



**General Certificate of Secondary Education
June 2011**

Environmental Science 44401H
(Specification 4440)

**Unit 1: Topics in Environmental Science
(Higher)**

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Marking Guidance for Examiners GCSE Science Papers

1 General

The mark scheme for each question shows:

- The marks available for each part of the question
- The total marks available for the question
- The typical answer or answers which are expected
- Extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
Where consequential marking needs to be considered in a calculation;
Or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

OWTTE can be used as an abbreviation for 'or words to that effect'

2 Crediting quality of overall response

In questions where there are a number of acceptable responses, the whole answer needs to be considered to ensure that marks that have already been awarded are not contradicted.

3 Emboldening

- 3.1 In a list of acceptable answers where more than one mark is available 'any **two from**' is used, with the number of marks emboldened. Each of the following lines is a potential mark.
- 3.2 bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 3.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / eg allow smooth / free movement.

4 Marking points

4.1 Marking of Quality of Written Communication (QWC)

In some questions candidates are assessed on using good English, organising information clearly and using specialist terms where appropriate.

Instructions for assessing QWC are given against the appropriate questions in the mark scheme.

4.2 Marking of lists

This applies to questions requiring a set number of response, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: Name the part of the cell that carries genetic information from parent to offspring (1 mark)

Candidate	Response	Marks Awarded
1	Chromosome, gamete	0
2	Chromosome, cytoplasm	0
3	Chromosome, *nucleus	1
4	Nucleus*, cytoplasm	0

Example 2: Name the two products of aerobic respiration. (2 marks)

Candidate	Response	Marks Awarded
1	Oxygen, carbon dioxide, water	1
2	Oxygen, carbon dioxide, water, nitrogen	0

4.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

4.4 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column ‘answers’ without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the ‘extra information column’;

4.5 Interpretation of ‘it’

Answers using the word ‘it’ should be given credit only if it is clear that the ‘it’ refers to the correct subject.

4.6 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowance for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

4.7 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

4.8 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

Higher Tier – 44401H

Question 1 44401H

Question 10 44401F

	answers	extra information	mark
1(a)	the distance food has to travel from producer to consumer		1
1(b)	any two from: the further it travels, the more fuel is used/fuel energy used in transport energy costs in refrigeration/preserving storage during transport	accept increased packaging needed	2
1(c)(i)	any five from: recycles water uses solar energy trapped by the glass to keep the crop warm uses water from the bore hole uses water from roof run-off produces its own electricity/heat uses waste heat uses waste CO ₂ uses bees for pollination uses biological pest control	accept does not use peat	5
1(c)(ii)	temperature plants adapted to survive in narrow range of temperature/ enzymes only work in a narrow range of temperatures carbon dioxide rate limiting factor in photosynthesis water needed for photosynthesis turgidly nutrient uptake		1 1 1
1(d)	because of the energy needed to grow them in our climate owtte		1

Question 1 continued

1(e)	production of crops for MEDCs can increase food prices in LEDCs cause damage to the local environment diversion of resources from locals to crop eg water	accept they do not get to eat the crop they grow accept vulnerable to changes in demand if they only grow one crop accept they do not always get a fair price for the crop	2
Total			14

Question 2 44401H

Question 11 44401F

	answers	extra information	mark
2(a)	any two from: grass/shrubs got too long chough could not find food loss of habitat hunting predation competition disease pollution	accept disturbance by walkers	2
2(b)	grazing reduced grass to suitable length/removed shrubby plants cow pats provided source of insects		2
2(c)	eg ringing survey to identify individuals count several times work out an average count number of nests	any suitable method	1
2(d)	any one from: routing people away from the nesting area fencing permits signage		1
2(e)(i)	any one from: cattle intimidating make paths muddy/mucky restrict free access		1
2(e)(ii)	any one from: cattle scare horses gates/fences restrict movement		1
2(e)(iii)	cattle may disturb the Iron Age settlement		1

Question 2 continued

	answers	extra information	mark
2(f)	any one from: increasing opportunities for everyone to enjoy the wonders of the natural world reducing the decline of biodiversity and licensing of protected species across England designating National Parks and Areas of Outstanding Natural Beauty managing most National Nature Reserves and notifying Sites of Specific Scientific Interest raising awareness of conservation issues		1
Total			10

Question 3 44401H

Question 12 44401F minus part (e)

	answers	extra information	mark
3(a)	biofuels from plants plants get their energy from the sun/photosynthesis		2
3(b)	1 mark for each fuel x2 solid eg wood liquid eg biodiesel 1 mark for each correct method of production x2 solid eg coppice willow production gaseous eg anaerobic digestion 1 mark for each appropriate use x2 liquid eg fuel for transport gaseous eg heating systems	accept fuel type if correct but does not match with method eg ethanol for liquid accept methane to power cars accept waste cooking oil/fat do not accept vegetable oil do not accept flatulence for methane production do not accept electricity generation as use for liquid biofuels	2 2 2
3(c)	they only release as much CO ₂ on combustion as was removed by photosynthesis when growing	do not accept CO ₂ absorbed by other plants	1
3(d)(i)	any one from: use of pesticides fertilisers land clearance still releases CO ₂ pollution from agricultural machines		1
3(d)(ii)	land used for growing fuels rather than crops for the local people		1
3(d)(iii)	any one from: natural habitats cleared to grow fuel crops crops grow as monoculture/intensively which is less good for wildlife		1

Question 3 continued

3(e)	some biofuels have a lower energy density than fossil fuel solid biofuels have lower density than solid fossil fuels or liquids and gaseous biofuels can have similar energy densities to fossil fuel	accept biofuels release less energy than fossil fuels	1 1
Total			14

Question 4 44401H

	answers	extra information	mark
4(a)	any two from: to influence government thinking to influence decision makers to raise awareness of global warming encourage people to reduce their carbon footprint to raise awareness of the work of WWF	do not accept to reduce carbon footprint do not accept to save energy	2
4(b)	any one from: maintains sufficiently high temperature too cold to support life all water frozen OWTTE		1
4(c)	shortwave absorbed longwave absorbed		1 1 1 1
4(d)	carbon dioxide – any form of combustion or deforestation. methane – agriculture livestock (ruminants), rice production, waste disposal nitrogen oxides – high temp combustion, cars, power stations etc application of fertiliser or their production	ignore respiration/digestion	1 1 1
4(e)(i)	companies can only produce as much CO ₂ as they have a permit licence for		1
4(e)(ii)	companies who produce low levels of CO ₂ can sell their CO ₂ permissions to other companies (who cannot meet the limits of their own licences) thus not reducing output in total	accept levels not set low enough ignore difficult to monitor	1
Total			12

Question 5 44401H

	answers	extra information	mark
5(a)	any two from: increased population size increased standards of living increased technology more vehicles industrialisation of developing countries energy inputs for increased food production		2
5(b)	any two from: many sites not suitable much of wind too high up cloud cover	accept equipment not efficient enough accept impractical due to numbers of solar panels/wind farms needed	2
5(c)(i)	low demand at night when people are asleep/industry not working higher demand in day when people using energy at home and at work		2

Question 5 continued

5(c)(ii)	Marks awarded for this answer will be determined by the quality of written communication.	
	The answer is coherent and in a logical sequence. It contains a range of appropriate or relevant specialist terms used accurately. The answer shows very few errors in spelling, punctuation and grammar. There is a clear and detailed scientific explanation of the way the predictability and intermittency of energy supplies produces the pattern shown in the graph. Covers all four energy sources.	4
	The answer has some structure and the use of specialist terms has been attempted, but not always accurately. There may be some errors in spelling, punctuation and grammar. There is a scientific explanation of the way the predictability and intermittency of energy supplies produces the pattern shown in the graph, but there is a lack of clarity and detail. Covers at least two to three energy sources.	2–3
	The answer is poorly constructed with an absence of specialist terms or their use demonstrates a lack of understanding of their meaning. The spelling, punctuation and grammar are weak. There is a brief explanation of the way the predictability and intermittency of energy supplies produces the pattern shown in the graph, which has little clarity and detail. Covers at least one energy source.	1
	There is no relevant content.	0
	examples of valid points that may contribute to a candidates response: <ul style="list-style-type: none"> • comment for each source of energy using one of the terms correctly in context eg- <ul style="list-style-type: none"> ○ tides intermittent but predictable ○ wind intermittent and unpredictable 	
5(d)(i)	waves are caused by the movement of wind	1
5(d)(ii)	geothermal	allow tidal
5(d)(iii)	any two from: reliant on specific sites which are limited many suitable sites already used very expensive to construct given the likely return	accept environmental considerations
Total		14

Question 6 44401H

	answers	extra information	mark
6(a)	US / USA		1
6(b)	78.4	accept 78 / 78.42..	1
6(c)(i)	1000 billion barrels		1
6(c)(ii)	\$100 per barrel		1
6(c)(iii)	\$50 – \$115	accept $\pm \$2$ (48 – 52 113 – 117)	1
6(d)	any four from: tar sands requires more energy per barrel to produce than conventional conventional produces least CO ₂ or open-cast the most conventional uses least water or mining tar sands the most opencast uses hot water and chemicals or conventional does not mining tar sands open-cast and therefore visual or other underground therefore less impact conventional produces less solid waste or tar sands produces the most	accept any general environmental impact related to differences between open-cast and drilling for oil	4
Total			9

Question 7 44401H

	answers	extra information	mark
7(a)	A – physical C – biological F – chemical		1 1 1
7(b)(i)	stage E – sludge digester		1
7(b)(ii)	stage C – trickling filter bed		1
7(c)	nitrate phosphate	do not accept nitrogen do not accept phosphorus	2
7(d)	nutrients cause increase in plant growth/algae blooms bacteria decompose <u>dead</u> plant material oxygen used by bacteria/ increased BOD and therefore aerobic species decline	eutrophication not credit worthy without explanation accept algae block out light causing death of other plants or reduced photosynthesis	3
Total			10

Question 8 44401H

	answers	extra information	mark
8(a)(i)	the numbers of extinctions and human population growth follow a similar pattern		1
8(a)(ii)	any three from: hunting/poaching introduction of pests pollution habitat destruction introduction of 'alien' species	accept climate change	3
8(b)	one mark for each management technique linked to an appropriate species eg providing nest sites for birds preventing human disturbance managing succession providing food sources habitat creation removing predators control of chemicals eg pesticides	max 3 marks ignore breeding programmes/zoo	3
8(c)(i)	CITES – prohibits trade in endangered species		1
8(c)(ii)	IUCN – lists endangered species in Red Data Book		1
8(c)(iii)	Ramsar – protects wetland habitats		1
Total			10

Question 9 44401H

	answers	extra information	mark
9(a)(i)	genetics – example using selective breeding or genetic modification		1
9(a)(ii)	feeding – example where management of diet, correct feeding is used to increase the yield		1
9(a)(iii)	technology – example of environmental management to increase yield		1
9(b)(i)	use of machinery use of chemical inputs eg fertiliser environmental control		3
9(b)(ii)	energy is becoming increasingly scarce/expensive	accept environmental impact or example of	1
9(c)(i)	land cleared to make more room for agricultural production		1
9(c)(ii)	any one from: use of monocultures use of sprays habitat destruction		1
9(c)(iii)	any one from: monoculture inorganic fertiliser use over stocking cultivation of marginal land use of heavy machinery larger fields/removal of hedges		1
9(c)(iv)	any one from fertiliser runoff pesticide use increased soil erosion		1

Question 9 continued

	answers	extra information	mark
9(d)	transfer of genes from one species to another		1
9(e)(i)	to be able to spray the crop to kill weeds without harming the crop		1
9(e)(ii)	any two from: invasion/competition with natural ecosystems cross pollination eg super weeds human health considerations		2
Total			15

Question 10 44401H

	answers	extra information	mark
10(a)	any six from: overfishing-catching faster than they can reproduce use of sonar factory ships/bigger ships net technology discarded by-catches food for farmed fish pirate fishing pollution climate change catching of immature fish bottom trawling destroying habitats	ignore more ships	6
10(b)(i)	meets the demand for fish without taking from the wild		1
10(b)(ii)	any one from: eliminates by-catches damage caused by nets	accept catches individual species	1
10(b)(iii)	allows smaller fish to escape for breeding		1
10(b)(iv)	reduces the numbers taken to a more sustainable level/protects vulnerable species		1
10(c)	EU common fisheries policy sets quotas which just regulate the number of each species that can be landed whereas the Convention looks at the impact on the whole food chain within the Antarctic		1 1
Total			12