a-level exam questions & answers:

water & carbon cycles (section a) >

20 mark question #4 (w&c interrelationships)

References:

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This document is available both as a pdf and editable word document – from the water & carbon cycles topic page which can be printed.

1) 'Assess the extent to which there are inter-relationships between processes in the water cycle and factors driving change in the carbon cycle.'

Water & Carbon Cycles >> 3.1.1.4 >> Water & Carbon Cycles & Their Interrelationships

AQA [20 marks]

writing tips & tricks:

This question involves combining your entire knowledge from this topic together in one question. Follow the PEEL (Point – Evidence – Explain – Link (to the question)) structure. Ensure you use your tropical rainforest case study very thoroughly within the answer to this, as its very easy to just ramble without any valid evidence.

I would recommend 4 paragraphs backing up your point, maybe some explaining the closest interrelationships as well as some which are a little less relevant or on a different temporal or spatial context (e.g. taking place but over a lot more time so less directly relevant) or on a larger/smaller scale. Keep some time (at least 5 mins) to write a good conclusion which draws all your arguments together concisely.

a-level exam questions & answers:
water & carbon cycles (section a) >
mark scheme | 20-mark question #4

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Q.:	Sp. Ref.:	Information For Markers:	B'down:	Marks:
4)	3.1.1.4 AQA	**Assess the extent to which there are inter-relationships between processes in the water cycle and factors driving change in the carbon cycle.** AO1 – Knowledge and understanding of processes in the water cycle and factors driving change in the carbon cycle and how they are interlinked in our natural world. AO2 – Application of knowledge and understanding to assess the inter-relationships between processes in the water cycle and factors driving change in the carbon cycle. Response should come to a view in relation to extent of inter-relationships with use of case study examples to further their arguments. Notes for answers AO1 • Processes in the water cycle which directly inter-relate to/with the carbon cycle. • Processes in the water cycle which do not relate to the carbon cycle. Evaporation and condensation are processes which are determined by the sun's energy and the variation in temperature related to this. • Factors driving change in the magnitude of stores and transfers in the water cycle. These factors may relate to the sun's energy as well as vegetation coverage in drainage basins. • Global distribution and size of major stores of water – lithosphere, hydrosphere, cryosphere and atmosphere. Some may structure their responses around the four major spheres and the interrelationships which exist in these distinct zones. • The role of transpiration in the carbon cycle may be considered as a specific example where there are clear interactions between the two cycles. • Global distribution, and size of major stores of carbon – lithosphere, hydrosphere, cryosphere, biosphere, atmosphere and the interactions with the water cycle which exists in these four major zones. • Factors driving change in the magnitude of carbon stores over time and space, including flows and transfers at plant, sere and continental scales. Photosynthesis, respiration, decomposition, combustion, carbon sequestration in oceans and sediments, weathering. Knowledge and understanding	AO1=10 AO2=10	20

		of the role of the water cycle should be applied here (See AO2) • Case study of a tropical rainforest setting to illustrate and analyse key themes in water and carbon cycles and their relationship to environmental change and human activity. This case study may be used to exemplify some of the inter-relationships within the biosphere. AO2 • Evaluation – Responses may challenge the theme of the question and suggest that the water cycle has many elements which are not inter-related to the carbon cycle. The basic elements of the water cycle involve the transfer of water through the lithosphere, hydrosphere, cryosphere and atmosphere. This is entirely driven by the sun's energy and gravity and is independent of the carbon cycle. • Analysis – Water cycle transfers and stores within drainage basins may also be considered as processes. Infiltration and through flow for example can only occur in the presence of wellformed soils. The formation of soil structures is dependent upon factors driving change in the carbon cycle. • Analysis – A number of processes within the carbon cycle directly relate to the water cycle. Photosynthesis for example, converts the sun's energy into chemical energy. This is completely reliant upon the presence of water for all plant growth. Transpiration may also be considered in this context. • Analysis – Decomposition is another important process in the carbon cycle. This activity is undertaken by detritivores which cannot operate without the presence of water in the areas where decomposition occurs. The detritivores themselves respire which is a key carbon process which can only operate in the presence of water, stored in soils and groundwater. It is important to note that some carbon is lost to the system due to detritivore respiration which can only take place in the presence of water, provided via precipitation. Some may use the tropical rainforest case studies to exemplify and support the analysis. • Analysis – Some may refer to the fact the carbon can be dissolved directly into large water bodies such as oceans, seas and lakes. Furthermore, carbon can be dissolved in precipitation as rain falls to the earth's surface. When dissolved in water, carbon dioxide reacts with water molecules and forms carbonic acid, which contributes to ocean acidity. • Analysis and evaluation – Responses may also explore the interrelationships between processes in the water cycle and factors driving change in the carbon cycle in a range of human activities and human life processes. This is a legitimate approach. • Analysis – Some may make further links eg to decomposition in periglacial areas (cryosphere) which is currently being exacerbated by climate change. The melting ice in the active layer is leading to rapid decomposition and a release of carbon dioxide and methane.		

		• Analysis and evaluation – Natural fires may also be considered also act as process within the carbon cycle where there are interrelationships with processes in the water cycle. Pyriscence for example has maturation and release of seeds which is triggered, in whole or in part, by fire or smoke; fire is a critical ingredient in the renewal of some ecosystems (biosphere). This is an example of where a factor driving change in the carbon cycle might impact processes in the water cycle. • Analysis and evaluation – Weathering is another process which releases carbon back to the atmosphere (lithosphere and hydrosphere). This requires the presence of water, usually through precipitation or under sea water weathering. This potentially reveals another link between precipitation and the carbon cycle. This potentially reveals another link between processes in the water cycle and the factors driving change in the carbon cycle. • Overall evaluation – More sophisticated responses should note that the carbon cycle is entirely dependent upon the water cycle for its existence. Without the cycling of water through the lithosphere, hydrosphere, cryosphere and atmosphere, there could be no carbon cycle. • Credit any other valid material.		

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)	• 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). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).
HIGH LEVEL 3 (11-15 marks – 55-75% - B to A grade answer)	• 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). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

	• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1)
LOWER LEVEL 2 (6-10 marks – 30-50% - D-C grade answer)	• 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. • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).
LOW LEVEL 1 (1-5 marks) - <25% - E or below answer	• 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. • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1)
LEVEL 0 (0 marks) – no answer provided	• Nothing worthy of credit (something has gone ridiculously wrong if you're here!)