p>allow no (statement is incorrect) as 21% is not 20% / 180 is not 190</p>
	(b)	68	1	
	(c)	<p><i>any two from:</i></p> <p>use of fossil fuels (oil/gas/coal) becomes a smaller proportion of total input (1)</p> <p>use of renewable fuels/nuclear increases / becomes a larger proportion of total input (1)</p> <p>total input increases as a whole (1)</p>	2	<p><b>do not allow</b> use of fossils fuels decreases (given in the stem)</p> <p><b>ignore</b> nuclear decreases</p>
<b>Total</b>			<b>5</b>	

Question	Answer	Mark	Guidance
4	<p><b>(Level 3)</b> Answer includes suitable recommendation(s) for energy production <b>AND</b> detailed justification of why this is appropriate <b>AND</b> mentions the management of energy use on the island in the future. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>(Level 2)</b> Answer includes suitable recommendation(s) of energy production <b>AND</b> some justification(s) of why this is appropriate. Answer may mention the management of energy use on the island in the future. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>(Level 1)</b> Answer includes suitable recommendation(s) of energy production <b>AND</b> a justification of why this is appropriate. 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>Indicative scientific points include:</b></p> <p><b>Recommendation for energy production:</b></p> <ul style="list-style-type: none"> <li>• wind farm</li> <li>• (energy from) waves</li> <li>• biomass</li> <li>• (energy from) tides</li> <li>• hydroelectric</li> <li>• solar</li> </ul> <p><b>ignore</b> nuclear/use of fossil fuels</p> <p><b>Justification of choice:</b></p> <ul style="list-style-type: none"> <li>• small population / large power station unnecessary</li> <li>• small land area / less space for large power station</li> <li>• remote / difficulty transporting materials</li> <li>• building and maintenance costs</li> <li>• impact on environment / pollution</li> <li>• continuous supply of energy needed</li> <li>• management of waste</li> <li>• economic benefit / employment opportunities</li> <li>• windy / an island surrounded by the sea</li> </ul> <p><b>allow</b> reasons why nuclear/fossil fuels are not appropriate compared to the recommendations above</p> <p><b>Managing energy use:</b></p> <ul style="list-style-type: none"> <li>• need to reduce energy demand</li> <li>• e.g. insulation/switching off appliances/turf roofs/working from home/using energy efficient appliances</li> <li>• mention of <u>sustainability</u></li> </ul>

Question			Answer	Mark	Guidance
					Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

Question		Answer	Mark	Guidance
5	(a)	used to monitor environment / environmental change (1)	1	<b>allow</b> specific ways in which environment can be monitored or may change, e.g. pollution, temperature, atmospheric change
	(b)	<p>(area A) because very polluted (1) other two areas are less polluted (1)</p> <p>OR</p> <p>(area B) because not polluted (1) A is very polluted / C is already recovering on its own (1)</p> <p>OR</p> <p>(area C) because it is recovering from pollution / recently became less polluted (1) A is very polluted / B is not polluted (1)</p>	2	<p>why they chose their area (1) why they didn't choose one of the other areas (1)</p> <p><b>ignore</b> idea of conserving the nymphs</p> <p><b>allow</b> idea that environment is not clean / stagnant / lacking oxygen / high in nitrates for pollution throughout</p> <p><b>ignore</b> better habitat / better quality area</p>
<b>Total</b>			<b>3</b>	

Question			Answer	Mark	Guidance																		
6	(a)	(i)	(krill) -----> jellyfish -----> sea turtles (1)	1	arrows must have clear arrow heads arrows must point in correct direction																		
		(ii)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">They prevent nutrients being recycled...</td> <td style="width: 20px; text-align: center;"> </td> <td style="width: 20px; text-align: center;"> </td> </tr> <tr> <td style="padding: 2px;">They fix nitrogen.</td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="padding: 2px;">They feed on dead organisms...</td> <td style="text-align: center;">✓</td> <td style="text-align: center;"> </td> </tr> <tr> <td style="padding: 2px;">They are predators of decomposers.</td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="padding: 2px;">They carry out photosynthesis....</td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="padding: 2px;">They release carbon dioxide.....</td> <td style="text-align: center;">✓</td> <td style="text-align: center;"> </td> </tr> </table> <p style="text-align: right;">(1)</p>	They prevent nutrients being recycled...			They fix nitrogen.			They feed on dead organisms...	✓		They are predators of decomposers.			They carry out photosynthesis....			They release carbon dioxide.....	✓		1	both ticks required for mark  ticks in 3 or more boxes = 0 marks
They prevent nutrients being recycled...																							
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They release carbon dioxide.....	✓																						
		(iii)	decrease increase increase increase (1)	1	all correct for the mark																		
	(b)	(i)	0.14 (2)	2	if incorrect, look for:  140/100 000 (x 100) <b>OR</b> 0.0014 (1)																		
		(ii)	energy passes out of the food chain (at each stage) / less energy transferred to next level / energy used up (by organisms earlier in the food chain) (1)  (energy loss) via heat (from respiration) / movement / waste / uneaten parts / decomposition (1)  there are more stages in shark food chain (so more energy lost) (1)	3	<b>allow</b> energy is wasted  <b>ignore</b> respiration on its own  need to see a comparison with whale food chain  'energy is lost via heat' = 2 marks																		
<b>Total</b>				<b>8</b>																			

Question		Answer	Mark	Guidance
7	(a)	<p><b>(Level 3)</b> Answer gives a detailed and logically presented description of natural selection, identifying the key stages in a logical order. Quality of written communication does not impede communication of the science at this level.  (5 – 6 marks)</p> <p><b>(Level 2)</b> Answer gives a partial description of natural selection and identifies some of the key stages. The stages may not be sequenced in a logical order and there may be some errors. Quality of written communication partly impedes communication of the science at this level.  (3 – 4 marks)</p> <p><b>(Level 1)</b> Answer gives some correct features of natural selection but is poorly structured and does not describe the stages in a logical order. 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 for each stage of natural selection include:</b></p> <p><b>Variation</b></p> <ul style="list-style-type: none"> <li>• all individuals of the same species show variation / are different</li> <li>• some differences are genetic / random mutations can cause genetic differences</li> </ul> <p><b>Competition &amp; Survival</b></p> <ul style="list-style-type: none"> <li>• a change in conditions / idea of selection pressure, e.g. drought, change in food availability</li> <li>• leads to ‘fighting’ for food/mate etc / competition idea</li> <li>• best adapted organisms survive / ‘survival of the fittest’</li> </ul> <p><b>Reproduction</b></p> <ul style="list-style-type: none"> <li>• these organisms are more likely to reproduce</li> <li>• passing on the beneficial characteristic/alleles/genes to offspring</li> </ul> <p><b>allow</b> these points if made relevant to a specific organism</p> <p><b>ignore</b> references to Lamarck and his ideas (the idea that characteristics change during the lifetime of the organism)</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question		Answer	Mark	Guidance
(b)		Lamarck proposed his ideas much earlier...		3 ticks in 4 boxes deduct 1 mark ticks in 5 boxes deduct 2 marks ticks in 6 or more boxes = 0 marks
		Some people believe that God created.....		
		There is no scientific evidence to prove...	✓ (1)	
		Fossils found in older rocks are different....		
		There is no mechanism to explain how....	✓ (1)	
		Darwin used creative thought to.....		
		Darwin was not as well-known as.....		
		Our understanding of genetics now.....	✓ (1)	
<b>Total</b>			<b>9</b>	

Question		Answer	Mark	Guidance
8	(a)	2.78.....no (2)	2	<p>this question requires candidates to do a <b>calculation</b> and make a <b>decision</b> based on the value</p> <p><b>allow</b> any idea that it is not more, e.g. 'less' / 'not more' / 'fewer'</p> <p><b>if two marks can't be awarded:</b></p> <p><i>if decision is no, mark as follows:</i></p> <p>1 + 0.68/2 + 2.88/2... .no (1)  1 + 0.34 + 1.44.....no (1)</p> <p><i>if decision is yes, mark as follows:</i></p> <p>2.78.....yes (1)</p> <p><i>if the decision is missing:</i></p> <p>2.78..... (1)</p> <p><i>if the calculation is missing:</i></p> <p>.....yes/no (0)</p>



Question	Answer	Mark	Guidance
(b)	<p><i>any three from:</i></p> <p><i>arguments for lower salt levels in food:</i></p> <p>salt gives risk of high blood pressure/stroke/heart disease/heart attack/kidney disease (1)</p> <p>fewer people buy the food with high salt (because of the health risks) / less income for companies (1)</p> <p><i>arguments against lower salt levels in food:</i></p> <p>salt enhances flavour (1)</p> <p>fewer people buy the food with low salt (because it doesn't taste nice) / less income for companies (1)</p> <p>salt acts as a preservative / lower salt may result in food spoilage (1)</p> <p>low salt means companies have to find other ways of preserving / come up with other recipes (1)</p> <p>(food spoils quickly so) people have to shop more often / companies have to make food more regularly (1)</p>	3	<p><b>allow</b> 'heart problems'</p> <p><b>ignore</b> unqualified references to health</p>
	<b>Total</b>	<b>5</b>	

Question		Answer	Mark	Guidance																		
9	(a)	idea of sea / salty water (1)  idea of evaporation or drying up (1)	2	<b>do not allow</b> idea of extraction (from deposits in the ground)  'salt is left when the sea dries up' = 2 marks																		
	(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="height: 15px;"></td><td style="width: 20px;"></td></tr> <tr><td style="height: 15px;"></td><td></td></tr> <tr><td style="height: 15px;">Climates are different at different.....</td><td style="text-align: center;">✓</td></tr> <tr><td style="height: 15px;"></td><td></td></tr> <tr><td style="height: 15px;"></td><td></td></tr> <tr><td style="height: 15px;">Land masses move because of movement.....</td><td style="text-align: center;">✓</td></tr> <tr><td style="height: 15px;"></td><td></td></tr> <tr><td style="height: 15px;"></td><td></td></tr> <tr><td style="height: 15px;"></td><td></td></tr> </table> <p style="text-align: right;">(2)</p>					Climates are different at different.....	✓					Land masses move because of movement.....	✓							2	ticks in 3 boxes deduct 1 mark ticks in 4 or more boxes = 0 marks
Climates are different at different.....	✓																					
Land masses move because of movement.....	✓																					

Question	Answer	Mark	Guidance
(c)	<p><b>(Level 3)</b> Answer includes a detailed explanation of how the rocks can be used as evidence <b>AND</b> includes a detailed explanation why there are variations in the direction of magnetism. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>(Level 2)</b> Answer includes a reasonable explanation of how the rocks can be used as evidence <b>AND/OR</b> gives a reasonable explanation why there are variations in the direction of magnetism. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>(Level 1)</b> Answer attempts to explain how the rocks can be used as evidence for the movement of the continents <b>AND/OR</b> attempts to explain why there are variations in the direction of magnetism. 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>Indicative scientific points for HOW the rocks can be used as evidence:</b></p> <ul style="list-style-type: none"> <li>• direction of magnetism is the same (in S America as in W Africa)</li> <li>• when the continents were together rocks formed at the same time</li> <li>• evidence for movement of S America away from W Africa</li> <li>• ref tectonic plate movement</li> </ul> <p><b>ignore</b> ref to geometric fit / fossils the same <b>ignore</b> ref to 'being part of the same land mass' (in stem)</p> <p><b>Indicative scientific points for WHY there are variations in the direction of magnetism include:</b></p> <ul style="list-style-type: none"> <li>• molten rocks solidify</li> <li>• magnetism is fixed in rocks (when they solidify)</li> <li>• direction of the magnetism is determined by Earth's magnetic field</li> <li>• rocks formed in different places will have different directions of magnetism</li> <li>• direction of Earth's magnetic field can switch / ref to reversal of magnetism</li> <li>• allow ref to sea floor spreading / magnetic stripes</li> </ul> <p><b>allow</b> idea that variation is due to movement of rocks (max Level 2)</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>10</b>	

Question		Answer	Mark	Guidance
10	(a)	2.2 (tonnes) (2)	2	<p>if incorrect, look for evidence of <b>correct</b> method (max 1):</p> <p>examples include:</p> <p>46/100 x 10 and 24/100 x 10 (1)  46% x 10 and 24% x 10 (1)  4.6 – 2.4 (1)  22/100 x 10 (1)</p> <p><b>NOTE:</b></p> <p><b>allow</b> 2.9 (tonnes) <b>with</b> clear working / indication that the candidate has identified that segment for alkali (in 2010) fits 53% rather than 46% (2)</p> <p><b>allow</b> 2.9 (tonnes) <b>without</b> working / indication that the chart is incorrect (max 1)</p> <p><b>allow</b> a candidate who makes clear that the segment of the pie chart for alkali is too large (OWTTE) and is then unsure how to answer (1)</p>

Question		Answer	Mark	Guidance
	(b)	<p><i>any three from:</i></p> <p><i>in 2010:</i></p> <p>process produces less CO<sub>2</sub> / pollution (1)</p> <p>process less likely to contribute to greenhouse effect / global warming / climate change (1)</p> <p>no hydrogen chloride / hydrogen sulphide made (which are dangerous/smelly) (1)</p> <p>waste products (chlorine) can be used for other things (1)</p> <p>method is more sustainable (1)</p> <p>less coal/limestone available (1)</p> <p>lower costs for transporting materials (1)</p> <p>legal restrictions to pollution / dumping of waste / emissions (1)</p> <p>electricity is more available (1)</p>	3	<p><b>allow</b> ora throughout</p> <p><b>ignore</b> vague ref to efficiency</p> <p><b>ignore</b> non-specific 'damage to environment'</p> <p><b>ignore</b> ref to toxic gases in general</p> <p><b>allow</b> idea that coal not used as much (in 2010)</p>
<b>Total</b>			<b>5</b>	

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