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General Certificate of Secondary Education
June 2011

Environmental Science 44401F

(Specification 4440)

Unit 1: Topics in Environmental Science (Foundation)

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.

Further copies of this Mark Scheme are available from: aqa.org.uk

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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 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 / 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 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.

Foundation Tier – 44401F

Question 1 44401F

	answers	extra information	mark
1(a)	global warming/climate change	accept specific consequence	1
1(b)	carbon dioxide – burning rain forests CFCs – using aerosols nitrogen oxides – driving cars methane – tipping waste into landfill If line from 2 gases → same activity and one is correct = 1 mark If line from all 3 gases → same activity = 0 mark		3
1(c)	any **two** from: sea levels rise/flooding melting icecaps changing weather loss of food production area changes in crop distribution changes to wildlife distribution increased extinctions habitat loss increase in pests/disease		2
Total			**6**

Question 2 44401F

	answers	extra information	mark
2(a)(i)	porous or permeable owtte	accept either	1
2(a)(ii)	sandstone		1
2(b)(i)	only one result taken – may not be typical of average discharge		1
2(b)(ii)	take results over the whole year	must be over an extended period ignore repeat (unqualified)	1
2(b)(iii)	population increase = 16000 – 12000 4000 x 200 litres = 800 000L	1 mark for some correct working but wrong answer correct answer = 2 marks	1 1
2(c)(i)	indicator species are present/absent at different levels of pollution	accept species in stream have different O_2 needs, pollution tolerance	1
2(c)(ii)	nitrate from fertiliser/organic waste phosphate from detergents or pesticides (organophosphates) or fertiliser/organic waste		1 1
2(c)(iii)	eutrophication		1
Total			**10**

Question 3 44401F

	answers	extra information	mark
3(a)	30%		1
3(b)	least water – fruit and vegetables most water – animal products		1 1
3(c)(i)	any **one** from increased population increased standards of living (or example of) global warming	accept lack of suitable reservoir sites	1

Question 3 continued

3(c)(ii)	**1 water supply companies:-** any **one** from: reduce leaks education on water conservation install water meters increase the price of water		1
	2 schools:- any **one** from: replace washers in dripping taps educate pupils on water conservation automatic urinal flushing with turns off during closures identify and stop leaks use low water appliance in the kitchens use rainwater for gardens (not drinking) dual flush toilets		1
	3 homes: - any **one** from: stop dripping taps use rain water in garden use a grey water system dual/low flush toilets shower rather than bathe/less time in shower/low water showers turn tap off when brushing teeth use plug rather than letting tap run when washing		1
Total			**7**

Question 4 44401F

	answers	extra information	mark
4(a)	freezing pickling canning drying		1 1 1 1
4(b)	any **two** from: transportation over long distances eat out of season improve/change flavour stop going bad **or** it is safe to eat **or** kill bacteria to reduce food wastage to conserve nutrients	do not accept healthier	2
4(c)	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 of 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 to carry out a valid scientific investigation.		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 how to carry out a valid scientific investigation, but there is lack of clarity and detail.		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 how to carry out a valid scientific investigation which has little clarity and detail.		1
	no relevant content.		0
	examples of valid points that may contribute to a candidates response: • choose a number of strawberries • all of same age; condition; variety • choose a suitable range of temperatures • observe the condition of the strawberries over a period of time • record at which temperature the strawberries stay edible for longest		
Total			**10**

Question 5 44401F

<table>
<tr><th></th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>Agricultural practice</th><th>Int</th><th>Ext</th></tr>
<tr><td>high energy consumption</td><td>✔</td><td></td></tr>
<tr><td>large number of workers</td><td></td><td>✔</td></tr>
<tr><td>seen as better for animal welfare</td><td></td><td>✔</td></tr>
<tr><td>highly mechanised</td><td>✔</td><td></td></tr>
<tr><td>small numbers of animals per hectare</td><td></td><td>✔</td></tr>
<tr><td>animals housed indoors</td><td>✔</td><td></td></tr>
</table>
</td><td></td><td>6</td></tr>
<tr><td>5(b)</td><td>any two from:
animal welfare
waste production
disease concentration owtte
may feel food is of lower quality</td><td>accept energy consumption if linked to environmental impact</td><td>2</td></tr>
<tr><td>5(c)</td><td>heavy machinery – loss of crumb structure or compaction
use of inorganic fertilisers /monoculture – loss of humus binding properties
removal/burning of vegetation – leads to exposure to wind/runoff
ploughing to the same depth producing a plough sole – leads to soil slippage
damage to soil structure by ploughing slopes – increased runoff
ploughing – exposes soil to wind/rain/runoff</td><td>action – 1 mark
related impact – 1 mark</td><td>2</td></tr>
<tr><td>5(d)</td><td>plant more hedges
add organic material such as manure</td><td></td><td>1
1</td></tr>
<tr><td>Total</td><td></td><td></td><td>12</td></tr>
</table>

Question 6 44401F

	answers	extra information	mark
6(a)(i)	south-facing towards the sun (for maximum heat absorption)		1
6(a)(ii)	any **one** from: north small windows to reduce heat loss north is the cold side		1
6(b)	15 years		1
6(c)	eg closing doors and windows turning heating down or off switching off lights when not in room turning off computers/projectors etc at the end of the day	any four sensible suggestions ignore methods to generate energy or energy saving appliances ignore education to reduce wastage	4
6(d)(i)	inkjet printer		1
6(d)(ii)	photocopier		1
Total			**9**

Question 7 44401F

	answers	extra information	mark
7(a)	any **three** from: pollution qualified – noise smell visual dust methane danger leachate vermin waste of resources loss of land or habitats lack of suitable sites animals harmed by waste, eg birds trapped in multipack plastic rings	ignore transport impacts	3
7(b)	any **two** from: recycling or reusing composting incineration	accept dumping at sea do not accept putting into space	2
7(c)	any **one** from: kerbside collections of recyclable waste providing recycling bins advice on how to recycle encourage reuse		1
7(d)	any **one** from: use less packaging charge for carrier bags reusable bags encourage recycling	accept biodegradable or recyclable packaging	1
Total			**7**

Question 8 44401F

<table>
<tr><th></th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>8(a)</td><td colspan="2"><table>
<tr><th>Factor</th><th>Population increase or decrease?</th></tr>
<tr><td>Access to birth control</td><td>decrease</td></tr>
<tr><td>Vaccination</td><td>increase</td></tr>
<tr><td>Improved agricultural output</td><td>increase</td></tr>
<tr><td>More women working</td><td>decrease</td></tr>
<tr><td>Increased cost of raising children</td><td>decrease</td></tr>
</table></td><td>5</td></tr>
<tr><td>8(b)(i)</td><td>10.8 – 7.4 = 3.4 <u>billion</u></td><td>accept ± 0.3
units required</td><td>1</td></tr>
<tr><td>8(b)(ii)</td><td>any one from
based on poor data (incomplete, unreliable, flawed)
changing birth/death rates
impact of natural or manmade disasters/ disease/health care</td><td></td><td>1</td></tr>
<tr><td>8(c)(i)</td><td>the amount of the Earth’s resources that a person consumes</td><td></td><td>1</td></tr>
<tr><td>8(c)(ii)</td><td>any two from:
not enough food produced
increased pollution
exhaustion of resources
destruction of wildlife habitats or loss of biodiversity</td><td></td><td>2</td></tr>
<tr><td>Total</td><td colspan="2"></td><td>10</td></tr>
</table>

Question 9 44401F

<table>
<tr><th></th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>9(a)</td><td>a supply of water for (cooling)</td><td>ignore away from people</td><td>1</td></tr>
<tr><td>9(b)</td><td>any one from:
facilities already there
easier to get planning approval</td><td>accept cheaper if qualified</td><td>1</td></tr>
<tr><td>9(c)</td><td>any one from:
(nuclear power stations) which don’t produce much CO_2 / greenhouse gases
could replace fossil fuel stations which do
no combustion (of fossil fuels)</td><td></td><td>1</td></tr>
<tr><td>9(d)</td><td>any two from:
<u>highly</u> hazardous waste produced
waste dangerous for a long time
nuclear weapons proliferated
non renewable
accidents such as Chernobyl
target for terrorists
effect on health of workers/locals</td><td></td><td>2</td></tr>
<tr><td>9(e)(i)</td><td colspan="2"><table><tr><th>Component</th><th>Material</th></tr><tr><td>control rods</td><td>boron</td></tr><tr><td>fuel rods</td><td>uranium</td></tr><tr><td>containment</td><td>concrete</td></tr><tr><td>coolant</td><td>water</td></tr></table></td><td>1
1
1
1</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Question 9 continued

9(e)(ii)		**Component**	**Function**		
		control rods	controls reaction/energy output		1
		fuel rods	source of energy		1
		containment	prevent release of radiation **or** contains the radioctivity		1
		coolant	transfer heat away from reactor to where it can be used (accept stops overheating)		1
Total					**13**

Question 10 44401F Question 1 44401H

	answers	extra information	Mark
10(a)	the distance food has to travel to consumer		1
10(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
10(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
10(c)(ii)	**temperature** plants adapted to survive in a narrow range of temperature/ enzymes only work in a narrow range of temperature **carbon dioxide** rate limiting factor in photosynthesis **water** needed for photosynthesis turgidity nutrient uptake		1 1 1
10(d)	because of the energy needed to grow them in our climate owtte		1

Question 10 continued

10(e)	production of crops for MEDC 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 11 44401F Question 2 44401H

	answers	extra information	Mark
11(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
11(b)	grazing reduced grass to suitable length/removed shrubby plants cow pats provided source of insects		1 1
11(c)	eg ringing survey to identify individuals count several times work out an average count number of nests	any suitable method	1
11(d)	any **one** from: routing people away from the nesting area fencing permits signage		1
11(e)(i)	any **one** from: cattle intimidating make paths muddy/mucky restrict free access		1
11(e)(ii)	any **one** from: cattle scare horses gates/fences restrict movement		1

Question 11 continued

11(e)(iii)	cattle may disturb the Iron Age settlement		1
11(f)	any **one** from: increasing opportunities for everyone to enjoy the wonders of the natural world reducing the decline of biodiversity **or** licensing of protected species across England designating National Parks **or** Areas of Outstanding Natural Beauty managing most National Nature Reserves **or** notifying Sites of Special Scientific Interest raising awareness of conservation issues		1
Total			**10**

Question 12 44401F Question 3 44401H (plus part (e))

	answers	extra information	mark
12(a)	biofuels from plants plants get their energy from the sun/photosynthesis		1 1
12(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
12(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
12(d)(i)	any **one** from: use of pesticides fertilisers land clearance still releases CO_2 pollution from agricultural machines		1
12(d)(ii)	land used for growing fuels rather than crops for the local people		1
12(d)(iii)	any **one** from: natural habitats cleared to grow fuel crops crops grow as monoculture/intensively which is less good for wildlife		1
Total			**12**

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