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91413



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Level 3 Earth and Space Science 2022

91413 Demonstrate understanding of processes in the ocean system

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of processes in the ocean system.	Demonstrate in-depth understanding of processes in the ocean system.	Demonstrate comprehensive understanding of processes in the ocean system.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (///). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: THERMOHALINE CIRCULATION

Thermohaline circulation, also called the Global Ocean Conveyor Belt, is the part of general oceanic circulation controlled by horizontal and vertical differences in temperature and salinity.



Adapted from: https://hchscollier.weebly.com/uploads/6/5/1/8/65182593/day_6_-_el_nino_la_nina_notes.pdf

Explain, in detail, the effects of temperature and salinity on the transport of matter and energy through thermohaline circulation.

Your answer should:

- include on the diagram above, labels where upwelling and downwelling occur
- explain the processes of upwelling and downwelling
- explain how downwelling drives thermohaline circulation
- comprehensively explain how heat energy and nutrients are transported through thermohaline circulation.

An annotated diagram may assist your answer.

Lined writing area with horizontal lines for text entry.

There is more space for your answer to this question on the following pages.



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QUESTION TWO: OCEANIC CARBON PUMPS

The ocean is important in the global carbon cycle, and is an important carbon sink.



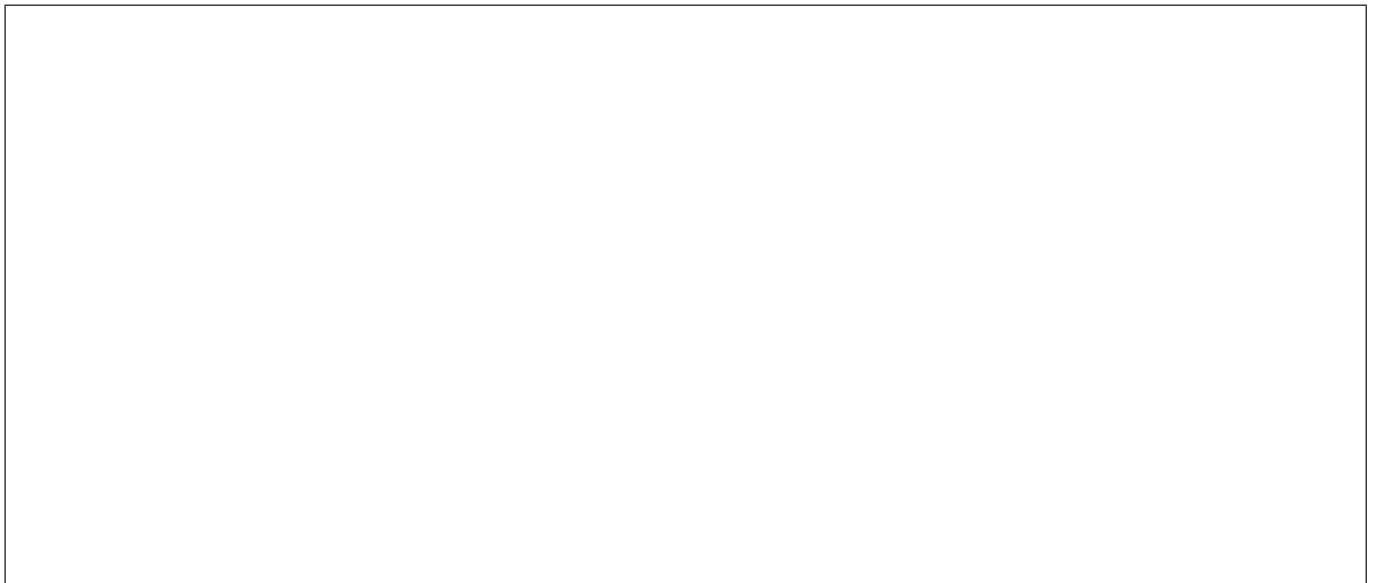
Source: <https://oceanacidificationgeog5.wordpress.com/2015/03/10/ocean-acidification/>

Explain, in detail, how carbon moves into the ocean, and how changes in atmospheric carbon dioxide impact ocean carbon chemistry.

Your answer should include:

- a detailed explanation of the biological ocean carbon pump
- an explanation of the processes involved in the physical ocean carbon pump (include equations)
- a comprehensive explanation of how the biological and physical carbon pumps may change with an increase in atmospheric carbon dioxide levels.

An annotated diagram may assist your answer.



*There is more space for
your answer to this question
on the following pages.*

QUESTION THREE: OCEAN SURFACE SALINITY**Average ocean surface salinity**

Adapted from: <https://salinity.oceansciences.org/smap-salinity.htm>

The ocean contains a large amount of salt in solution. The above map shows how the salinity of the surface layer of the ocean varies globally.

Explain, in detail, the factors that affect the global variations in surface ocean salinity.

Your answer should:

- explain the reasons why the ocean contains salt
- explain the processes that increase and decrease the salinity of the surface ocean layer
- discuss why salinity varies between the Equator, mid latitudes, and poles.

An annotated diagram may assist your answer.

Extra space if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

Lined area for student responses.



