





# a-level exam questions & answers:

## water & carbon cycles (section a) >

### mark scheme | 20-mark question #2

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Q.:	Sp. Ref.:	Information For Markers:	B'down:	Marks:
1)	3.1.1.2 3.1.1.6	<p><b>With reference to a river catchment, examine the successes and challenges of managing storm/flooding events sustainably.</b></p> <p><b>AO1</b> – Knowledge and understanding of processes in the water cycle and factors driving changes to stores of water. Knowledge and understanding of the concept and behaviour of storm or flood events and the purpose of flood hydrographs.</p> <p><b>AO2</b> – Application of knowledge and understanding to be able to critically analyse, in a spatial and temporal sense, the various successes and challenges associated with managing river flood or storm events with reference to various dimensions of sustainability.</p> <p><b>Notes for answers</b></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>Processes in the water cycle to at least include evapotranspiration, condensation, and precipitation.</li> <li>Global distribution and size of major stores of water – lithosphere, hydrosphere, cryosphere, and atmosphere.</li> <li>Knowledge of the concept of a river catchment as a finite area of land in which a drainage basin can be found. This is an area of land where precipitation collects and drains to a common outlet, such as into a bay, lake or other body of water.</li> <li>Only approximately 0.006% of all global stores water is held in freshwater rivers and lakes, however this still represents in absolute units a large amount at more than 2 million cubic metres.</li> <li>Factors driving change in the magnitude of stores and transfers in the water cycle to be both natural and increasingly anthropogenic, which can lead to more severe storm events. Storm events typically lead to flooding in poorly managed or overflowing river catchments where the inflows significantly exceed outflows and discharge rapidly increases to the point at which the system cannot cope with the level of water present. This can vary between river systems, landscapes, topography, profiles, tributaries etc...</li> <li>Knowledge and understanding of different flood / storm characteristics in the context of flood/storm hydrographs. These show the response of a drainage basin to a period of rainfall, including features such as peak rainfall/discharge, lag time, storm runoff, excess, flashy vs subdued hydrographs etc... and what these events would look like.</li> </ul>	AO1=10 AO2=10	20

- These can be seen as challenges in managing flood/storm events because each river is different, and each storm event is likewise different.
- Appreciation that 'sustainable' management of river systems is a holistic approach that requires the input of numerous stakeholders and a long-term view. Sustainable policies typically involve an analysis on the environmental and social impacts of any changes to the river catchment.

## AO2

- Many answers may consider evaluation in terms of scale / time, contextualised to the question, particularly in their conclusions.
- The question asks about successes and challenges, and so is framed as an assessment as to the overall effectiveness of flood/storm management in a named area.
- Analysis that successes in the context of flood management is very varied because no two storm events are ever the same. However, there are some methods that can be used to sustainably develop river catchments. One strategy is isolating and keeping empty from development any greenfield floodplains 'sustainable floodplain management.' This gives the river natural 'flexibility' and builds in redundancy in the river system.
- Other efforts could include channels dug, canals or river outflows to divert flows of water... Along the river mole in Surrey, Gatwick airport is investing in an £8M Gatwick Stream Flood Attenuation scheme and working closely with the environment agency to reduce flood risk. Furthermore, upstream the upper mole flood alleviation scheme (£15M) aims to reduce flood risk in urban areas of over 50,000 people such as Crawley and Horley, which include building new CO2 neutral flood retention reservoirs and raising dam walls. These are hard engineering strategies so aren't inherently as ecologically sustainable.
- Evaluation that in many areas of the UK this is no longer possible, due to the crowded and built up nature of many river catchment areas. Towns and cities have historically been built near sources of running water and the need to continue building in limited available land has resulted in the necessity to build on floodplains. This is what has occurred in London and is the reason for the lengthy embankment and Thames flood barrier.
- Analysis of the relative extents of challenges to river catchments, including potential future changes due to climate change and increasing storm severity as can be referenced by an increasing number in isolated storm events in the UK.
- Impacts of flood events such as the 2013/14 winter season can include power failures and cuts (putting vital services at risk), damage to communications infrastructure as well as road or rail links. Following the near collapse of The Whaley Bridge reservoir dam in 2019, increasing awareness about the structural integrity of short-term hard engineering strategies have been brought to question, particularly in the context of worsening storm events.
- Answers may consider the relevance of location in this question, i.e. the ability and willingness for flood/storm

		<p>management may be significantly impacted by which human activities are impacted. As an example, little changes have occurred since the 2013/14 Somerset Levels Floods because principally rural, agricultural land was impacted, compared to urban areas. Additionally, the flood events there occur on a far less regular basis, so there is little appetite for significant changes. Therefore more natural, small scale, sustainable solutions can be sought.</p> <ul style="list-style-type: none"> <li>• It could be argued that flood/storm events are significantly easier to manage if the element of sustainability is ignored. This is because large, 'hard engineering' solutions can be implemented with less regard for the natural course of a river catchment. These can involve artificial large flood defences such as the £534M Thames Barrier or Dykes and Levees in the Netherlands.</li> <li>• Students may make references to scale/temporal context either throughout or within the conclusion of this essay – which should be given appropriate credit. These include the importance of bigger rivers vs. Smaller ones, human settlement and population growth/overcrowding as well as the impacts of unforeseen events or climate induced changes.</li> <li>• Credit specific and more isolated references made to students' local case studies in the context of flood management.</li> </ul>		
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### Examiner Marking Level Criteria:

This grid is used by teachers and examiners to decide first your working level, then narrow down to a mark out of 20 for all long answer questions, and the kinds of things they are looking to see in each of these answers.

Level/Mark Range	Criteria/Descriptor
TOP LEVEL 4 (16-20 marks – 80+% - typically an A* answer)	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
HIGH LEVEL 3 (11-15 marks – 55-75% - B to A grade answer)	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> </ul>

	<ul style="list-style-type: none"> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1)</li> </ul>
<p>LOWER LEVEL 2 (6-10 marks – 30-50% - D-C grade answer)</p>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>
<p>LOW LEVEL 1 (1-5 marks) - &lt;25% - E or below answer</p>	<ul style="list-style-type: none"> <li>• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1)</li> </ul>
<p>LEVEL 0 (0 marks) – no answer provided</p>	<ul style="list-style-type: none"> <li>• Nothing worthy of credit (something has gone ridiculously wrong if you're here!)</li> </ul>