

a-level exam questions & answers:

water & carbon cycles (section a) >

20 mark question #1 (cryosphere change)



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) 'Current changes in glaciated, permafrost and ice sheet regions will have a global impact.' To what extent do you agree with this view?

Water & Carbon Cycles >> 3.1.1.4 >> Water, Carbon and Life on Earth

[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.

This image shows a blank 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.

writing tips & tricks:

This question relies on a very good in-depth understanding of one specific subcomponent of the course – and I reckon that it's quite hard to include necessary examples to your answers. This is where students lost most marks. I'd suggest thinking as broadly to theory as possible here and making links. I'd suggest using our [A* Example on Siberian Tundra](#) if you are struggling for facts ☺ Try to stick to the PEEL 'Point > Evidence > Explain > Link (to question)' strategy throughout your answers, making up around 4-5 short paragraphs. Make sure you leave time (around 5 mins or so) to write a short conclusion, the best of these typically include information on a future hypothesis or contextualise the question in terms of scale.

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mark scheme | 20-mark question #1

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Q.:	Sp. Ref.:	Information For Markers:	B'down:	Marks:
1)	3.1.1.2	'Current changes in glaciated, permafrost and ice sheet regions will have a global impact.' To what extent do you agree with this view? AO1 – Knowledge and understanding of processes in the water cycle and factors driving changes to stores of water. Knowledge and understanding of the concept of the cryosphere and its importance in human and environmental affairs. AO2 – Application of knowledge and understanding to be able to critically analyse, in a spatial and temporal sense, the consequences of cryospheric changes, considering both local and far-field impacts. Notes for answers AO1 - Processes in the water cycle to at least include evapotranspiration, condensation, and precipitation. - Global distribution and size of major stores of water – lithosphere, hydrosphere, cryosphere, and atmosphere. Essay responses should focus on cryospheric stores including location and / or relevant statistical evidence. - Understanding that the cryosphere comprises different locations and each locations holds a different 'form' of frozen water. These can be highland glaciated areas, ice sheets and caps (less than / greater than 50,000km²) as well as vulnerable permafrost landscapes (inundated by ice / frozen land for over 2 years) etc... - Factors driving change in the magnitude of stores and transfers in the water cycle to be both natural and increasingly anthropogenic. - Knowledge of the links between human activity, global atmospheric carbon levels rising, leading to global warming/climate change and resultant melting of cryospheric stores of water and carbon, and the consequences of this... - Reference to the concept of the carbon cycle, processes, and links to the cryosphere. 'Current changes', so any knowledge of general trends or patterns in a global or localised context of both water and carbon would be considered credit for AO1 and if successfully evaluated/explained AO2. AO2	AO1=10 AO2=10	20

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| | <ul style="list-style-type: none"> • Many answers may consider evaluation in terms of scale / time, contextualised to the question, particularly in their conclusions (see below.) • Globally, current trends are indicating a rapid and increasing shrinking of Earth's cryosphere, currently by 87,000km² (around 33,000 square miles) every year on average between 1976 and 2016. This is principally a result of climate change and increasing global temperatures which cause melting not only more frequently but for also many semi-frozen landscapes, increased periods of ice depletion. This can have numerous effects in both a socioeconomic and environmental sense, on a variety of scales. • A key implication of this question is that many local impacts can have large, widespread, and often global ramifications as they occur similarly in many locations around the world, at an increasing rate. Take glacial 'thinning' as an example. The South Col Glacier in Nepal, for example, is reducing over 80 times faster than the 2,000 years it took to form the ice, this is lost to rivers and flows out to sea. On the local, this can cause flooding and habitat loss, but combined with other cryospheric losses, is contributing sea level rise, a far more widespread impact (predicted to rise up to 1m by 2100), putting up to 410 million people at risk. • Credit relevant links between water and carbon cycles, including reference specifically to a cryospheric store, such as permafrost, in more detail, to elaborate specific dangers. Reference could be made to carbon sinks in cryosphere being flipped. • Permafrost can be found in many areas of high latitude / tundra, such as in Siberia (where it occupies almost 2/3 of the surface.) Permafrost thawing can have a dramatic impact on our planet. Likewise, locally it can destroy infrastructure built on it. Far more concerning, however, is the role of organic carbon and other greenhouse gases such as Methane (25x more powerful than carbon) which is stored in permafrost (around 1.4 GtC metric tonnes of it! – over double that in the atmosphere) This is expelled into the atmosphere, thus causing a positive feedback loop and worsening global warming... permafrost thawing etc... This is an immense global challenge which could end up making dealing with climate change far more challenging. However, there is some evidence to suggest that permafrost carbon has started to decay thus far. • Reference could be made to currently in trial technologies such as computer modelling, carbon capture etc.. as attempt through advancements to limit the damage to global stores of water in the cryosphere, as well as initiatives such as the 2015 Paris Climate Accord (ratified by 191 countries representing 97% of global emissions) to limit global warming to under 2 degrees. Evaluation could include pros/cons of programs such as this including the lack of legally binding clauses/ineffectiveness of global governance. • Credit any other valid material or evaluation to include conclusions focusing on the ultimate extent to which these impacts are global and what is achievable in terms of their mitigation. It could be argued that there is absolutely | | |
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		nothing we can do at this point, especially once carbon budgets have been exceeded, in terms of coping with these impacts. Others may suggest that we haven't yet reached a tipping point and that further study of cryospheric change can help us develop a deeper and more holistic understanding.		
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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!)