

A-LEVEL ENVIRONMENTAL SCIENCE

(7447)

Marked response – extended response question

Using an example question based on the content of the specification, understand how different levels are achieved and how the mark scheme is applied.

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EXAMPLE RESPONSE



The following response and examiner comments provide teachers with the best opportunity to understand the application of the mark scheme.

This question is not taken from specimen assessment materials or a live exam series, so has not been subject to the usual rigorous question paper production process.

The student response has been typed exactly as it was written.

The mark scheme has not been subject to the usual standardisation process.

Question

Discuss the ways in which agriculture can cause environmental change

[25 marks]

Mark scheme

Level	Marks	Descriptor
5	21-25	<p>A comprehensive response with a clear and sustained focus. Content is accurate and detailed. Relationships are identified, reflecting the holistic nature of environmental science and the answer as a whole is coherent.</p> <p>A wide range of relevant natural processes/systems and environmental issues are described and articulated clearly. These are applied systematically to the question, with clear relevance to the context.</p> <p>Where conclusions are made, these are fully supported by judgements and presented in a logical and coherent way.</p> <p>Relevant environmental terminology is used consistently and accurately throughout. If there are errors, these are very minor indeed and not sufficient to detract from the answer.</p>
4	16-20	<p>A response in which the focus is largely sustained, with content that is mainly accurate and detailed. Relationships are identified and the answer is largely coherent.</p> <p>A range of natural processes/systems and environmental issues are described and articulated clearly. In most cases, these are applied appropriately to the question but, in some, it is less clear why they are relevant.</p> <p>Where conclusions are made, these are supported by judgements which are mostly coherent and relevant.</p> <p>Relevant environmental terminology is used consistently and throughout, with no more than minor errors.</p>

3	11-15	<p>A partial response which is focused in parts. The content is mostly accurate but not always detailed. There is an attempt at identifying relationships, but the answer as a whole is not fully coherent.</p> <p>A range of natural processes/systems and environmental issues are described, most are articulated clearly. In some cases, these are applied appropriately to the context but, in most, it is less clear why they are relevant.</p> <p>Where conclusions are made, it is not always clear how they relate to the judgments given and are likely to contain errors.</p> <p>Relevant environmental terminology is used, but not consistently and there may be errors.</p>
2	6-10	<p>An unbalanced response, lacking in focus. The content may be inaccurate and lacking detail. There is some attempt at identifying relationships, but the answer is not coherent.</p> <p>A limited range of natural processes/systems and environmental issues are described but not articulated clearly and likely to contain errors and/or omissions. There is a limited attempt to apply them to the context.</p> <p>Any conclusions are likely to be asserted, with no supporting judgements and fundamental errors.</p> <p>Environmental terminology is used, but not always appropriately and sometimes with clear errors.</p>
1	1-5	<p>Fragmented points, whose relevance to the question and relationships to each other are unclear.</p> <p>A few natural processes/systems and environmental issues are listed, but unlikely to be described and many may be irrelevant. There is no clear attempt to apply them to the context.</p> <p>It is unlikely that a conclusion will be present.</p> <p>There is an attempt to use environmental terminology, but seldom appropriately.</p>
	0	Nothing written worthy of credit.

Indicative content

Marking guidance	Comments	Total marks	AO
<p>Indicative content</p> <p>Key points that could be expanded with details of examples and processes</p> <p>Biodiversity changes</p> <ul style="list-style-type: none"> • Habitat loss • Forests • Grasslands • Wetlands • Habitat separation/islandisation • Reduced biodiversity • Introduced species: crops, livestock, biological control agents <p>Habitat creation</p> <ul style="list-style-type: none"> • Plagioclimaxes • Meadows • Chalk grassland • Heathland • Hedgerows • Agri-environmental schemes <p>Hydrological changes</p> <ul style="list-style-type: none"> • Irrigation • Drainage • Evapotranspiration <p>Pollution</p> <ul style="list-style-type: none"> • Fertilisers • Pesticides • Energy inputs <p>Soil erosion</p> <ul style="list-style-type: none"> • Rivers, reservoirs, coral reefs • Turbidity • Sedimentation <p>Transport</p> <p>Processing</p> <p>Waste production</p> <ul style="list-style-type: none"> • Manure • Crop waste 	<p>Students should be able to</p> <ul style="list-style-type: none"> • identify a wide range of environmental impacts caused by agriculture • distinguish between negative and positive impacts • make links between actions, processes, impacts and other environmental topics • show an understanding of the extent and significance of impacts. 	25	<p>AO1 = 10</p> <p>AO2 = 10</p> <p>AO3 = 5</p>

Student response

See **Comment 1** in Additional comments section.

See **Comment 2** in Additional comments section.

See **Comment 3** in Additional comments section.

This is an important issue but could have been expanded to cover drainage of wetlands and peat bogs.

See **Comment 4** in Additional comments section.

The example of vultures in India is useful, although it would have been better if a less specific example had been used that illustrated more general issues related to pesticides.

Agriculture involves the control of selected species and environmental features of an area to provide humans with food. This unavoidably involves big changes to the habitat to increase the production of desirable species and reduce numbers of unwanted ones. Some unwanted species may be targeted because they are competitors, predators or pathogens. Other species may decline because they are not adapted to the new conditions, while others may become more abundant as the new conditions are better for them. Controlling abiotic features of the area can also cause significant environmental changes, for example to the hydrology and biogeochemical cycles.

Changing an area so it can be farmed means the previous habitat must be changed or even destroyed completely.

Farms usually have a low biodiversity because the area is controlled to boost the growth of a small range of crop or livestock species. These take the space of the indigenous species.

In the UK woodland and wetland habitats have been lost, but others have been created such as meadows and hedgerows.

Woodland clearance removes a major carbon reservoir, adding to climate change. This is made worse if the land is ploughed as this aerates the soil, increasing the rate of aerobic decay.

Farmers add nutrients to fields using natural and artificial fertilisers. Both can cause harm. Natural fertilisers such as manure may get washed into rivers where they are decomposed by bacteria, causing deoxygenation. Inorganic nutrients can cause pollution with algal blooms, toxins, shading of water weeds and deoxygenation.

Pesticides are used because they are poisonous to pests. However they may also kill wildlife. Insecticides may kill butterflies and bees, herbicides may kill wildflowers and other non-target plant species.

Pesticides that are not specific are likely to harm a wider range of species. If they don't break down they can last long enough to spread further from where they were used and may build up through food chains to reach higher concentrations, especially if they dissolve in body fat. DDT killed birds of prey.

Species that are not actually killed by the pesticides can still be affected if their food species or predators die out.

In India the agricultural chemical diclofenac is used to treat inflammation and pain in cattle. But, vultures that feed on the carcasses are poisoned by the drug residues and the populations of many vulture species has dropped dramatically in less than 20 years. It is feared that the loss of vultures will mean that rotting carcasses will increase the frequency of human diseases like anthrax.

See **Comment 5** in Additional comments section.

See **Comment 6** in Additional comments section.

See **Comment 7** in Additional comments section.

See **Comment 8** in Additional comments section.

It is good that the essay includes the beneficial impacts of agriculture and especially the inclusion of the agri-environmental schemes as a way of minimising damage and increasing wildlife value.

The use of a list is appropriate here as it avoids unnecessary repetition and does not detract from the descriptive prose.

This summary is rather brief. It would be useful to emphasise the key points that have been made.

Livestock release methane that adds to global climate change.

Removing forests and activities like ploughing cause soil erosion. Eroded soil causes sedimentation in rivers, lakes and on beaches and coral reefs. This can kill aquatic plants and filter feeding organisms.

All farming involves energy inputs. Modern farming involves lots of fossil fuel use, some directly for driving machinery, some indirectly in making fertilisers and equipment. This adds to problems such as global climate change, acid rain and smogs.

Abstraction of water to irrigate crops can cause major hydrological changes such as lowered water tables and the drying up of surface water features. This is very bad for other species or communities that rely on the water.

Lowering the water table may cause salt water incursions in coastal areas.

Agriculture can also cause changes to the environment that are beneficial for some species. Some species prefer the newly created habitats such as grasslands and drainage ditches.

Farming can also be controlled to minimize damaging change and make farmland more suitable for wildlife. Agri-environmental schemes provide grants to farmers if they include a range of beneficial management practices. These include:

- maintaining hedges around fields and filling gaps
- protecting in-field trees
- not clearing out ditches too often
- having uncultivated, unsprayed field margins
- leaving crop gaps for skylark nesting
- maintaining dry stone walls and archaeological features

These help to restore habitats lost during periods of farm intensification and protect the appearance of the countryside.

Overall, farming has a big impact on the environment but careful management can reduce this and some damage is unavoidable as people have to have food to eat.

Additional comments

Comment 1:

This is a good introductory overview of what agriculture actually is and why environmental change is inevitable. This is developed further to explain how environmental control will increase productivity but also increase the environmental change.

No specific details or examples are given, but this does not matter as long as they are developed later in the essay. However, it is often beneficial to identify the main topics that will be covered, which could just be the headings from the plan. This will help the examiner to follow the essay structure.

Comment 2:

These statements are true but they lack detail. This is a serious omission as habitat change is the biggest single impact of agriculture.

Some key issues that could have been included are:

- deliberate removal of existing vegetation eg forests, grasslands.
- drainage of wetlands
- fragmentation of remaining habitats and loss of biological corridors.

Comment 3:

Details could have been included of particular species that have been lost. This could have been related to whether the species were directly killed eg tree felling or whether they were affected by changes in biotic or abiotic conditions eg loss of pollinators, grazing, light levels.

Comment 4:

This section includes many important issues but lacks technical terminology, such as:

- named nutrients eg phosphates and nitrates
- eutrophication
- macrophytes
- named pests eg weeds, insects and fungi
- non-target species
- persistent
- bioaccumulation
- biomagnification
- liposolubility.

Additional comments

Comment 5:

This is true, but needs to be expanded with reference to anaerobic gut microbes, also rice padi fields, and a comparison with the previous habitat

Comment 6:

There is no explanation of why erosion is increased and the processes involved.

Details could have been included of how the sediments cause harm by increasing turbidity, reducing light penetration or by direct physical damage.

Comment 7:

This is an important issue. The candidate clearly understands these but has not shown this with examples of the emissions involved. However, it is important not to include too much detail that is irrelevant to the essay title.

Comment 8:

More details could have been included on why the water table may be lowered, preferably mentioning the disturbance of dynamic equilibria and the fact that the recharge rate has been exceeded.

The issue of soil salinisation could also have been included.

Mark awarded

- This essay includes all the main issues that would be expected and many of the less important ones.
- The focus is sustained but important details are missing and opportunities to link issues and develop conclusions are missed.
- There are no significant errors.
- The best match to the level descriptors is to level 4.

Level 4

18 marks (out of 25)

Get help and support

Visit our website for information, guidance, support and resources at [aqa.org.uk/7447](https://www.aqa.org.uk/7447)

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