

# **Environmental and Land Based Science**

General Certificate of Secondary Education

Unit **B681/02/04**: Management of the Natural Environment (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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For answers marked by levels of response:

- a. **Read through the whole answer from start to finish**
- b. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- c. **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.

### 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
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
	draw attention to particular part of candidate's response
	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. 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>

Question		CBT	Answer	Marks	Guidance	
1	(a)	1	<p>Artificial ecosystems have fewer habitats. <input checked="" type="checkbox"/></p> <p>Golf courses use a lot of herbicides. <input checked="" type="checkbox"/></p> <p>Golf courses use high levels of irrigation. <input type="checkbox"/></p> <p>Golf buggies produce high levels of pollution. <input type="checkbox"/></p> <p>Grass is a poor food source for animals. <input type="checkbox"/></p> <p>Moorland soils are acidic. <input type="checkbox"/></p> <p>Recreation is bad for biodiversity. <input type="checkbox"/></p>	2		
	(b)	2	<p>Golf courses are often built on reclaimed land. <input type="checkbox"/></p> <p>Golf courses use high levels of irrigation. <input type="checkbox"/></p> <p>Golf courses use large quantities of artificial fertilisers. <input checked="" type="checkbox"/></p> <p>Grass is kept short through regular mowing. <input type="checkbox"/></p> <p>Soil is compacted by trampling. <input type="checkbox"/></p>	1		
2		3	<p>preservation is keeping the environment as it is;  conservation is management of the environment to keep a  balance in the environment  owtte</p>	2		
3	(a)	(i)	4	C – 70%	1	
		(ii)	4	£34.65 million	1	<b>allow</b> responses in the range £34.6 to £34.7 million

Question		CBT	Answer	Marks	Guidance
	(b)	5	<p><b>two from:</b> sandy or sandy loam/light soils (warm up more quickly) because they have reduced water content because they have larger particles and drain more quickly; (1) the result is that soils warm up more quickly because water evaporates before the soil is warmed/air has a lower heat capacity than water ora (1)</p>	2	<p><b>no marks</b> for just soil type without justification.</p> <p><b>allow</b> peaty loam because soil is black so absorbs more heat so warms up more quickly than light/reflective soils; (1 mark)</p> <p><b>1 mark</b> for selection of correct soil type and reason <b>1 mark</b> for description of the soil science relating to the soil</p>
4	(a)	6	beef because it is the only consumer/animal/others are all producers/plants	1	<b>no marks</b> for beef on its own
	(b)	7	$30/750 \times 100 = 4 (\%)$	2	<p>2 marks for correct answer 1 mark for correct working with incorrect answer</p>
	(c)	8	<p>losses due to: death of plants/organisms/parts of plants not eaten so energy unavailable to next level owtte;</p> <p>respiration of organisms transfers energy as heat; inefficiency of processing material by organisms; losses in faeces/urine</p>	2	<p><b>allow</b> produces energy as heat <b>allow</b> reference to energy being used in regular activities</p>
	(d)	9	use a more intensive system of (animal) production	1	<p><b>accept</b> examples of intensive systems <b>accept</b> concepts of making more of the plant energy ie harvesting and using all of the plant</p>
5	(a)	10	£100	1	

Question		CBT	Answer	Marks	Guidance
	(b)	11	heavy rain: slurry run off: apply in dry conditions/inject into soil; leaching: pollution of water-courses/ground water: apply during growing season spread of disease: illness to operator: wear protective equipment/wash; equipment hazard: excess nitrogen: scorching of plants/ reduce crop yield; limit amounts supplied	3	for full mark, all three boxes need to link logically <b>accept</b> falling into slurry and suitable responses <b>ignore</b> responses linked to smell  <b>accept</b> concept of heavy metal build up/ entering the food chain with the requirement for sampling and testing of the slurry
	(c)	12	need to test slurry to find nitrate/nitrogen content;  plus 1 of: only apply at certain times of the year; requirement to keep records on the total amount of nitrogen added from all sources; protect water courses;	2	look for the concept that slurry contains nitrates/ nitrogen  <b>accept</b> limitation of the amount of slurry to be added if linked to the fact that it contains nitrogen/ nitrates
6	(a)	13	10.5 million tonnes	1	<b>allow</b> responses between 10.2-10.8 million tonnes
	(b)	14	increase between 2002 and 2007; with one of: increase in demand; improved marketing; environmental awareness increase in costs of fossil fuel/ production became more cost effective  reduction from 2007-2009; with one of: cheaper production elsewhere; other crops produced more profit; reduction in government subsidy/change in policy; land needed for food production dissatisfaction with quality of product owtte	4	<b>allow</b> poorer growing conditions

Question		CBT	Answer	Marks	Guidance
	(c) (i)	15	D – 2.0	1	
	(ii)	16	32.5 million hectares	1	units needed <b>allow</b> ecf from <b>6ci</b>

Question		CBT	Answer	Marks	Guidance
7		17	<p><b>[Level 3]</b> Provides a very detailed description of a wide range of environmental impacts with detailed scientific explanations relating to intensive farming practices. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Provides a more detailed description of a limited range of environmental impacts with some simple explanations. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Provides a limited list <u>of changes</u> to the environment but without explanation. Alternatively, the candidate provides information of a specific change which is well explained. Answer may be simplistic. 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>Relevant points may include:</b></p> <ul style="list-style-type: none"> <li>• reduction in range of habitats because of loss of hedgerows to create larger fields</li> <li>• potential imbalance in nutrients / nutrient deficiencies due to repetition of the same crop (monoculture)</li> <li>• reduction in biodiversity because range of habitats is reduced, including loss of bird species and pollinators</li> <li>• reduction in biodiversity because of increased use of farm chemicals</li> <li>• potential increase in pests and diseases due to lack of natural predators / high density of food for pests, including species of birds</li> <li>• poorer soil structure due to heavy machines and (possibly) lack of organic matter returning to soil</li> <li>• decrease in numbers of soil organisms due to reduction in level of organic matter and degradation of soil structure</li> <li>• pollution due to high rate of chemical use – pesticides in food chains, eutrophication</li> <li>• ability to devote other areas to nature reserves.</li> </ul> <p><b>accept</b> references to aesthetic changes to landscape requirements for less labour <b>accept</b> references to pollution due to machine use</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>

Question		CBT	Answer	Marks	Guidance
8		18	<p><b>any two from:</b>                      hedge will trap cold air (from frost);                      soil will warm up more slowly/later crops;                      shade;                      protection of crops from excessive sunlight;                      less photosynthesis/growth/yield near hedge;                      reduced wind damage;                      nutrient robbing owtte;                      increased pest damage;                      water logging;                      reduction in wind speed- less crop damage</p>	<p>2</p> <p>2</p>	<p><b>allow</b> qualified answers relating to:                      erosion control;                      availability of water</p> <p><b>1 mark</b> for the identification of the issue and a further <b>1 mark</b> for the scientific explanation of the effect of the issue  <b>reject</b> simple statements such as “does not grow well”</p>

Question		CBT	Answer	Marks	Guidance
9		19	<p><b>[Level 3]</b> Provides a very detailed description of a wide range of cultural techniques with detailed scientific explanations relating to plant physiology and soil science. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Provides a more detailed description of a limited range of cultural techniques with some simple explanations. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Provides a limited list of changes to the cultural techniques to save water but without explanation. Answer may be simplistic. 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>Relevant points may include:</b></p> <ul style="list-style-type: none"> <li>• add organic matter to the soil to increase water holding capacity; improving crumb structure of soil to increase water holding capacity</li> <li>• use of trickle irrigation or other methods which deliver water close to the crop rather than boom sprayers or water ‘thrown’ over large distances; reduces losses due to evaporation and run off</li> <li>• measurement of weather/soil conditions to only add water when really required; to reduce wastage e.g. if forecast is for rain or soil has sufficient water in it; irrigation in the cooler part of the day to prevent excessive evaporation</li> <li>• collection of irrigation water run-off in a reservoir to recycle again</li> <li>• mulching the soil to reduce evaporation, aid infiltration and decrease run off</li> <li>• use of windbreaks to reduce transpiration rate of plants</li> <li>• need to maximise rate of photosynthesis and therefore growth by maintaining adequate supply of water, and keeping stomata open, to maintain CO<sub>2</sub> uptake</li> <li>• description of rainwater capture from buildings/ use of grey water</li> <li>• ICT solutions are linked to soil moisture measurement triggering irrigation as required. (ignore low level generic responses)</li> <li>• provide irrigation in the morning and evening (avoiding periods of high potential evaporation from the soil).</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks</b></p>

Question	CBT	Answer	Marks	Guidance
10	20	<p><b>[Level 3]</b> Provides a very detailed description of a wide range of changes to the design and use of machines with detailed scientific explanations relating to soil science and the physics of compaction. A well structured response, explaining a range of at least four relevant points from the list opposite. Quality of written communication does not impede communication of the science at this level. (5 – 6marks)</p> <p><b>[Level 2]</b> Provides a more detailed description of a limited range of changes to the design and use of machines with some simple explanations and some description of the effects of compaction on the soil. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Provides a limited list of changes to the design and use of machines but without explanation or provides some description of the consequences of soil compaction. Answer may be simplistic. 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>Relevant points may include:</b></p> <ul style="list-style-type: none"> <li>• compaction leads to poor soil structure – drainage, air, microbial activity – therefore loss of fertility and yield</li> <li>• use low impact/pressure/balloon/twin tyres to reduce mass/m<sup>2</sup></li> <li>• tread of tyres to reduce damage to soil surface</li> <li>• sprayers have narrow wheels to reduce compaction over the rest of the field/use defined tracks for vehicles to reduce area of compacted soil</li> <li>• use attachments with large ‘reach’ to reduce the number of track routes needed</li> <li>• do not use when soil is most likely to be compressed (high levels of water in the soil)</li> <li>• use sub-soiling to break up hard pan and compacted soils, to reduce water logging, flooding, erosion and build up of toxic minerals</li> <li>• reduce mass of machines to reduce pressure on soil.</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks</b></p>
		<b>Paper Total</b>	<b>50</b>	

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