AQA

General Certificate of Secondary Education
June 2013

Environmental Science   44401H

(Specification 4440)

Unit 1: Topics in Environmental Science (Higher)

Final

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 students' 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 students' 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 students' 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.

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 delinieate 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 / e.g. 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 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 include to help the examiner identify the sense of the answer required.

Question 1   **common with Q3 44401F**

Question	Answers	Extra information	Mark
1(a)	any **two** from: methane more animal farming/rice growing/ land fill oxides of nitrogen vehicle exhausts/power stations/ increased fertiliser application CFCs aerosols/fridges/packaging water vapour global warming	**1** mark for gas **1** mark for correct source x2 accept cooling towers	4
1(b)	any **two** from: dissolved in oceans been absorbed by crustaceans taken in by plants	accept dissolved in rain accept - stored in a carbon sink accept carbon capture	2
1(c)	away from (localised) <u>sources</u> of pollution **or** they are looking for global changes		1
1(d)	any suitable examples eg **Legislation** MOT check vehicle emissions carbon taxes congestion zones **Scientific developments** development of the catalytic converter more efficient cars development of alternative energies **Personal action** recycling more waste using public transport or carshare energy saving actions		3

Question 1 continues on the next page

Question 1 continued

Question	Answers	Extra information	Mark
1(e)	any **four** suitable suggestions eg loss of agricultural land due to desertification loss of agricultural land due to flooding shortage of water for irrigation increased pest damage drought storms	accept some areas may cool, more 'natural' fires	4
1(f)	any suitable suggestion eg (increased CO_2) leading to increased photosynthesis warmer climate may improve crop production in cooler areas		1
1(g)	Kyoto (protocol)	accept phonetic spelling	1
Total			**16**

Question 2   **common with Q8 44401F**

Question	Answers	Extra information	Mark
2(a)	10 billion	10 000 000 000 or 10x10^9 or 1x10^{10}	1
2(b)	due to (ocean) currents, whirlpool, gyres		1
2(c)	any **two** ways: eg thrown from ships from tsunami washed down rivers (lakes) blown into the sea from land taken out by tides		2
2(d)	any **two** valid suggestions **or** **one** suggestion explained eg causing choking when swallowed causing drowning when animals become entangled plastics absorb toxic waste which is then ingested		2
2(e)	not broken down by <u>biological</u> action (bacteria/fungi)	accept does not rot, decay	1
2(f)	small organisms consumed by larger	accept no food for plankton eaters if plankton die	1
	repeated along the food chain each organism getting a larger amount **or** food chain magnification		1

Question 2 continues on the next page . . .

Question 2 continued   **common with Q8 44401H**

Question	Answers	Extra information	Mark
2(g)	any **two** suggestions: eg limit plastic packaging reuse plastic items use alternatives to plastics recycle plastics use photo/biodegradable plastics stricter legal enforcement of illegal dumping/littering charging for use of plastic	ignore burning/burying/landfill	2
Total			**11**

Question 3   **common with Q10 44401F**

Question	Answers	Extra information	Mark
3(a)	any **three** valid suggestions eg creation of new habitats (plant more trees) removal of pest species/predators removing of competition halting natural succession controlling hunting improving food supply providing nest boxes excluding people		3
3(b)	cutting down trees to just above ground level to encourage new growth (from the stump)		1 1
3(c)	any **four** from: suitable random method to place the quadrat identification of species within the quadrat estimate/count numbers of each species repeat several times at different places or different seasons calculate means use statistics to find diversity	 if repeats done	4
Total			**9**

Question 4

Question	Answers	Extra information	Mark
4(a)	any **three** from: more evaporation as it is warmer in the south and east they get less rain in the south and east population higher in the south east so more water is used a lot of water used for irrigation in the east	ignore industry	3
4(b)	any **three** valid suggestions eg improved standards of living more water consuming appliances warmer summers growing populations better supply of water leads to greater consumption	eg product manufacture needed water	3
4(c)	55.8	correct answer gains **2** marks accept 56, 55.7971 for **2** marks evidence of correct working eg $\dfrac{\text{incorrect sub total}}{138} \times 100$ **or** $\dfrac{77}{\text{incorrect total}}$ gains **1** mark accept 55.79 for **1** mark	2
4(d)	49.5	correct answer gains **2** marks accept 50 for **2** marks correct working eg 0.55 m x 75/100 = 0.4125 m gains **1** mark 0.55 x 0.75 = 0.4125 or 66 x 75/100 or 66 x 0.75	2

Question 4 continued

Question	Answers	Extra information	Mark
4(e)	any **three** valid suggestions eg (short) shower instead of bath use bucket instead of hose to clean the car stop dripping taps install a grey water system low flush toilets use low water appliances use a bowl instead of running water install water meter	ignore collect rainwater	3
Total			**13**

Question 5

Question	Answers	Extra information	Mark
5(a)	black absorbs heat (better) a vacuum reduces heat loss vertical angle - can cope with the sun being at different heights in the sky horizontal angle – can follow the sun throughout the day		4
5(b)	**Predictability** solar predictable in terms of day and night but not in terms of strength during the day due to cloud cover etc	**1** mark for each sensible application of the term	1
	Reliability can not rely on solar energy in the UK due to weather considerations		1
	Energy density solar has low energy density		1
5(c)	<u>photovoltaic systems</u> so lower electricity bills and/or sale of surplus <u>water heating/solar panel</u> so less money spent from other sources <u>passive space heating/building design</u> helps keep the building warm <u>growing fuel crops</u> so reduces need for fossil fuels <u>growing food crops</u> so reduces need to purchase <u>light tubes</u> to direct light into the building	4 methods described **or** 3 different methods described with 1 explanation **or** 2 methods described with 2 explanations **or** 1 method with very detailed explanation	4

Question 5 continued

Question	Answers	Extra information	Mark
5(d)	any **two** valid suggestions eg visual impact on the street scene consumption of resources in the production of the equipment pollution caused in their production/disposal		2
5(e)	any **three** valid suggestions eg tax incentives subsidised equipment feed-in tariffs education/advertising removing planning restrictions		3
Total			**16**

Question 6

Question	Answers	Extra information	Mark
6(a)	any **three** from: species caught over quota species caught not commercial species fish caught outside legal size/age limits damaged fish (or not parts wanted)	accept by-catch for **1** mark if second and third points not awarded	3
6(b)	any valid suggestions eg **Supermarkets** labelling of fish caught by sustainable means only selling sustainably caught fish good stock control reducing waste **Restaurants** producing recipes made from alternative species only sourcing sustainable fish **Consumers** only buying sustainable fish eating a bigger range of fish species	repetition of same point cannot score again allow using/buying farmed fish accept purchasing locally caught fish to reduce air miles or pollution accept promoting sustainable fish	3
6(c)	any **four** from: setting quotas limiting the amount of time boats may be at sea restricting the size of fishing fleets setting 'no fishing areas' helping fix prices to support fishing carrying out research into sustainable fishing supporting fish farming encourage selective fishing gear	**1** mark for each suggestion **1** mark for amplification of how the suggestion makes it more sustainable	4

Question 6 continued

Question	Answers	Extra information	Mark
6(d)	any **three** from: catching juvenile fish killing fish that have to be returned damaging marine habitats catching sea mammals/non-target species ghost fishing		3
6(e)	eg worries about radioactive contamination	accept any sensible suggestion	1
6(f)	the greatest amount of fish caught that can be replaced through reproduction	idea of maintaining breeding stock/total population	1
Total			**15**

Question 7

Question	Answers	Extra information	Mark
7(a)	any **three** from: poverty natural disasters warfare/political instability overpopulation poor growing conditions lack of resources pests/diseases cropping land been used for non food crops – palm oil etc unfair distribution of food (food wastage)	accept rich nations buying up crops for supermarkets ie money displaces food accept climate change/global warming	3
7(b)(i)	greatest % hunger occurs in the southern hemisphere most undernourished continent is Africa least undernourished are in higher latitudes eg N America	accept any sensible suggestion accept around the equator	1
7(b)(ii)	any **two** from: climatic conditions low levels of development political instability in the regions poor environment for food production	accept converse answers for low levels of hunger	2
7(c)	any **three** from: increased crop yields higher pest resistance higher nutrition value in crops crops ability to cope with poor environments (accept examples)		3

Question 7 continued

Question	Answers	Extra information	Mark
7(d)	any **two** from: cost of the seed/GM products may need expensive inputs often carry terminal gene prevents saving the seed for next year		2
Total			**11**

Question 8

Question	Answers	Extra information	Mark
8(a)	**Highest** uranium-235 coal tidal solar **Lowest**	all correct = **2** marks 2 displaced = **1** mark	2
8(b)	**Hydrogen** very high amount of energy by mass but very low by volume so more difficult than petrol to store enough in a car **Petrol** intermediate by mass but very high by volume making it very practical for car use compared with ethanol or hydrogen **Ethanol** low energy value by mass and intermediate by volume so more needed than petrol for the same performance	**1** mark for each description of the relative energy density by mass and/or volume of each fuel **1** mark for each comparison in terms of use max **4** marks for comparisons with no reference to car additional mark for a logical conclusion just mass/volume without reference to energy – no marks	5
8(c)	**Hydrogen** any **one** from: can be made from water so a renewable resource only produces water when burnt so not polluting in use **Ethanol** any **one** from: can be produced from fermentation of crops/waste organic material so a renewable resource low levels of pollution produced when burnt	ignore cheaper unless qualified allow easier to obtain if qualified	1 1
Total			9

Question 9

Question	Answers	Extra information	Mark
9(a)	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 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 how a good range of agricultural practices have contributed to loss of wildlife.		5–6
	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 how a range of agricultural practices have contributed to loss of wildlife, but there is a lack of clarity and detail.		3–4
	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 how agriculture has harmed wildlife, which has little clarity and detail.		1–2
	No relevant content.		0
	examples of valid points that may contribute to a candidates response: • destruction of habitats to facilitate larger machinery • draining of wetlands to use for agriculture • monocultures provide a poor habitat for wildlife • intensive agriculture produces poor soils with low bio-diversity • use of pesticides killing non-target species • pollution from fertiliser run off		
9(b)(i)	any **two** from: selection of the best individuals (of a species) breeding to produce offspring with the desired characteristics breeding repeated over many generations		2

Question 9 continues on the next page . . .

Question 9 continued

Question	Answers	Extra information	Mark
9(b)(ii)	involves direct manipulation of an organism's genes		1
	to produce new characteristics		1
	or		
	can involve transfer of genes from one species to another		
	to transfer a characteristic		
9(c)	fertiliser is applied to the field **or** animal waste leaks		1
	run off finds its way into streams/rivers/reservoirs		1
	fertiliser/animal waste provides nutrients for algae		1
	algae grow rapidly forming algal blooms		1
Total			**14**

Question 10

Question	Answers	Extra information	Mark
10(a)(i)	10 289 tonnes	accept 10 289.08 or 10 289.1	1
10(a)(ii)	3.9% or decrease by 3.9%	accept 3.922 or 3.92	1
10(b)	any **four** valid suggestions eg councils provide bins/bags councils collecting recycling materials councils providing recycling centres labeling of products suitable for recycling education of people supermarkets encouraging recycling given no other option if they want their waste collected financial penalties for not recycling		4
Total			**6**

UMS conversion calculator www.aqa.org.uk/umsconversion