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Environmental Science 44401F

(Specification 4440)

Unit 1: Topics in Environmental Science (Foundation)

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.

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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.

Question 1

Question	Answers	Extra information	Mark
1(a)	**1** mark for each correct suggestion eg **Floors** – carpet, carpet underlay, wooden flooring, thermal breaks in the floor (any one), suspended floors **Walls** – cavities, cavity insulation, thermal blocks (any one), thicker walls **Roof** – loft insulation, boarding over the loft	accept insulation as unqualified, but max **1** mark	3
1(b)	30%		1
1(c)	air/gas in the gap air/gas poor conductor of heat **or** reduces loss by conduction	accept vacuum between the glass accept convection if in a vacuum	1 1
1(d)	any **two** from: turn the heating down/off in summer install radiator thermostats install an alternative energy system not leaving equipment on standby switch lights off when out of the room use more energy efficient equipment	accept using an energy meter accept change to cheaper tariff	2
1(e)(i)	£50		1
1(e)(ii)	110 years	accept ecf from **1(e)(i)**	1
Total			**10**

Question 2

Question	Answers	Extra information	Mark
2(a)(i)	increasing human population leads to increasing animal extinctions		1
2(a)(ii)	any **three** from: loss of habitats for wildlife, loss of food supply increased hunting pressure overfishing (increased) pollution introduction of pests introduction of disease competition pesticides		3
2(b)	**Increased food production** fewer people die as a consequence of lack of food improved fertility better diet **Improved sanitation and hygiene** people less likely to become ill less spread of disease **Improved medical provision** if people do become ill then they are more likely to survive less disease		1 1 1
2(c)	Sustainable development		1
2(d)(i)	name of a suitable NGO eg RSPB, WWF or local wildlife trust, Greenpeace, IUCN		1

Question 2 continues on the next page . . .

Question 2 continued

Question	Answers	Extra information	Mark
2(d)(ii)	any **three** acceptable suggestions eg habitat creation captive breeding education programs campaigning for legal protection campaigning for environmental improvement protecting from poachers habitat protection		3
2(e)	CITES		1
Total			**13**

Question 3 **common with Q1 44401H**

Question	Answers	Extra information	Mark
3(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
3(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
3(c)	away from (localised) <u>sources of</u> pollution **or** they are looking for global changes		1
3(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 3 continues on the next page . . .

Question 3 continued

Question	Answers	Extra information	Mark
3(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
3(f)	any suitable suggestion eg (increased CO_2) leading to increased photosynthesis warmer climate may improve crop production in cooler areas		1
3(g)	Kyoto (protocol)	accept phonetic spelling	1
Total			**16**

Question 4

Question	Answers	Extra information	Mark
4(a)	radioactive decay	accept friction at plate boundaries	1
4(b)	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 the advantages and disadvantages of geothermal energy for the UK.		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 explanation of the advantages and disadvantages of geothermal energy for the UK but there is a 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 the use of geothermal energy for the UK which has little clarity and detail.		1
	No relevant content.		0
	Examples of valid points that may contribute to a candidates response: Advantages • predictable • significant amounts of energy available • does not deplete fossil fuel resource • less CO_2 • no fuel costs Disadvantages • limited to certain locations • not very efficient • can be noise polluting • can be smelly (sulfur) • cost of drilling		

Question 4 continues on the next page . . .

Question 4 continued . . .

Question	Answers	Extra information	Mark
4(c)(i)	must be a straight line or smooth curve starting between 100 – 105 on y axis finishing between 115 – 125 at 100 on x axis with roughly equal numbers of points above and below the line	accept a curve starting between 95 –105 on y axis finishing between 115 – 120 at 100 on x axis	1
4(c)(ii)	any **two** from: they have been getting bigger (the bigger they are the) noisier (they are) energy output increased	 accept there are more small wind turbines than large	2
4(c)(iii)	any **four** valid suggestions eg visual impact often in UKs most beautiful environments thought of as noisy can be a hazard to birds doubts about energy output claims	accept misleading claims about generating capacity ignore intermittency unless compared to other named source ignore cost	4
4(d)(i)	**Advantages** do not cause as much visual impact not taking up land does not matter if they are noisy wind flow smoother at sea making them more efficient potential for bigger wind farms	 accept stronger mean wind strength at sea	2

Question 4 continues on the next page . . .

Question 4 continued . . .

Question	Answers	Extra information	Mark
4(d)(ii)	**Disadvantages** more costly to construct/maintain can be a hazard to shipping expensive to lay cables to bring electricity to shore bird strike	accept difficult to access	2
Total			**16**

Question 5

Question	Answers	Extra information	Mark
5(a)	Environment agency		1
5(b)(i)	**Porous** spaces between particles of the rock **or** the rock can store water		1
5(b)(ii)	**Permeable** how well water moves through the rock **or** a measure of how well connected the pores are in the rock		1
5(c)	sandstone, limestone or chalk	allow sand or gravel	1
5(d)(i)	lowland river		1
5(d)(ii)	aquifer		1
5(d)(iii)	sterilisation/disinfection	accept chlorination, ozone treatment, UV	1
5(e)	any **four** valid suggestions eg high rainfall large area available narrow valley no endangered animals/habitats impermeable rock base suitable stream/river low pollution levels low land values near to population low population density		4

Question 5 continues on the next page . . .

Question 5 continued

Question	Answers	Extra information	Mark
5(f)	any **four** valid suggestions eg power generated from tides power generated from waves HEP cooling (in thermal power stations) steam generation in (thermal power stations) cooling spent nuclear fuel		4
Total			**15**

Question 6

Question	Answers	Extra information	Mark
6(a)	**A –** screens removing large items of solid waste **B –** primary settlement or allowing solid waste to settle out **C –** trickling fliter beds allowing (aerobic) digestion of solid waste **D –** secondary settlement or allowing solid waste to settle out **E –** anaerobic digestion of solid waste **F –** discharge of treated waste to river (sea)		6
6(b)	any **two** from: can still contain nutrients (or examples) can still contain (pathogenic) bacteria, virus can still contain some suspended material	ignore water contains disease	2
6(c)	any **two** valid suggestions eg shower rather than bath collect rainwater use a bucket to wash the car rather than a hose low flush toilets turn off tap when (brushing teeth), any one example use of grey water low water appliances	accept answers which suggest ways in which authorities might encourage lower domestic consumption eg fit water meters ignore turn off tap	2
Total			**10**

Question 7

Question	Answers	Extra information	Mark
7(a)	a resource that is being consumed faster than it can ever be replaced	accept limited resouce or resouce will run out	1
7(b)	use less fuel per passenger mile **or** less pollution per passenger mile	accept a bus can carry as many people as a lot of cars	1
7(c)	nitrogen reacts (with oxygen) at very high temperatures (engines/furnaces)		1 1
7(d)	electricity needs to be generated/(produced in power) stations to be used by the car, cars need to be charged up which may use as much/more fossil fuels	accept fuels used in manufacture of car/batteries	1 1
7(e)	**Biodiesel** → **Waste product of sewage farms** **Bioethanol** → **Produced by the fermentation of sugar-rich crops** **Biogas** → **Refined from oil-rich crops such as oil seed rape**		3
7(f)	any **two** from: only buying locally produced food eating food only in season growing your own food shopping locally	accept any sensible suggestions eg ship rather than plane transport	2
7(g)	doing something to remove CO_2 from the atmosphere	accept example, eg companies plant trees to consume the CO_2 produced by the activity	1
Total			**12**

Question 8 **common with Q2 44401H**

Question	Answers	Extra information	Mark
8(a)	10 billion	10 000 000 000 or 10 x 10^9 or 1 x 10^{10}	1
8(b)	due to (ocean) currents, whirlpool, gyres		1
8(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
8(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
8(e)	not broken down by biological action (bacteria/fungi)	accept does not rot, decay	1
8(f)	small organisms consumed by larger repeated along the food chain each organism getting a larger amount **or** food chain magnification	accept no food for plankton eaters if plankton die	1 1

Question 8 continues on the next page . . .

Question 8 **common with Q2 44401H**

Question	Answers	Extra information	Mark
8(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 9

Question	Answers	Extra information	Mark
9(a)(i)	**Animal production** temperature light levels food supply water supply waste removal stocking levels restrict movement disease free environment ventilation		4
9(a)(ii)	**Plant production** temperature humidity carbon dioxide levels light levels nutrient supply pH water supply soil/compost	must not have been used in the answer to **9(a)(i)**	2
9(b)(i)	**Animal production** eg pollution by waste produced pollution by methane visual pollution	ignore pollution unqualified	1

Question 9 continues on the next page . . .

Question 9 continued

Question	Answers	Extra information	Mark
9(b)(ii)	**Plant production** eg pollution by pesticide sprays pollution by fertilsers pollution by producing the energy it uses visual pollution impact of machinery on the environment impact on habitat biodiversity water consumption	ignore pollution unqualified	1
Total			**8**

Question 10 **common with Q3 44401H**

Question	Answers	Extra information	Mark
10(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
10(b)	cutting down trees to just above ground level to encourage new growth (from the stump)		1 1
10(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		4
Total			**9**

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