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General Certificate of Secondary Education
June 2012

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 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.

Higher Tier – 44401H

Question 1 44401H Question 8 44401F

	answers	extra information	mark
1(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
1(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
1(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
1(d)	any **one** from (EU) Common Fisheries Policy Convention for the Conservation of Antarctic Marine Living Resources		1
Total			**9**

Question 2 44401H Question 9 44401F

	answers	extra information	mark
2(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
2(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 2 continued

	answers	extra information	mark
2(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		
2(b)(i)	the higher the GDP the greater the energy consumption	accept converse	1
2(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 3 44401H Question 10 44401F

<table>
<tr><th></th><th colspan="2">answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>3(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>3(b)</td><td colspan="2">Rock C</td><td></td><td>1</td></tr>
<tr><td>3(c)</td><td colspan="2">sandstone</td><td></td><td>1</td></tr>
</table>

Question 3 continued

3(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 only	3
3(e)(i)	any suitable example eg anglers disturbed by sailing	must be explained accept pollution from recreation ignore swimmers	1
3(e)(ii)	any **two** from zoning by space zoning by time prohibiting watersports on reservoirs used by anglers		2
3(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
3(g)	screening clarification filtration disinfection	3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark	3
Total			**18**

Question 4 44401H

	answers	extra information	mark
4(a)(i)	the smaller the population, the slower the growth rate snowball effect OWTTE	accept high infant mortality rate reduces potential population growth OWTTE	1
4(a)(ii)	4 billion		1
4(a)(iii)	any **three** from shortage of food shortage of potable/clean water depletion of (non-renewable) resources increased pollution habitat/wildlife loss	accept examples accept shortage of supply	3
4(b)(i)	**Developed** any **two** from declining populations lack of working population increased dependency	 eg economic or medical care	2
4(b)(ii)	**Developing** any **two** from rapid population growth high mortality rate large numbers of dependent young people economic migration		2
4(c)(i)	no change in birth rate OWTTE		1
4(c)(ii)	many countries don't have an accurate census many developing countries have rapidly changing birth/death rates or changing population	1 mark per reason or 2 marks for reason with suitable explanation accept reference to natural disasters/war/disease or unpredictable factor increases death rate	2
Total			**12**

Question 5 44401H

	answers	extra information	mark
5(a)	any **three** from conservation of existing resources or reduction in use of energy discovery of new reserves alternative resources improved extraction technology more efficient use of energy	accept limitations in the reliability of the date	3
5(b)	we are likely to use more coal as oil/gas run out		1
5(c)	any **four** from global warming (consequence of CO_2 and NO_X) particulates (from incomplete combustion) acid rain (from SO_2, NO_X) photochemical smogs (from NO_X and hydrocarbons) damage to environments by extraction less to use for non-energy purposes		4
5(d)	any **two** from easily stored/transported high energy density easily converted into other forms of energy constancy of supply		2
Total			**10**

Question 6 44401H

	answers	extra information	mark
6(a)	any **two** from more storms more extreme weather increased rainfall in some areas, decreased in others cooler if Gulf Stream moves	 accept flooding/droughts	2
6(b)	any **three** from warmer climate may help some crops grow areas too cold now for crop growth may become warm enough different types of crops grown some areas may become too hot to grow crops need for/shortage of water for irrigation in some areas increased pest damage	accept examples accept crops could be grown further north	3
6(c)	**Carbon taxes** – charging businesses for the carbon they release/use **Carbon off-setting** – doing something compensate for the CO_2 produced such as planting trees **Carbon capture** – removing CO_2 from emissions and storing it, eg in porous rocks underground	accept taxes on fuel or tax on CO_2 output of vehicles	1 1 1

Question 6 continued

	answers	extra information	mark
6(d)	any **two** from Australia/USA failed to ratify few counties actually meeting their targets LEDCs feel penalised as MEDCs caused the problem selling of unused carbon quotas difficult to enforce or people ignoring treaty output of developing countries increasing alternatives not sufficiently developed		2
6(e)	shows international cooperation can work or encourages further agreements removes CFCs which are greenhouse gases		2
Total			**12**

Question 7 44401H

	answers	extra information	mark
7(a)	**Overfishing** – stocks already low damage to food chains or death of fish through poisoning further damage depleted stocks	one mark for simple reason second for linked explanation	2
	Loss of wetland habitats – pollution by the oil damages wetland plants and animals damage to already fragile habitat/ foodchains that sustain the wetland		2
	Oxygen depletion – as the oil is broken down by bacteria they use up O_2 for respiration **or** oil forms barrier at surface resulting in reduced photosynthesis or gas exchange at the surface	accept oil kills oxygenating plants so less oxygen produced	2
7(b)	**Population size** – the smaller the population the more vulnerable it is small population = small gene pool		1
	Sex ratios – if there is a reduced number of one sex then their loss could have a greater significance for population recovery		1
	Position in the food chain – species higher up in the food chain are lower in number and vulnerable to losses in their prey species	accept loss of species low in the food chain has knock on effect for species further up the food chain	1
	Tolerance range – species that are less tolerant (of oil levels) in the environment are more vulnerable		1
Total			**10**

Question 8 44401H

	answers	extra information	mark
8(a)(i)	the more developed a country is the greater its average cereal yield	accept converse	1
8(a)(ii)	any **three** from eg in Mozambique there is less pesticide use less fertiliser use low levels of mechanisation shortage of water higher levels of damaged soils	or accept converse for UK do not accept that the UK is developed and Mozambique is not	3
8(b)	develop species that: have higher yields/grow faster are drought/temperature tolerant can grow in saline soil need less fertiliser have greater pest/disease resistance have resistance to pesticide/ herbicide have shorter stems to resist wind damage		4
8(c)	eg use of fertilisers harm to non-target species tree/hedgerow removal or ploughing increased waste to be disposed of or increased disease transmission	 accept examples ignore references to animal welfare issues	 1 1 1 1
8(d)	subsidies guaranteed prices		1 1
Total			**14**

Question 9 44401H

	answers	extra information	mark
9(a)	Convention on International Trade of Endangered Species or it is about the sale of any part of an endangered animal makes it harder/illegal to sell the parts of endangered animals or it discourages poaching		2
9(b)(i)	any **four** from remove vulnerable species from where they are at risk have captive breeding programs research systems to improve breeding success eg zoos sharing blood lines to enlarge gene pool reintroduce species to the wild when appropriate education encouraging support for conservation programs money from zoo entrance fees supports conservation work		4
9(b)(ii)	reduced gene pool lack of suitable habitats for reintroduction tame behaviour or unnatural behaviour zoos removing animals from the wild depletes wild population		3

Question 9 continued

	answers	extra information	mark
9(b)(iii)	any **four** from game wardens to protect from poachers tagging animals so game wardens know where they are education of local people generate income from eco-tourism wildlife reserves habitat management medical intervention		4
9(b)(iv)	a list of the worlds most endangered species		1
Total			**14**

Question 10 44401H

	answers	extra information	mark
10(a)(i)	requires at least **two** management strategies to maintain the habitat **or** one strategy with expansion eg moorland - introduction of wolves to control red deer removal of introduced species such as rhododendron burning to produce new habitats for grouse		2
10(a)(ii)	any **two** valid points eg red deer remove germinating trees rhododendrons crowd out native species ageing heather does not provide food for young grouse		2
10(b)(i)	**quadrat** – placed randomly within an area plants sampled within the quadrat **transect**– plants sampled along a straight line across a habitat		1 1
10(b)(ii)	**quadrat** – uniform habitat such as a field **transect** - changing habitat /environmental gradient such as the edge of a wood	area and reason needed for mark	1 1

Question 10 continued

	answers	extra information	mark
10(c)	**two** valid points eg pH meter/probe suitably calibrated or (BDH) soil test Use of barium sulfate/distilled water	accept use of universal indicator/full range pH papers compare with colour standard	2
Total			**10**

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