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General Certificate of Secondary Education
June 2012

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 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.

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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

<table>
<tr><th></th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>1(a)(i)</td><td colspan="2">one mark for each correct row
<table>
<tr><th>Energy resource</th><th>Predictable</th><th>Intermittent</th></tr>
<tr><td>Fossil fuels</td><td>✔</td><td></td></tr>
<tr><td>Nuclear power</td><td>✔</td><td></td></tr>
<tr><td>Biofuels</td><td>✔</td><td></td></tr>
<tr><td>Tidal power</td><td>✔</td><td>✔</td></tr>
<tr><td>Wind power</td><td></td><td>✔</td></tr>
</table></td><td>5</td></tr>
<tr><td>1(a)(ii)</td><td colspan="2">
<table>
<tr><th>Energy resource</th><th>Solar</th></tr>
<tr><td>Fossil fuels</td><td>✔</td></tr>
<tr><td>Nuclear power</td><td></td></tr>
<tr><td>Bio fuels</td><td>✔</td></tr>
<tr><td>Tidal power</td><td></td></tr>
<tr><td>Wind power</td><td>✔</td></tr>
<tr><td>Geothermal</td><td></td></tr>
</table>
3 correct for 2 marks
2 correct for 1 mark</td><td>2</td></tr>
<tr><td>1(b)(i)</td><td>sunnier (climate)</td><td>ignore hotter</td><td>1</td></tr>
<tr><td>1(b)(ii)</td><td>USA has more space/land</td><td>accept deserts</td><td>1</td></tr>
<tr><td>1(b)(iii)</td><td>to track the sun’s changes (with the seasons/daily)
so more energy absorbed/ collected</td><td>accept follow the sun’s movement
accept more electricity/energy produced
accept more sunlight collected
accept less energy reflection</td><td>1
1</td></tr>
</table>

Question 1 continued

	answers	extra information	mark
1(c)(i)	28 – 32 000		1
1(c)(ii)	any **two** from environmental awareness fossil fuel cost fossil fuel running out government support/subsidy increased costs of energy making it viable lower costs of production/ equipment improved technology greater awareness by general public	 accept example eg concern over fossil fuels/global warming allow better deals available saving money needs qualification	2
Total			**14**

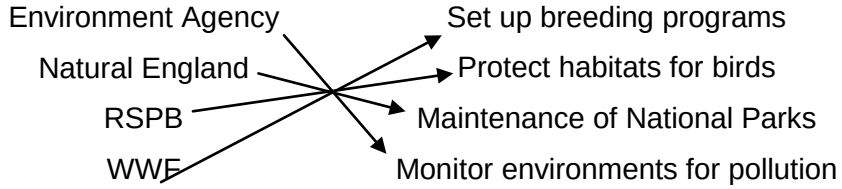
Question 2 44401F

	answers	extra information	mark
2(a)	encourage manufacture of energy efficient machines	accept market forces	1
2(b)(i)	noise of aircraft disturbs people/ wildlife		1
	more efficient fuel consumption saves resources or reduces pollution	accept fewer stops (for refuelling) ignore save energy	1
2(b)(ii)	more fuel burned during take off and landing		1
	allows individuals to see their own CO_2 impact	accept allows individuals to compare planes accept full plane is more CO_2 efficient	1
2(c)	any **four** from		4
	turn down thermostats	accept reduce heating	
	wear more clothes indoors		
	walk/cycle		
	use public transport or car share		
	avoid flying		
	switch off appliances when not in use	accept do not leave on standby	
	use less hot water	accept examples eg shower instead of bath less water in kettle	
	other lifestyle change that reduces energy use	ignore recycle waste ignore energy saving appliances	
Total			**9**

Question 3 44401F

	answers	extra information	mark
3(a)	any **two** from plenty of fuel produces large amount of electricity/energy/power (compared with renewable) less/no CO_2/greenhouse gases produced predictable/not intermittent does not use fossil fuels	 ignore sustainable/renewable	2
3(b)(i)	any **two** from highly hazardous due to radioactivity hazardous for a long time expensive to make safe can be used to make nuclear weapons	 accept causes cancer/mutations	2
3(b)(ii)	any **two** from encapsulation vitrification storage for long time deep burial	 accept encase in concrete accept ion exchange treatment of low level liquid waste	2
3(c)	any **two** from cooling steam generation as a moderator	 accept storage of nuclear waste accept to turn turbines	2
3(d)	heat produced by (subterranean) radioactive decay	accept nuclear reactions underground	1
Total			**9**

Question 4 44401F

	answers	extra information	mark
4(a)	any **three** from predation competition disease change habitat	accept examples accept disrupts food chains	3
4(b)			4
4(c)	CITES		1
4(d)	any **one** from become too tame don't have skills to survive gene pool too small no suitable habitat to return to		1
4(e)	**B** – Water Boatman **C** – Water Scorpion **A** – Midge larva		3
Total			**12**

Question 5 44401F

	answers	extra information	mark
5(a)(i)	**Mechanisation** – work quicker cultivate marginal land	any one	1
	Chemicals – control pests and diseases fertiliser increase yield	any one	1
	Plant breeding – higher yield varieties disease resistance	any one accept reference to GM crops grow in hostile environments	1
5(a)(ii)	**Mechanisation** – air pollution soil compaction	any one accept damages soil	1
	Chemicals – kill non-target species water pollution loss of biodiversity	any one accept examples	1
	Plant breeding – contamination of wild species need high levels of input	any one accept reference to GM crops	1
5(b)	any **one** from weather related factors pests disease economic factors or supply and demand		1
5(c)(i)	all species constantly fluctuating **or** all species increased by (13%)	accept statements such as ‘almost constant’, ‘quite a lot’, or ‘the most’	1
	woodland species declined by (15 –16%)		1
	farmland species declined by (42%)	accept answers in range 40–42%	1
5(c)(ii)	any **three** from decrease in certain species because of loss of habitats poisoning by pesticides loss of food supply increased predation	accept examples ignore shooting them ignore chemicals ignore scarecrows	3

Question 5 continued

5(c)(iii)	any **three** from plant hedges/trees leave headlands or set-aside use specific pesticides leave permanent pasture plant to encourage insect habitats nest boxes go organic or use fewer pesticides control of corvides and other predators put out food for them		3
Total			**16**

Question 6 44401F

	answers	extra information	mark
6(a)	any **three** from increased pollution increased use of non-renewable resources failure to produce enough food destruction of wildlife habitats and diversity increased likelihood of epidemics/ disease increase in mean global temperature insufficient water to drink urban sprawl more vehicles	if no other mark awarded allow "not enough resources" for 1 mark only ignore not enough space ignore not enough energy	3
6(b)	any **three** from develop less polluting technology develop alternatives to non-renewable resources increased crop yields reduce losses in crop production produce more wildlife-friendly chemicals increase water supplies	accept examples	3
6(c)	any **two** from recycle more reduce energy consumption grow own food/buy locally	or one point with expansion/ amplification accept examples	2

Question 6 continued

6(d)	any **three** sensible suggestions eg improved survival rates for children reduced economic value (increased cost) of having children changing role of women increased access to consumer goods and lifestyle choices improved methods/access to birth control government restrictions education	accept example eg China's 1 child policy or taxation	3
Total			**11**

Question 7 44401F

	answers	extra information	mark
7(a)(i)	any **one** from respiration combustion	accept fermentation/decay accept volcanic eruptions must be process not source	1
7(a)(ii)	any **one** from photosynthesis precipitation	accept dissolving in water	1
7(a)(iii)	any **one** from carbonate rocks oceans/sea plants/trees swamps/peat		1
7(b)	**Carbon dioxide** – burning fossil fuels deforestation making cement **Water vapour** – electricity generation (cooling towers) building reservoirs **Methane** – (anaerobic) decomposition of waste animal production rice production **Nitrous oxides** – power stations (fossil fuel) vehicles/transport (fossil fuel) fertiliser use	any one accept using vehicles ignore combustion/respiration any one any one accept landfill any one	1 1 1 1
7(c)(i)	**flooding** – any **one** from expanding oceans rise in sea level thermal expansion/melting ice caps		1
7(c)(ii)	**reduced food production** – loss of cropping areas or increased pest damage or drought	accept flooding (causes loss of land)	1

Question 7 continued

7(c)(iii)	**loss of species** – changing habitats or drought (desertification)		1
7(c)(iv)	**increased rainfall –** due to increased evaporation		1
Total			**11**

Question 8 44401F Question 1 44401H

	answers	extra information	mark
8(a)	eg the 'heavier' the fishing, the younger the average age of the fish caught reducing the opportunities for the fish to breed reducing the sustainability of fishing	one mark for description second mark for explanation	2
8(b)	any **two** from taking from wild stock to feed farmed fish disease/pests from farmed fish passing to wild stock cross-breeding of wild and farmed fish can be detrimental to wild fish, eg reduction in gene pool	 accept taking stock initially from the wild for breeding accept fish farming pollutes the sea for wild fish	2
8(c)	**quotas** – reduce the numbers of any one species of fish that can be caught **nets with larger mesh size** – allows smaller fish to escape **zoning** – gives fish areas where they can breed safely to replenish stock **line fishing** – reduces by-catches	 allow return of unwanted fish	1 1 1 1
8(d)	any **one** from (EU) Common Fisheries Policy Convention for the Conservation of Antarctic Marine Living Resources		1
Total			**9**

Question 9 44401F Question 2 44401H

	answers	extra information	mark
9(a)(i)	any **two** from lower demand at night when people are asleep increases in the morning when people get up or cook breakfast or switch on lights etc higher during the working day demand from industry/shops/offices peak at lunch time when people cook lunch highest peak at 5pm when people cook dinner or start to watch television or switch on lights etc declines as people go to bed switch off lights heaters etc	1 mark for identifying change in demand second mark for explanation of change x2 max 1 mark for each part if no reference to graph accept reference to need for heating in winter or more energy needed at night	4
9(a)(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 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 different energy sources can be used to meet changing demand.		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 different energy sources can be used to meet changing demand or a detailed explanation of one method for sudden changes in demand.		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 description of energy sources and how these can be used to meet changing demand, which has little clarity and detail.		1
	No relevant content.		0

Question 9 continued

	answers	extra information	mark
9(a)(ii) cont	examples of valid points that may contribute to a candidates response: • coal oil and nuclear consistent and capable of meeting base load demand and are predictable • alternatives generally intermittent useful for adding to supply when available helping reduce demand for non-renewable • tidal predictable but not necessarily available at times of peak demand • HEP predictable and with pumped storage capable of meeting sudden peaks in demand rapidly		
9(b)(i)	the higher the GDP the greater the energy consumption	accept converse	1
9(b)(ii)	any **two** from higher standards of living more cars more domestic appliances developed transport infrastructure greater business demand they have less money therefore can afford less energy	 accept high cost of energy	2
Total			**11**

Question 10 44401F Question 3 44401H

<table>
<tr><th></th><th colspan="2">answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>10(a)</td><td colspan="2"><table>
<tr><th></th><th>Advantage</th><th>Disadvantage</th></tr>
<tr><td>Rivers</td><td>Water can be abstracted along their entire length
Don’t need to build anything
Often close to point of use or easy to access</td><td>Cost of treatment
Limited amount of water available at any one time
Vulnerable to drought
Vulnerable to pollution
Need more treatment or more polluted</td></tr>
<tr><td>Reservoirs</td><td>Smooth out seasonal demand
Storage helps clean the water
Large volumes stored</td><td>Need a lot of land
Eyesore (visual)
Loss of habitat/land
Expensive to construct
Running out of sites
Pollution from recreational use
Algae can build up
Water has to be transported
Pumped to consumer</td></tr>
<tr><td>Aquifers</td><td>Safer from pollution
Water requires little treatment or water is clean
Storage underground no surface impacts
Large volumes
Can contain (beneficial) minerals
Little evaporation</td><td>Needs pumping up (harder to get at or cost)
Salty if take too much
Not widely located
Can disturb water table
Once polluted take many years to clean
Water has to be transported (pumped to consumer)
Can contain (unwanted) dissolved solids</td></tr>
</table></td><td></td><td>6</td></tr>
<tr><td>10(b)</td><td colspan="2">Rock C</td><td></td><td>1</td></tr>
<tr><td>10(c)</td><td colspan="2">sandstone</td><td></td><td>1</td></tr>
</table>

Question 10 continued

	answers	extra information	mark
10(d)	any **three** from low value land use high rainfall adequate source of water (river/stream) clean source of water impermeable soil/rock valley proximity to demand for water elevated site low pollution in surrounding environment large area of land local population	(eg not important for wildlife, existing use) 1 mark only	3
10(e)(i)	any suitable example eg anglers disturbed by sailing	must be explained accept polution from recreation ignore swimmers	1
10(e)(ii)	any **two** from zoning by space zoning by time prohibiting watersports on reservoirs used by anglers		2
10(f)	water which has been used once that is used again (for a purpose that does not require potable water)	accept reused water ignore recycled unless qualified ignore rainwater	1
10(g)	screening clarification filtration disinfection	3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark	3
Total			**18**

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