AQA Qualifications

GCSE
ENVIRONMENTAL SCIENCE

44401H

Mark scheme

4440

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Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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.

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

Mark Scheme

Information to Examiners

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 delineate 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 Assessment Objectives and specification content that each question is intended to cover.

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.

2. Emboldening

2.1 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 bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 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.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, 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 errors / 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: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 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.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, 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 or by each stage of a longer calculation.

3.4 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.

3.5 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 is kept to a minimum. Allowances 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.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Written Communication and levels marking

In Question **4** candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO/Spec
1(a)(i)	(allows the consumer to choose cars which –) use less fuel produce less CO_2	 accept uses less energy accept produces less pollution	 1 1	AO2 A2.2
1(a)(ii)	makes it more likely that people will choose less polluting cars because of the financial incentive		1	AO2 A2.2
1(b)	any **two** from: • faster driving uses more fuel • more stopping and starting uses more fuel • more time spent standing in traffic all increase consumption • smoother driving reduces consumption • short journeys have high fuel consumption		2	AO2 A2.2
1(c)	**either** use same volume of fuel measure the distance **or** use the same distance measure fuel consumed any **two** control measures: eg same driving conditions same measuring equipment same driver same type of fuel same amount of fuel at start	 allow use same amount of fuel ignore repeats	 1 1 *2*	AO2 A2.2
Total			9	

Question	Answers	Extra information	Mark	AO/Spec
2(a)	D C A B	all four correct **two** marks two correct for **one** mark	2	AO1 A1.4
2(b)	lime		1	AO1 A1.4
2(c)	rain water leaches / dissolves nutrients nutrients get into groundwater groundwater fills aquifer	accept dissolved nutrients run off into streams and rivers	1 1 1	AO2 B2.2
Total			6	

Question	Answers	Extra information	Mark	AO/Spec
3(a)	any **three** from: increase in species that cod feed on eg herring / zooplankton increase in species that eat herring / zooplankton decrease in species that feed on cod eg shark / seal decrease in species that predators of the cod feed on impact on humans described, eg loss of income for fishermen	ignore decrease in numbers of humans	3	AO2 B1.1
3(b)	any **three** from: allow to breed they need to reach maturity/ breed before they are caught need to protect all the species they feed on throughout their life cycle need to protect the areas where they breed / live (because they do not migrate) *rear cod in fish farms*	allow avoiding fishing at the time when the fish are breeding	3	AO2 B1.3
3(c)	numbers of a particular species you are allowed to catch		1	AO1 B1.3

Question 3 continues on the next page . . .

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO/Spec
3(d)	any **three** from: line fishing increased net mesh size further legal protection over-quota not thrown back avoiding nets that damage habitats avoid fishing in breeding grounds or over-fished areas	 eg size of ship, hours allowed to fish ignore quota unqualified ignore activities that are not part of cod fishing eg fish farming, eating alternative fish, reintroduction of fish stocks	3	AO1 B1.3
Total			10	

Question	Answers	Extra information	Mark	AO/Spec
4(a)	any **three** from: • pollution • desertification • salinization • global warming • erosion • flooding • building / urbanisation • other specified alternative uses for land • growing non-food crops	*ignore ''cash crop''* *allow soil damaged by farming methods* eg reservoirs, solar arrays, landfill	3	AO2 A1.3
4(b)	a crop with genes not present in its parents		1	AO1 A1.3
4(c)	where genes are transferred from one <u>species</u> to another	allow characteristics are transferred from one <u>species</u> to another	1	AO1 A1.3

Question 4 continues on the next page . . .

Question 4 continued . . .

Question	Answers	Extra information	Mark	AO/Spec
4(d)	QWC see below		4	AO1 A1.3
4 (d)	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 changes in agricultural methods increased crop yields.		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 description of how changes in agricultural methods increased crop yields but there is limited explanation and 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 some description of how changes in agricultural methods increased crop yields.		1	
	No relevant content.		0	
	Answers explain a range of different examples including: use of fertilisers use of pesticides use of machinery environmental control plant breeding irrigation protected cultivation		4	
Total			9	

Question	Answers	Extra information	Mark	AO/Spec
5(a)	112 years		1	AO3 A2.3
5(b)	any **three** from: pollution legislation use of alternatives energy demand population growth improved efficiency of use rate of discovery of new reserves alternative uses for coal likely to use more coal in the future due to large current reserves	*accept examples. eg more technology – developing countries*	3	AO2 A2.1,2,3
5(c)(i)	new resources discovered	allow improved technology	1	AO3 A2.3
5(c)(ii)	2068-2070		1	AO2 A2.3

Question 5 continues on the next page…

Question 5 continued…

Question	Answers	Extra information	Mark	AO/Spec
5(d)	any **six** from: **For –** high energy density large reserves easy conversion to other forms of energy existing technology reliable source safer / easier to store **Against –** non-renewable pollution from combustion cost of pollution reduction environmental impact of extraction would need to modify existing technology- *(old mines have closed)* *power stations slow to start up* less energy dense than nuclear	**1** mark for each suggestion max **4** marks if argument does not discuss both for and against	6	AO1/AO2 A2.3,4
5(e)	biofuels release CO_2 that was taken in during the time that the plant grew fossil fuels add to present CO_2 levels in the atmosphere (because fossil fuels release CO_2 that was stored deep within the earth millions of years ago)	 allow fossil fuels add to carbon levels in the atmosphere	1 1	AO2 A2.4
Total			14	

Question	Answers	Extra information	Mark	AO/Spec
6(a)(i)	southern		1	AO1/AO3 B2.2
6(a)(ii)	They are all in sedimentary rocks		1	AO1/AO3 B2.2
6(a)(iii)	any **two** from: • high population • low rainfall • high water demand • warmer climate • lack of spare land for reservoirs		2	AO2 B2.1
6(b)	porous permeable		1 1	AO1 B2.2
6(c)	any **two** from: water cleaner from aquifers needs less treatment more predictable source safer from pollution		2	AO1 B2.2
6(d)	any **two** from: • *more difficult to abstract* • springs / streams dry up • lower river levels • contamination of aquifer water (with salt) • loss of wetland habitats	*accept (water shortages) ignore dry soils* allow reduced wetland biodiversity/*aquatic wildlife die*	2	AO1 B2.2
6(e)	collect / store the surplus water reservoir located over an exposed part of the aquifer rock	 accept pumping the excess water into the aquifer	1 1	AO2 B2.2
Total			12	

Question	Answers	Extra information	Mark	AO/Spec
7(a)	any **two** from: to prevent disease to prevent eutrophication to reduce turbidity	 Ignore to prevent pollution	2	AO1 B2.3
7(b)	screens solids aerobic anaerobic nutrient stripping	5 correct – **4** marks 3/4 correct – **3** marks 2 correct – **2** marks 1 correct – **1** marks	4	AO1 B2.3
7(c)	methane – as an energy source sludge – as an energy source, fertiliser, soil improver		1 1	AO2 B2.3
7(d)	14 763 158 *14763157.89*	accept 14.8 million if answer incorrect award **1** mark for correct working eg $\frac{500\,000 \times 56.1}{1.9}$ **or** incorrect rounding eg 14 million	2	AO3 B2.3
7(e)	any **one** from: • *smell/vermin* • if disposed of in sea can cause pollution (eutrophication) • if burnt adds to global warming • lack of suitable sites for on land disposal • if (buried) will produce methane		1	AO1 B2.3
Total			11	

Question	Answers	Extra information	Mark	AO/Spec
8(a)	conventional HEP traps water which is constantly replaced pumped storage uses the same water moving backward and forward between the two reservoirs	allow open system or outlet allow closed system	1 1	AO1 A2.4
8(b)	the surplus energy at night is used to pump water from the lower reservoir to the higher		1	AO2 A2.4
8(c)	demand often increases suddenly eg in TV intervals so this can meet that sudden demand		1	AO2 A2.4
8(d)	Sun evaporates the water which falls on uplands as rain giving the water potential energy		1 1	AO1 A2.4
8(e)	E - all of these		1	AO1 A2.4
8(f)	any **two** from: • lack of suitable sites • environmental impact • cost of building	accept flooding, visual impact, loss of habitats	2	AO2 A2.4
8(g)	any **four** from: much less expensive to construct no need to flood land less impact on shipping less impact on wildlife/*habitats* generate on both tides less visual impact	allow easier construction *allow takes up less space*	4	AO2 A2.4
Total			13	

Question	Answers	Extra information	Mark	AO/Spec
9(a)(i)	any **four** from: • never work alone • avoid swallowing water • wear appropriate clothing / footwear • never work in deep water • wash hands afterwards • make sure sample is not contaminated • only use small containers to avoid risk of slipping • use non-breakable apparatus	allow cover cuts	3	AO1 B2.1
9(a)(ii)	any **four** points: • rinse out container with water to be tested • collect water to be tested • add correct amount of water • add reagent • wait for indicated time • compare colour with standard • record result • take more than one sample	accept test strip method if given *allow indicator or chemical*	4	AO1 B2.1
9(b)(i)	use pond dipping / kick sampling identify species present compare abundance of species with (published tables) for pollution levels	 *accept reference to specific species*	1 1 1	AO1 B2.1
9(b)(ii)	C - oxygen		1	AO2 B2.1
9(b)(iii)	any **one** from: • chemical tests only tell you the current pollution levels; biological indicators give you a historical pattern • *biological indicators show the effect of pollution on wildlife*		1	AO2 B2.1
Total			12	

Question	Answers	Extra information	Mark	AO/Spec
10(a)	any **three** from: • restricts energy loss in movement • reduces losses in heat maintenance • diet can be controlled • light control to increase egg production • protected from stress	 eg predators, bad weather	3	AO2 A1.3
10(b)	subsidies for production guaranteed prices	eg grants for buildings, food, fencing	1 1	AO1 A1.4
10(c)	any **two** from: • animal welfare • waste production • energy consumed • disease • taste / quality • high initial investment		2	AO1 A1.4
10(d)	increases food miles animals / animal products need to be transported further to market		1 1	AO2 A1.4
10(e)	any **two** from: if the animals become extinct their genes are gone forever the genetic characteristics might be needed in the future genetic variability reduces vulnerability of the species to disease	 accept loss of biodiversity	2	AO2 B1.2
Total			11	

Question	Answers	Extra information	Mark	AO/Spec
11(a)	containment vessel turbine heat exchanger coolant fuel rods control rods	all correct four correct for **2** marks two correct for **1** mark	3	AO1 A2.4
11(b)	uranium(-235) plutonium(-239)	accept U or Pu ignore incorrect numbers	1	AO1 A2.4
11(c)	require smaller amounts of fuel do not produce carbon dioxide, *sulphur dioxide, NO_x*		1 1	AO1 A2.4
11(d)(i)	any **four** from: • remote location • water for cooling • access to sea for transport • few existing buildings • existing power station • workforce nearby • prevailing winds		4	AO2 A2.4
11(d)(ii)	any **three** from: impact on: • *local people* • water / sea • wildlife • transport links • any historical sites • visual impact • existing land use • noise • electricity transmission infrastructure already present		3	AO1 A2.4
Total			13	