

water & carbon cycles (section a) >

20 mark question #3 (carbon stores & cycles)



References:

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- 1) Assess the extent to which changes to carbon stores are a result of human action as opposed to natural variation.**

Water & Carbon Cycles >> 3.1.1.3 >> The Carbon Cycle

[20 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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writing tips & tricks:

This question is very relevant, theoretical and focuses on carbon, so make sure you focus on your knowledge and theory from this part of the course. Climate change, carbon stores and the risks associated are always in the news! Try and include a case study wherever you can, though not explicitly mentioned. I'd suggest using a PEEL Structure where you make a point for/against, back this up with evidence e.g. facts/stats or case study knowledge, then evaluate the relevance and link it back to the original question. Write a super 5 or so line conclusion at the end which makes sure you it is very obvious where you stand on this issue, or risk losing marks.

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a-level exam questions & answers:

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mark scheme | 20-mark question #3

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Q.:	Sp. Ref.:	Information For Markers:	B'down:	Marks:
1)	3.1.1.3	Assess the extent to which changes to carbon stores are a result of human action rather than natural variation. AO1 – Knowledge and understanding of different stores of carbon across earth. Knowledge and understanding surrounding the processes in the carbon cycle over time and in different scales, from local to global. AO2 – Application of knowledge and understanding to be able to critically analyse the extent to which human activity (anthropogenic) is responsible for recent changes to carbon stores as opposed to natural fluctuations. Notes for answers AO1 • Knowledge and understanding of stores of carbon in the hydrosphere (water), cryosphere (ice sheets/caps, glaciers etc...), lithosphere (ground) and atmosphere (air), including their relative sizes and locations. • Appreciation that the amount of stored carbon on a global scale is massive (around 1.85Bn tonnes), of which 99.985% is stored primarily in the slow carbon cycle within sedimentary rocks and unextracted fossil fuels. All other stores are by comparison far smaller, but the way carbon is cycled within means that the impacts of shifting carbon between these stores is more directly influential. • Globally stores of carbon have remained fairly constant for hundreds of thousands of years, owing to the two different carbon cycles operating, and that typically short term changes experienced would be 'cyclic' in nature and occur around every hundred thousand years or so. • Historical changes to carbon stores with particular reference to atmospheric carbon, including levels of carbon in the atmosphere fluctuating between 180 and 300 PPM over last 800k years, and rising from 1950 by nearly 50% to over 400 PPM in recent years. Acknowledgement that the greatest changes to carbon stores in recent years (and that which poses the greatest threat to human habitation and our environment through climate change) is a global increase in atmospheric carbon as part of the short carbon cycle. • Knowledge of different processes within the carbon cycle and their impacts on life on earth, which could include photosynthesis, decomposition, respiration, the oceanic carbon pump, and human emissions through activity such as the burning of fossil fuels.	AO1=10 AO2=10	20

		• Knowledge of the processes involved with fossil fuel extraction, burning and the surrounding impacts of this in terms of greenhouse gases and global warming due to the expulsion of carbon into the atmosphere. AO2 • The impact of natural ebbs & flows in the carbon cycle over time cannot be underestimated. Even before human impacts were at all significant, for example in the period 1000-1800, carbon stores in the atmosphere increased from 180PPM to 260PPM. • Furthermore, naturally earth enters and exits periods of enhanced glacial activity and those without it (postglacial periods.) This has had a significant impact on the extent of cryospheric ice, which at times extended over most of Northern Europe, Asia and the USA annually. Since we are in a postglacial period now, melting events and glacial retreat can be expected to occur, thus shifting the GtC stored in the cryosphere into the atmosphere and hydrosphere as part of a natural process; and/or vice versa during glacial periods. • Evaluation that human activity has unequivocally increased the proportion of atmospheric carbon exponentially. At the same time, anthropogenic activity is very capable to create 'positive feedback loops' which worsen the situation. • An example of this is deforestation such as in the Amazon rainforest, where thousands of hectares of valuable carbon sink have not only been deforested but also replaced by carbon producing farms in 80% of cases. These are local changes ultimately but will have global consequences and this has created a multiplier effect, and the environmental destruction may be impossible to rectify by any natural process • Therefore, it could be argued that human activity is doing two essential things: not only making the changes more severe and rapid, but also preventing nature from 'rehealing' thus preventing the return to a dynamic equilibrium. • Conclusion could focus on the 'bigger picture' or being holistic – for example it could be stated that up until the industrial revolutions of the 1800s, natural carbon movement between stores would've been by far the dominant process, but in the last 200 years localised human activity has disrupted this delicate equilibrium within the carbon system, thus leading to irreversible feedback cycles on the global and local scales which ultimately has shifted the balance between slow and fast carbon cycles and become the dominant process. Without decisive action on reaching net zero, humans are in danger of breaching our own carbon budget, leading to severe consequences in the long-term on our planet earth. • Credit any other valid points made with reference to either natural or human factors.		
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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)	- 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!)