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Tick this box if there is no writing in this booklet

Level 3 Earth and Space Science 2020

91413 Demonstrate understanding of processes in the ocean system

2.00 p.m. Wednesday 18 November 2020
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 and clearly number the question.

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

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

TOTAL

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QUESTION ONE: THE THERMOHALINE CURRENT AND CLIMATE CHANGE

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The thermohaline current is dependent on ocean temperature and salinity.

This slow-moving, deep-ocean current is crucial to the distribution of heat and nutrients.

The current begins in the Arctic and Antarctic regions.

Source: https://en.wikipedia.org/wiki/Thermohaline_circulation

Explain how the deep-ocean current is formed, AND the possible effects of climate warming on this current in the Arctic and Antarctic regions, AND the possible impact of these effects on Earth.

In your answer you should consider:

- the role of **temperature** in the formation of this current
- the role of **salinity** in the formation of this current
- **short-term** changes on this current due to climate warming
- the possible **long-term** effects of climate warming on this current AND the impact on the Earth's climate.

You may include fully annotated diagrams to help answer this question.

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

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QUESTION TWO: THE SOUTH PACIFIC GARBAGE PATCH

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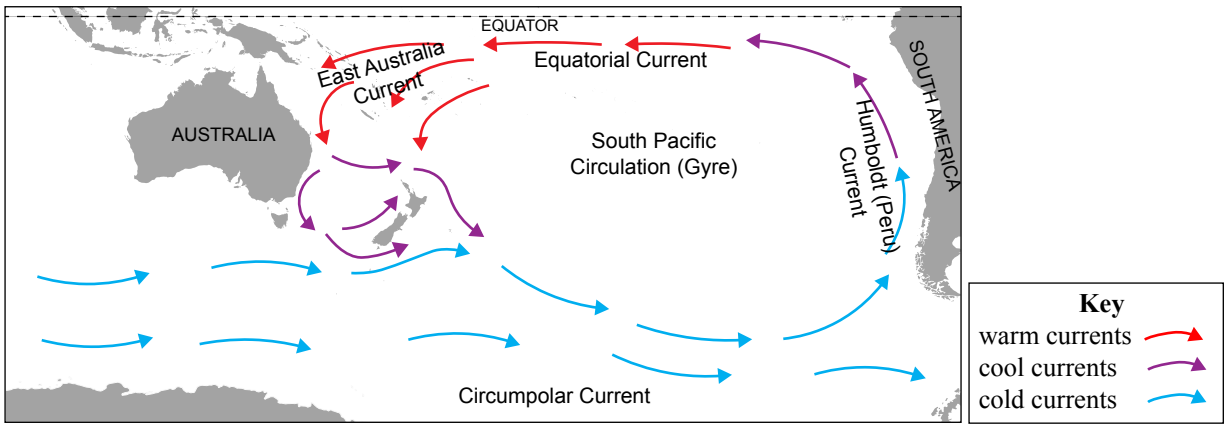
The South Pacific Garbage Patch, located in the South Pacific Gyre, covers an area of 1.6 million square kilometres in the South Pacific Ocean. A gyre is a rotating ocean current.

The Garbage Patch is made up of vast amounts of floating waste material, which includes household rubbish, plastics and microplastics.



Adapted from: http://www.seafriends.org.nz/issues/res/pk/ecology.htm and https://freevectormaps.com

Explain the ocean processes that have led to the formation of the South Pacific Gyre AND explain **why** the South Pacific Garbage Patch has formed within it.

In your answer you should consider:

- the role of wind and landmass on the formation of surface currents
- the role the Coriolis effect plays in the formation of the gyre
- why garbage and plastic have collected in this region.

You may include fully annotated diagrams to help answer this question.

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

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QUESTION THREE: THE IMPACT OF SEA LEVEL RISE ON THE PACIFIC'S LOW-LYING CORAL ATOLLS

Kiribati is a group of 33 low-lying coral atolls, lying across the Equator in the western Pacific. Most of Kiribati is at sea level, with the highest point being 1.8 metres above sea level.

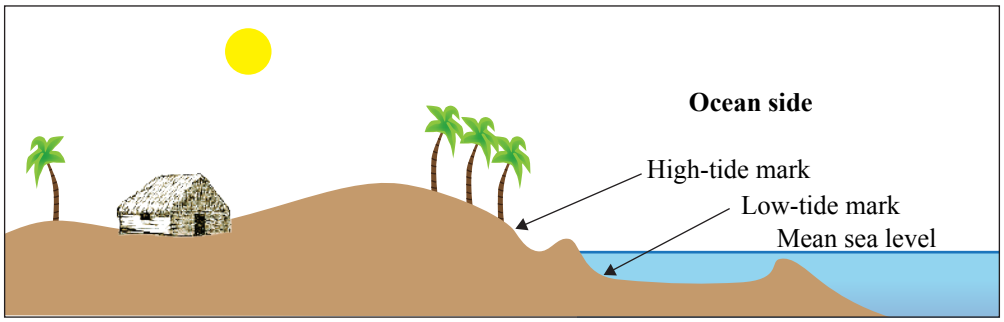
Source: https://en.wikipedia.org/wiki/Kiribati Source: www.britannica.com/place/Tarawa

The graph below shows the changes taking place in the "mean monthly sea levels" in this region since 1994, and the projected future change due to continuing climate change.

Mean monthly sea levels since 1994

Adapted from: https://tidesandcurrents.noaa.gov/sltrends/sltrends

"Mean sea level" is defined as the halfway point between the high- and low-tide marks, as shown in the diagram below.



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Explain how climate warming, AND climate events, such as La Niña, may affect the atolls of Kiribati in the future.

In your answer you should consider:

- how climate warming leads to sea-level rise
- how sea-level rise will affect tide levels
- what a La Niña event is, and how it affects ocean levels in the western Pacific Ocean
- how a combination of La Niña and climate warming may affect the atolls.

You may include a fully annotated diagram to help answer this question.

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

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

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