SPECIMEN MATERIAL

AS
ENVIRONMENTAL SCIENCE
PAPER 1

Mark scheme

Series

V 1.0

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

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Examiners are required to assign each of the students' responses to the most appropriate level according to its overall quality, then allocate a single mark within the level. When deciding upon a mark in a level examiners should bear in mind the relative weightings of the assessment objectives (see page 28) and be careful not to over/under credit a particular skill. For example, in question 11.3 more weight should be given to AO1 than to AO2 and AO3. This will be exemplified and reinforced as part of examiner training.

Qu	Part	Marking guidance	Comments	Total marks	AO
01	1	A = photosynthesis B = sedimentation/fossilisation		2	AO2
01	2	4	Absorbed – Decay = Death and sinking	1	AO2
01	3	42.42 Accept 42.4	7000/(36 + 37 + 92) = 42.4 Or 7000/(90 + 35 + 40) = 42.4	1	AO2
01	4	5	(7 +90 + 55 + 65) – (92 + 120) = 5	1	AO2

Qu	Part	Marking guidance	Comments	Total marks	AO
02	1	**Both answers correct for 1 mark** **X** 100 ^{O} C; [A any value in range 85–120 ^{O} C] **Y** 500 ^{O} C; [A any value in range 150– 550 ^{O} C]	Students must recognise, from the table of data, which procedures are taking place and deduce appropriate temperatures.	1	AO2
02	2	**Stage 1** Calculation of mass values 12.69 and 21.60 **Stage 2** Percentage calculation 58.75% ecf ***1*** *mark for a correct method of either stage* ***2*** *marks for correct final answer with no working/correct working*	Students must deduce which data relate to the wet soil sample, water loss or which value must be used for dry soil. Calculation summary: $\frac{\text{Mass of water lost}}{\text{Mass of wet soil}} \times 100\%$ Mass of water lost 31.02 – 18.33 = 12.69 Mass of wet soil 31.02 – 9.42 = 21.60 Percentage calculation $\frac{12.69}{21.60} \times 100 = 58.75\%$	2	AO2

02	3	Dry/in a desiccator (to prevent absorption of water)		1	AO2
02	4	53 hours	Constant mass reached and evident (not 52, as mass could still be declining further)	1	AO2

Qu	Part	Marking guidance	Comments	Total marks	AO
03	1	Any **two** from: • illegal to kill • illegal to injure • illegal to collect • illegal to sell • illegal to disturb breeding/nesting sites • designation of protected habitat		2	AO1
03	2	Any **two** from: • role in nutrient recycling • source of genes for crop breeding/GM • crop pollination • role in biological control of pests		2	AO1
03	3	One **named** conservation designation: eg Site of Special Scientific Interest/SSSI Local Nature Reserve/LNR National Nature Reserve/NNR Ramsar site Special Area of Conservation/SAC Special Protection Area/SPA Natura 2000 site Marine Nature Reserve/MNR Marine Conservation Zone/MCZ Marine Protected Area/MPA National Park Reject AONB/Green Belt/unqualified nature reserve/unqualified Country Park		1	AO1

03	4	Decreased fragmentation/prevents islandisation links habitats Any **two** from: • increased access to resources on other areas • prevention of separation of breeding populations • reduced inbreeding risk of isolated populations • larger gene pool of populations that can mix • allows recolonisation after local extinction	Students must show an understanding that the conservation role of biological corridors is for the wildlife in the habitats they link, not in the corridor habitat itself.	1 2	AO2

03	5	Any **two** from: • the tracking collar provides continual data record throughout the journey • intermediate destinations can be identified • periods of travel/rest can be identified • feeding sites can be identified • threats to survival can be identified • in-journey habitats that need protecting can be identified Accept converse statements about leg rings	2	AO2

Qu	Part	Marking guidance	Comments	Total marks	AO
04	1	One mark for correct answer for each stage: First mark Total dry biomass above ground = 54000 Carbon in above ground biomass = 12700.8t CO_2 released = 46569.6t Accept 46566.67 – 46569.6 ecf Three marks for correct final answer with no working/correct working	Calculation commentary (4320/100 x 50) x 25 = 54000t 48% of this is above ground 54000/100 x 48 = 25920t 49% of this is C 25920/100 x 49 = 12700.8t Mass of CO_2 from C combustion 12700.8/12 x 44 = 46569.6t	3	AO2
04	2	Any **two** from: • mangroves contain more stored carbon per unit area in living biomass • mangroves contain more stored carbon per unit area in dead organic matter • larger area cleared per year		2	AO2
04	3	Any **two** named methodologies • Random/systematic sample site location • (representative) number of sample sites • (representative) timing of samples related to weather/water flow replicates. Three marks for any **three** details of **one** sampling methods: Method 1 • standardised collection of sample/	Students must demonstrate that they know how to use a specific appropriate method that would produce accurate results, within a plan that would produce representative results.	5	AO1 = 3 AO2 = 2

		standardised water container/samples from same depth • standardised light source in dark room/ no other light source • standard distance between light source and water container • calibrated light meter/turbidimeter measure transmission/scatter/reflection Reject penetration **OR** Method 2 • Secchi disc/turbidity tube/bottle • measure depth when segments cross/ become indistinct • subjectivity of judgement • importance/difficulty of using with variable light levels **OR** Method 3 standardised collection of sample/ standardised water container/samples from same depth • measure volume of water sample in measuring cylinder • allow time for suspended solids to settle • measure volume of settled particles (related to sample volume)			

Qu	Part	Marking guidance	Comments	Total marks	AO
05	1	CO_2 removed from the atmosphere by named processes: • photosynthesis by vegetation/trees • dissolution in oceans	Students should use an understanding of natural processes to explain why about half of the CO_2 released by human activities is removed from the atmosphere.	2	AO2
05	2	Initial change causes increased temperature Any **one** detail of positive feedback mechanism eg • melting land/sea ice reduces albedo/more sunlight absorbed • melting permafrost releases methane • increased DOM decomposition releases CO_2 • more forest/peat fires release CO_2 Further increase in temperature	Students must relate their answer to the extra ice loss caused by the positive feedback mechanism, not just to melting caused by raised temperatures due to the release of greenhouse gases.	1 1 1	AO1
05	3	One mark for named sensor platform or type of sensor platform One mark for type of information collected eg One named sensor platform or type of sensor platform: • Polar orbit/low altitude satellite • Cryosat • Landsat One type of information collected: • Microwave emissions/Special Sensor Microwave Imager/SSMI/Advanced Microwave Scanning Radiometer/AMSR/Microwave scanner/radiometer • IR/visible light/IR scanner/visible light scanner • Altitude/Radar altimeter **OR** One named sensor platform or type of	Students must refer to a specific method that is actually used to measure ice area, not a method they plan. No credit is given to vague methods, such as aerial/satellite surveys without reference to a specific technology. The information collected must be appropriate for the type of sensor platform given.	1 1	AO2

		sensor platform: • Submarine • ROV • Autosub • Argo float One type of information collected: • Upward looking sonar/ULS • detect movement of waves/static ice Reject detail linked to inappropriate method			

05	4	Point in a changing climatic factor where natural processes perpetuate the change (so the original process is no longer required)	1	AO1

05	5	Input data for a particular year Compare the prediction for later years for which known data exist	2	AO1

Qu	Part	Marking guidance	Comments	Total marks	AO
06	1	CO_2 concentration in atmosphere reduced (by photosynthesis) Less IR absorbed by CO_2 (greenhouse gas)		2	AO2
06	2	Any **two** from: • tree growth affected by other factors • some years are hard to distinguish/low resolution • few very old trees/incomplete data record • trees not found in all locations	Students should demonstrate an understanding that the accuracy of proxy data can be low and that there may be limitations on the dates and locations for which it exists.	2	AO2
06	3	data loggers named vehicle/carrier/location eg • field stations/buoys/Argo float/Autosub/meteorological balloons/aircraft • remote sensing using reflectance values/infrared		2	AO2
06	4	For each feature: First mark: Identification of the secondary feature influenced by distance/mass Second mark: Use of data to illustrate difference in primary and secondary features. eg **Mass** First mark: Mass controls gravity which retains an atmosphere/maintains high atmospheric pressure/prevents water boiling Second mark Use of data Mass: Earth = 60×10^{23} kg, Mercury = 3.3×10^{23} kg Rel' Atm' Press': Earth = 1 Mercury= 1×10^{-14}.	Students should demonstrate an understanding that distance to the Sun and mass do not directly affect the ability of life to survive. Their importance is how they affect other factors. They should be able to apply their knowledge of Earth to the analysis of the data about other planets and make judgements on how the conditions would affect the survival of life.	4	AO3

		Distance to the Sun First mark Distance to the Sun controls insolation which controls temperature Second mark Distance: Earth = 150×10^8 km, Mercury = 58×10^8 km. Mean temperature: Earth = 15 ^{o}C, Mercury = 260 ^{o}C. Accept prose descriptions of the differences in values where numbers are not given			

<table>
<tr><th>Qu</th><th>Part</th><th>Marking guidance</th><th>Comments</th><th>Total marks</th><th>AO</th></tr>
<tr><td>07</td><td>1</td><td><table><tr><th>Process</th><th>Letter from Figure 8</th></tr><tr><td>Ultraviolet light absorbed by ozone layer</td><td>B</td></tr><tr><td>Infra red light absorbed by greenhouse gases</td><td>H</td></tr></table></td><td></td><td>2</td><td>AO1</td></tr>
<tr><td>07</td><td>2</td><td>Any one from:
• satellites collect more data
• satellites collect data from all areas
• satellites collect data more frequently
• satellites collect data from more predictable locations

Accept converse for helium balloons</td><td></td><td>1</td><td>AO1</td></tr>
<tr><td>07</td><td>3</td><td>Any two from:
• no significant difference if SD bars overlap
• indicates the distribution/spread/dispersal of results around each mean
• small standard deviation equals higher confidence in the mean</td><td></td><td>2</td><td>AO3</td></tr>
<tr><td>07</td><td>4</td><td>24.44% / 24.4%

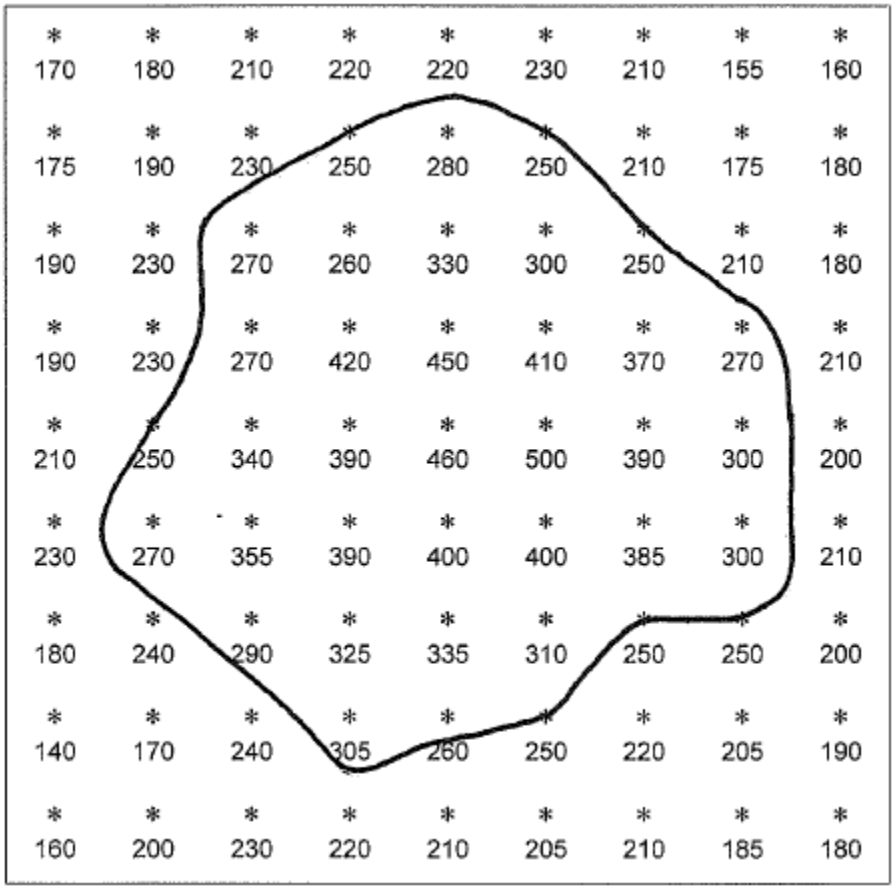
Accept correct method of calculation using values from graph ± 2 of correct values.</td><td>Calculation:

$\frac{\text{Difference in values}}{\text{1980 value}} \times 100\%$

$\frac{225 - 170}{225} \times 100\% = 24.44\%$</td><td>1</td><td>AO2</td></tr>
<tr><td>07</td><td>5</td><td>Any four from:
• reduced/banned production/use (of CFCs/ODSs)
• named alternative material eg HCs/HFCs/HCFCs/alcohols
• named alternative process eg pump action/trigger pack
• named method of preventing release of waste CFCs eg recycle/drain CFCs from fridges/AC
• named waste disposal technique eg incineration</td><td>Students do not need to describe the change in the trend but their answers should be related to changes in human activities that stabilise or reduce ozone depletion.</td><td>4</td><td>AO1 = 2

AO3 = 2</td></tr>
</table>

Qu	Part	Marking guidance	Comments	Total marks	AO
08	1	Isoline should pass between points whose values span 250 Where the value is 250, the line should pass through it	Students should draw an isoline which surrounds all areas with readings of 250 cpm and above. The exact position can be estimated but not identified, hence the range of acceptable estimates.	1	AO3



08	2	Area estimate = 32 km^2 Accept values between 26 and 38 Accept correct estimate of incorrectly drawn line		1	AO3

08	3	More trial cores between cores values closest to 250	1	AO3

08	4	**One** mark for named process **Two** marks for details of process Egs: Hydrothermal deposition Any **two** from: • hot mineral solutions cool as they move (along fissures) • different minerals have different solubilities • separation by precipitation/deposition /fractional crystallisation Contact metasomatism Any **two** from: • movement due to concentration gradient/pressure • fluid diffusion/infiltration • mineral replacement/deposition	1 2	AO1 = 2 AO2 = 1

08	5	Indicative content Advantages • less waste for disposal • less space required for landfill • no toxic leachate produced • less demand for virgin materials • less atmospheric pollution from extracting virgin materials • lower habitat impacts of mineral extraction/processing • reduced energy use for extraction/processing Disadvantages • difficulties with material separation • identification difficulties • restricted uses of recycled alloys/mixtures • increased transport costs of collection • higher handling costs of small quantities • toxic wastes produced by processing of some materials • supply can't match growth in demand – need for virgin materials • need for consumer cooperation Use of linked examples to illustrate points	Students should be able to give a balanced account of why recycling is an environmentally responsible way of dealing with wastes, but show an understanding of its limitations.	9	AO1 = 4 AO2 = 3 AO3 = 2

Examiners are reminded that AO1, AO2 and AO3 are regarded as interdependent. When deciding on a mark all should be considered together using the best fit approach. In doing so, examiners should bear in mind the relative weightings of the assessment objectives. More weight should therefore be given to AO1 than AO2 and AO3.

Level	Marks	Descriptor
3	7 - 9	A comprehensive response to the question, with the focus sustained. A conclusion is presented in a logical and coherent way, fully supported by relevant judgements. A wide range of knowledge and understanding of natural processes/systems is applied. The answer clearly identifies relationships between environmental issues. Relevant environmental terminology is used consistently and accurately throughout, with no more than minor omissions and errors.
2	4 - 6	A response to the question which is focussed in parts but lacking appropriate depth. A conclusion may be present, supported by some judgements, but it is likely not all will be relevant. A range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there may be a few inconsistencies, errors and/or omissions. The answer attempts to identify relationships between environmental issues, with some success. Environmental terminology is used, but not always consistently.
1	1-3	A response to the question which is unbalanced and lacking focus. It is likely to consist of fragmented points that are unrelated. A conclusion may be stated, but it is not supported by any judgments and is likely to be irrelevant. A limited range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there are fundamental errors and/or omissions. The answer may attempt to identify relationship between environmental issues, but is rarely successful. Limited environmental terminology is used, and a lack of understanding is evident.
	0	Nothing written worthy of credit.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking guidance</th><th>Comments</th><th>Total marks</th><th>AO</th></tr>
<tr><td>09</td><td>1</td><td>First mark:
Named human health problem

Second mark:
Named medicine

Third mark:
Named wildlife taxon used for research

Reject taxon, chemical/medicine or disease/treatment if unlinked to other detail

Suitable examples

<table>
<tr><th>Human health problem</th><th>Named medicine</th><th>Wildlife taxon</th></tr>
<tr><td>Pain/analgesia</td><td>Aspirin</td><td>Willow</td></tr>
<tr><td>Pain/analgesia</td><td>Opium/codeine</td><td>poppy</td></tr>
<tr><td>Breast cancer</td><td>Taxol</td><td>yew</td></tr>
<tr><td>Birth control pill/muscular injuries/ inflammation</td><td>Diosgenin/cortisone</td><td>Mexican yam</td></tr>
<tr><td>Brain cancer</td><td>Chlorotoxin</td><td>scorpion</td></tr>
<tr><td>Cancer</td><td>Melittin</td><td>Bee</td></tr>
<tr><td>Muscular dystrophy</td><td>PeptideGsMtx-4</td><td>tarantula</td></tr>
<tr><td>Arthiritis</td><td>CVF</td><td>Cobra</td></tr>
<tr><td>Skin burns</td><td>Hipposudoric acid</td><td>hippopotamus</td></tr>
<tr><td>HIV-AIDS</td><td>AZT</td><td>sponge</td></tr>
<tr><td>Herpes/melanoma/ leukaemia</td><td>Acyclovir</td><td>sponge</td></tr>
</table>

Credit other suitable examples.</td><td></td><td>3</td><td>AO1 = 2

AO2 = 1</td></tr>
<tr><td>09</td><td>2</td><td>First mark:
Why organism’s adaptations are useful for human physiology research

Second mark:
Named taxon

Third mark:
Area of physiological research
Reason why taxon is suitable for the study

Reject taxon, area of physiological research or reason for suitability if unlinked to other detail

eg
<table>
<tr><th>Taxon</th><th>Human health problem</th><th>Why the taxon is suitable for research</th></tr>
<tr><td>Marsupials</td><td>Embryo</td><td>Ease of gaining information</td></tr>
</table></td><td></td><td>3</td><td>AO1 = 2

AO2 = 1</td></tr>
</table>

	development	from young marsupials outside the mother about embryo development
Sea urchin embryos	Teratogen testing	Ability of embryo cells to reform if no teratogen is present is used to predict the side effects of drugs on humans
Scorpion venom	Pancreatitis	Antarease (venom) induces pancreatitis in lab animals which increases information to aid human treatment
Sponges	Graft rejection	The study of sponges which do not reject grafts, helps prevent transplant rejection
Squid	Nerve function	Squid nerve cells are very wide and easy to study/ experiment on, which increases the understanding of human neurological disorders

09	3	9 mark levels of response answer. Spec ref: All 3.3 **Sample location** - random sampling of vegetation in different areas - use of grid and coordinates, located using random numbers OR - transect from area of higher light levels to lower light levels - continuous/interrupted transect - light readings in each vegetation sampling area **Number of samples** - reference to variability of readings/data - reference to data analysis/statistical significance **Vegetation sampling** - quadrat - appropriate size eg 0.5m/1m - justified choice of open frame/grid/point - use of ID key - justified choice of ecological feature(s) measured • Species richness • Species diversity • Species frequency • Species density • Percentage cover • Biodiversity eg Simpson's Index **Light readings** Standardised method	9	AO1 = 4 AO2 = 3 AO3 = 2

		• Calibrated light meter • Height • Orientation • Same season/readings throughout year • Same time of day • Same weather conditions/cloud cover **Data analysis** Data would be presented as a graph		

Examiners are reminded that AO1, AO2 and AO3 are regarded as interdependent. When deciding on a mark all should be considered together using the best fit approach. In doing so, examiners should bear in mind the relative weightings of the assessment objectives. More weight should therefore be given to AO1 than AO2 and AO3.

Level	Marks	Descriptor
3	7 – 9	A comprehensive response to the question, with the focus sustained. A conclusion is presented in a logical and coherent way, fully supported by relevant judgements. A wide range of knowledge and understanding of natural processes/systems is applied. The answer clearly identifies relationships between environmental issues. Relevant environmental terminology is used consistently and accurately throughout, with no more than minor omissions and errors.
2	4 – 6	A response to the question which is focussed in parts but lacking appropriate depth. A conclusion may be present, supported by some judgements, but it is likely not all will be relevant. A range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there may be a few inconsistencies, errors and/or omissions. The answer attempts to identify relationships between environmental issues, with some success. Environmental terminology is used, but not always consistently.
1	1-3	A response to the question which is unbalanced and lacking focus. It is likely to consist of fragmented points that are unrelated. A conclusion may be stated, but it is not supported by any judgments and is likely to be irrelevant. A limited range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there are fundamental errors and/or omissions. The answer may attempt to identify relationship between environmental issues, but is rarely successful. Limited environmental terminology is used, and a lack of understanding is evident.
	0	Nothing written worthy of credit.

Qu	Part	Marking guidance	Comments	Total marks	AO
10	1	One mark for correctly identifying the water source **Sample A**: river water (**C**)	Students should be able to analyse the table of data and select the information that allows the correct water sources to be identified and the other possibilities to be rejected.	1	AO3 = 1
10	2	One mark for correctly identifying the water source **Sample B**: rainwater (**D**)	Students should be able to analyse the table of data and select the information that allows the correct water sources to be identified and the other possibilities to be rejected.	1	AO3 = 1
10	3	One mark for correctly identifying the water source **Sample D**: geothermal spring (**A**)	Students should be able to analyse the table of data and select the information that allows the correct water sources to be identified and the other possibilities to be rejected.	1	AO3 = 1
10	4	One mark for features that identify it and exclude others, for each source **Sample A**: high turbidity, high maximum coliform count, but low dissolved solid/calcium/sodium level. **Sample B**: highest dissolved oxygen saturation, lowest dissolved solid/chloride/calcium content. **Sample D**: highest temperature, no coliform bacteria, low turbidity.	Students should be able to analyse the table of data and select the information that allows the correct water sources to be identified and the other possibilities to be rejected.	3	AO3 = 3
10	5	9 mark levels of response answer Source management to maintain/increase supplies:		9	AO1 = 4 AO2 = 3

		• reservoir construction for storage of surplus • river regulation reservoirs • aquifer recharge using surface surplus • desalination of saline aquifers/seawater • afforestation to delay runoff • maintenance of flood plains for storm water retention • building rainwater catchments • pollution control eg reduced use of nitrate fertilisers nitrate control zones river buffer strips pesticides industrial waste management to reduce emissions • Control of leaks from water mains Water conservation methods: User management • Meters to reduce unnecessary use • Banned activities eg sprinklers/hosepipes during droughts Consumer choice • showers/baths • turning taps off • watering cans rather than hosepipe/sprinklers Low water use equipment/management • low water/timed/spray taps • low-flush toilets • low water-use washing machines/dish washers • greywater use • xeriscaping of gardens/urban spaces		AO3 = 2

Examiners are reminded that AO1, AO2 and AO3 are regarded as interdependent. When deciding on a mark all should be considered together using the best fit approach. In doing so, examiners should bear in mind the relative weightings of the assessment objectives. More weight should therefore be given to AO1 than AO2 and AO3.

Level	Marks	Descriptor
3	7 – 9	A comprehensive response to the question, with the focus sustained. A conclusion is presented in a logical and coherent way, fully supported by relevant judgements. A wide range of knowledge and understanding of natural processes/systems is applied. The answer clearly identifies relationships between environmental issues. Relevant environmental terminology is used consistently and accurately throughout, with no more than minor omissions and errors.
2	4 – 6	A response to the question which is focussed in parts but lacking appropriate depth. A conclusion may be present, supported by some judgements, but it is likely not all will be relevant.

		A range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there may be a few inconsistencies, errors and/or omissions. The answer attempts to identify relationships between environmental issues, with some success. Environmental terminology is used, but not always consistently.
1	1-3	A response to the question which is unbalanced and lacking focus. It is likely to consist of fragmented points that are unrelated. A conclusion may be stated, but it is not supported by any judgments and is likely to be irrelevant. A limited range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there are fundamental errors and/or omissions. The answer may attempt to identify relationship between environmental issues, but is rarely successful. Limited environmental terminology is used, and a lack of understanding is evident.
	0	Nothing written worthy of credit.

Qu	Part	Marking guidance	Comments	Total marks	AO
11	1	No gaseous phosphorus compounds Very low solubility of phosphorus compounds Accept converse statements for nitrogen		1 1	AO1
11	2	Any **two** processes involving nitrates from: • eutrophication • growth of algae • shading of macrophytes • breaking of foodchains • deoxygenation on decomposition • death of aerobic organisms • toxins released by blue-green algae/cyanobacteria Any **two** problems caused by eutrophication from: • loss of fisheries • loss of wildlife habitat • increased treatment costs • navigation difficulties		2 2	AO2
11	3	9 mark levels of response answer Ploughing/drainage – increased decomposition - CO_2 emissions – global climate change Compaction by machinery/trampling – reduced infiltration – increased runoff – faster runoff – increased flow extremes – flooding – ecological		9	AO1 = 4 AO2 = 3 AO3 = 2

		impacts eg flooding of sandbank/river bank nest sites Reduced addition of organic matter – loss of organic matter – reduced water retention – increased irrigation requirements – over exploitation of water sources – loss of wetland habitats Desertification – loss of farmland – land clearance elsewhere eg rainforest, grasslands Desertification – reduced vegetation/transpiration – reduced rainfall downwind Ploughing vulnerable soils/steep slopes/not contour ploughing, leading to soil erosion Soil erosion impacts: - sedimentation – reduced reservoir volume for water supply/HEP – river flooding - ecological impacts – reduced light for photosynthesis - sedimentation causes loss of fish breeding sites - damage to coral reefs/death of filter feeders - HEP turbine damage Increased atmospheric particulates – settling on plants/urban areas, respiratory problems Reduced land stability – landslides – impacts on urban areas/transport infrastructure Reduced agricultural productivity – habitat destruction to create more farmland – increased intensification eg increased fertiliser inputs		

Examiners are reminded that AO1, AO2 and AO3 are regarded as interdependent. When deciding on a mark all should be considered together using the best fit approach. In doing so, examiners should bear in mind the relative weightings of the assessment objectives. More weight should therefore be given to AO1 than AO2 and AO3.

Level	Marks	Descriptor
3	7 - 9	A comprehensive response to the question, with the focus sustained. A conclusion is presented in a logical and coherent way, fully supported by relevant judgements. A wide range of knowledge and understanding of natural processes/systems is applied. The answer clearly identifies relationships between environmental issues. Relevant environmental terminology is used consistently and accurately throughout, with no more than minor omissions and errors.
2	4 - 6	A response to the question which is focussed in parts but lacking appropriate depth. A conclusion may be present, supported by some judgements, but it is likely not all will be relevant. A range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there may be a few

		inconsistencies, errors and/or omissions. The answer attempts to identify relationships between environmental issues, with some success. Environmental terminology is used, but not always consistently.
1	1-3	A response to the question which is unbalanced and lacking focus. It is likely to consist of fragmented points that are unrelated. A conclusion may be stated, but it is not supported by any judgments and is likely to be irrelevant. A limited range of knowledge and understanding of natural processes/systems is shown. There is an attempt to apply this to the question, but there are fundamental errors and/or omissions. The answer may attempt to identify relationship between environmental issues, but is rarely successful. Limited environmental terminology is used, and a lack of understanding is evident.
	0	Nothing written worthy of credit.

Assessment Objective Grid

	AO1	AO2	AO3	Total
01.1		2		**2**
01.2		1		**1**
01.3		1		**1**
01.4		1		**1**
02.1		1 (practical)		**1**
02.2		2 (practical/maths)		**2**
02.3		1 (practical)		**1**
02.4		1 (practical)		**1**
03.1	2 (knowledge)			**2**
03.2	2 (knowledge)			**2**
03.3	1 (knowledge)			**1**
03.4		3		**3**
03.5		2		**2**
04.1		3 (maths)		**3**
04.2		2		**2**
04.3	3 (practical)	2 (practical)		**5**
05.1		2		**2**
05.2	3			**3**
05.3		2		**2**
05.4	1 (knowledge)			**1**
05.5	2			**2**
06.1		2		**2**
06.2		2		**2**
06.3		2		**2**
06.4			4 (2 maths)	**4**
07.1	2			**2**
07.2	1			**1**
07.3			2 (maths)	**2**
07.4		1 (maths)		**1**
07.5	2		2	**4**
08.1			1	**1**
08.2			1	**1**
08.3			1	**1**
08.4	2	1		**3**
08.5	4	3	2	**9**
09.1	2	1		**3**
09.2	2	1		**3**
09.3	4 (practical)	3 (practical)	2 (practical)	**9**
10.1			1 (maths)	**1**
10.2			1 (maths)	**1**
10.3			1 (maths)	**1**
10.4			3	**3**
10.5	4	3	2	**9**
11.1	2			**2**
11.2		4		**4**
11.3	4	3	2	**9**

Paper Total	**43**	**52**	**25**	**120**

13 January 2017