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91413M



914135

Tuhia he (X) ki te pouaka mēnā kāore koe i tuhi kōrero ki tēnei puka

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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Te Pūtaiao ā-Nuku, ā-Tuarangi, Kaupae 3, 2023

91413M Te whakaatu māramatanga ki ngā tukanga i te pūnaha o te moana

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā tukanga i te pūnaha o te moana.	Te whakaatu māramatanga ki ngā tukanga i te pūnaha o te moana, kia hōhonu.	Te whakaatu māramatanga ki ngā tukanga i te pūnaha o te moana, kia tōtōpū.

Tirohia kia kitea ai e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOĀ kei roto i tēnei pukapuka.

Mēnā ka hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (A E Tuhia i tēnei Pukapuka). Ka poroa taua wāhanga ka mākahia ana te pukapuka.

HOATU TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TE TŪMAHI TUATAHI: TE MITINGA O TE HAUHĀ I NGĀ PITO



Te Hoahoa 1: Te horahanga o te tio i te ao mai i te tau 1979

Te mātāpuna: <https://tamino.wordpress.com/2011/01/14/monckton-skewers-truth/>

Puritia ai ki ngā au hōhonu o te moana te hauhā e whakahekea ai tōna nui i te kōhauhau. Heoi, kua heke haere te kōpaka nā runga i te āhuarangi hurihuri, ā, ka whakararu pea te kōpaka e rewa haere ana i ngā au moana e whakahaere ana i te tangohanga o te hauhā.

Whakamāramatia te hiranga o te rewanga o ngā kōpaka i te tangohanga o te hauhā i te kōhauhau.

I tō tuhinga, me whakaaroaro koe ki:

- ngā pūtaka o te au totohu (*downwelling*) i ngā pito o te ao
- te papu waro i te moana i ngā ahopae teitei
- te hiranga o te rewanga o te tio ki te kare o te moana kōpaka.

Ehara i te mea me kōrero te mātāi matū waro, te rere rānei o te au waitai e mahana ana.

Ka whai hua pea ki tō tuhinga tētahi hoahoa whai kupu tāpiri.

QUESTION ONE: CARBON DIOXIDE ABSORPTION AT THE POLES



Figure 1: Global ice area since 1979

Source: <https://tamino.wordpress.com/2011/01/14/monckton-skewers-truth/>

Deep ocean currents store carbon dioxide and reduce its concentration in the atmosphere. However, polar ice has been reducing as a result of climate change, and melting polar ice may disrupt the ocean currents that enable this removal of carbon dioxide.

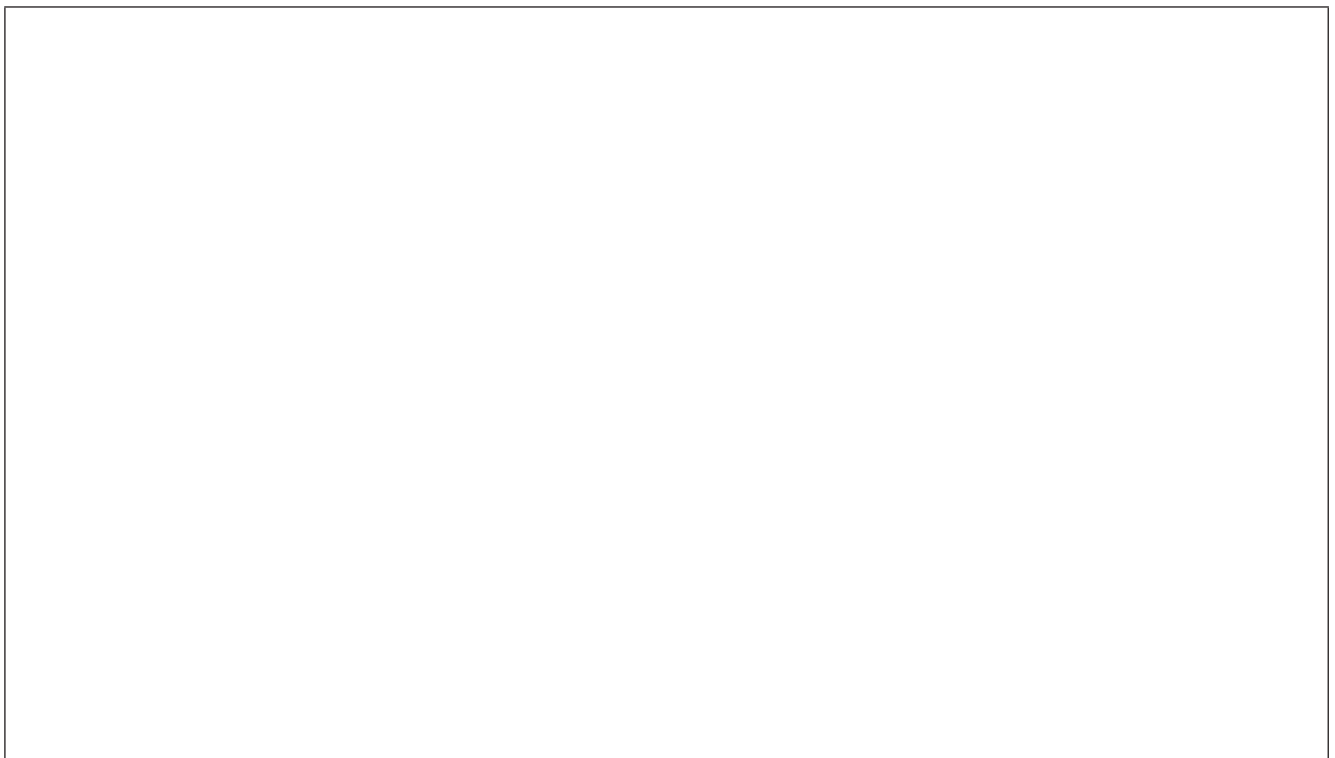
Explain the significance of melting polar ice in the removal of atmospheric carbon dioxide.

In your answer, you should consider:

- the causes of downwelling at the poles
- the physical ocean carbon pump at high latitudes
- the significance of melting ice to the polar ocean surface.

You do not need to discuss carbon chemistry or thermohaline circulation.

An annotated diagram may assist your answer.



*He wāhi anō mō tō
tuhinga mō tēnei tūmahi kei
ngā whārangi e whai ake
nei.*

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

TE TŪMAHI TUARUA: NGĀ HĪRANGI MOANA

Ka whanokē ana te mahana o te kare o te moana mō tētahi wā, kīia ai e ngā kaimātai pūtaiao he hīrangi moana. Mā ēnei tūāhuatanga e horo ai ngā nōhanga, nā te whakamānga o ngā kāoa, nā te whakamōtītanga hoki o ngā rimurehia, nā te matenga hoki o ngā ururua rimurapa, tae atu hoki ki te matenga o ētahi ika me ētahi atu momo nō te moana.



Te Hoahoa 2: Te hīrangi moana o te tau 2021–2022 i Te Whakataka-kārehu-a-Tamatea, i te pito whakatetonga-mā-uru o Aotearoa

He mea whakahāngai i: www.odt.co.nz/regions/southland/bleaching-fiordland-sea-sponges-may-be-largest-its-kind

I ngā tau tata nei, kua tau ki ngā takutai e karapoti ana i Aotearoa ētahi o ngā hīrangi moana te mutunga mai nei o te kino me te auroa kua mauhangatia, ā, i Te Whakataka-kārehu-a-Tamatea, i 6 °C te pikinga ake i te taumata teitei katoa o te paemahana kei ngā mauhanga. Tērā tonu pea i mahana te wai i te āhuarangi hurihuri me ngā āhuatanga auroa o te La Niña.

Matapakina te āhua o te whai wāhitanga pea o te āhuarangi hurihuri me te La Niña ki te piki haeretanga o te auau me te kino o ngā hīrangi moana huri noa i Aotearoa.

I tō tuhinga, me whakaaroaro koe ki:

- te āhua o te whakamahanatanga o te kare o te moana
- ngā pānga o te āhuarangi hurihuri ki te mahana o te kare o te wai
- te pānga o te La Niña ki te mahana o te kare o te wai huri noa i Aotearoa.

Ka whai hua pea ki tō tuhinga tētahi hoahoa whai kupu tāpiri.

When the surface ocean temperature is unusually high for a period of time, scientists consider this to be a marine heatwave. These events cause habitat destruction due to coral bleaching, seagrass destruction, and loss of kelp forests, as well as the death of fish and other marine species.



In recent years, the coastal waters around New Zealand have experienced some of the most extreme and persistent marine heatwaves on record, with Fiordland reaching 6 °C higher than previously recorded maximum temperatures. The warm water was likely caused by a mixture of climate change and the prolonged La Niña conditions.

In your answer, you should consider:

- how the surface layer of the ocean is heated
- the effects of climate change on surface water temperature
- the effect of La Niña on the surface water temperature around New Zealand.

An annotated diagram may assist your answer.

He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangi e whai ake nei.

*He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangi e whai ake nei.*

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

He moutere paku te Motu o Henderson, kāore e nōhia ana e te tangata, kei ngā Motu o Pitcairn, ā, kei Te Kōripo o Te Moana-nui-a-Kiwa ki te Tonga (*South Pacific Gyre*). E matapaetia ana kei ngā tuaone o Te Motu o Henderson ngā para kirihou e 38 miriona. I te moutere nei, kua kitea e ngā kairangahau he para kirihou nō Amerika ki te Tonga, nō Ahitereiria, waihoki, nō Ūropi rā anō.

Te mātāpuna: www.weforum.org/agenda/2017/05/the-untouched-south-pacific-island-choking-on-38-million-bits-of-plastic/

I tō tuhinga, me whakaaroaro koe ki:

- Ka whai hua pea ki tō tuhinga tētahi hoahoa whai kupu tāpiri.*

Henderson Island is a tiny uninhabited island in the Pitcairn Islands, and lies within the South Pacific Gyre. Beaches on Henderson Island contain an estimated 38 million items of plastic debris. On the island, researchers have found plastic rubbish from South America, Australia, and even as far away as Europe.

Source: www.weforum.org/agenda/2017/05/the-untouched-south-pacific-island-choking-on-38-million-bits-of-plastic/

In your answer, you should consider:

- how the South Pacific Gyre is formed
- how the Antarctic Circumpolar Current is formed
- how plastic debris travels thousands of kilometres from around the globe to accumulate on Henderson Island.

*He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangi e whai ake nei.*

Earth & Space Science 91413M, 2023

**He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.**

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

QUESTION
NUMBER

**He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.**

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

QUESTION
NUMBER

English translation of the wording on the front cover

Level 3 Earth & Space Science 2023

91413M Demonstrate understanding of processes in the ocean system

Credits: Four

91413M

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 2–23 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE IN THIS AREA). This area will be cut off when the booklet is marked.

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