

91193



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## Level 2 Earth and Space Science 2021

### 91193 Demonstrate understanding of physical principles related to the Earth System

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of physical principles related to the Earth System.	Demonstrate in-depth understanding of physical principles related to the Earth System.	Demonstrate comprehensive understanding of physical principles related to the Earth 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.

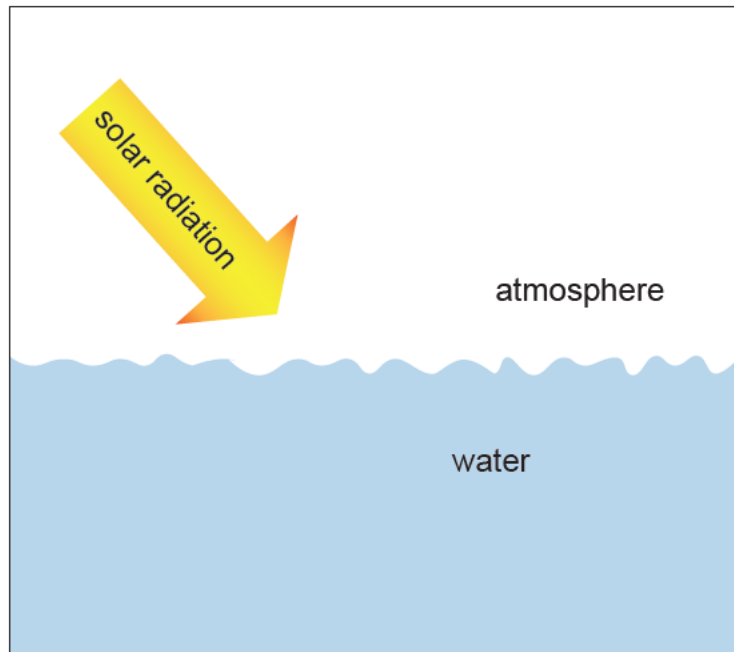
Do not write in any cross-hatched area (✂). This area may be cut off when the booklet is marked.

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

**QUESTION ONE: BLUE WATERS**

Solar radiation is emitted from the Sun in the form of electromagnetic radiation, and includes the visible spectrum.

- (a) Complete the diagram below, by drawing labelled arrows to show what can happen to solar radiation when it enters water.



- (b) Explain how different parts of the visible spectrum behave as they enter ocean water. In your answer you should refer to the colour, wavelength, and energy of the visible spectrum. *An annotated diagram may assist your explanation.*



- (c) To an observer flying over the Australian Great Barrier Reef, the ocean appears to be different shades of blue.



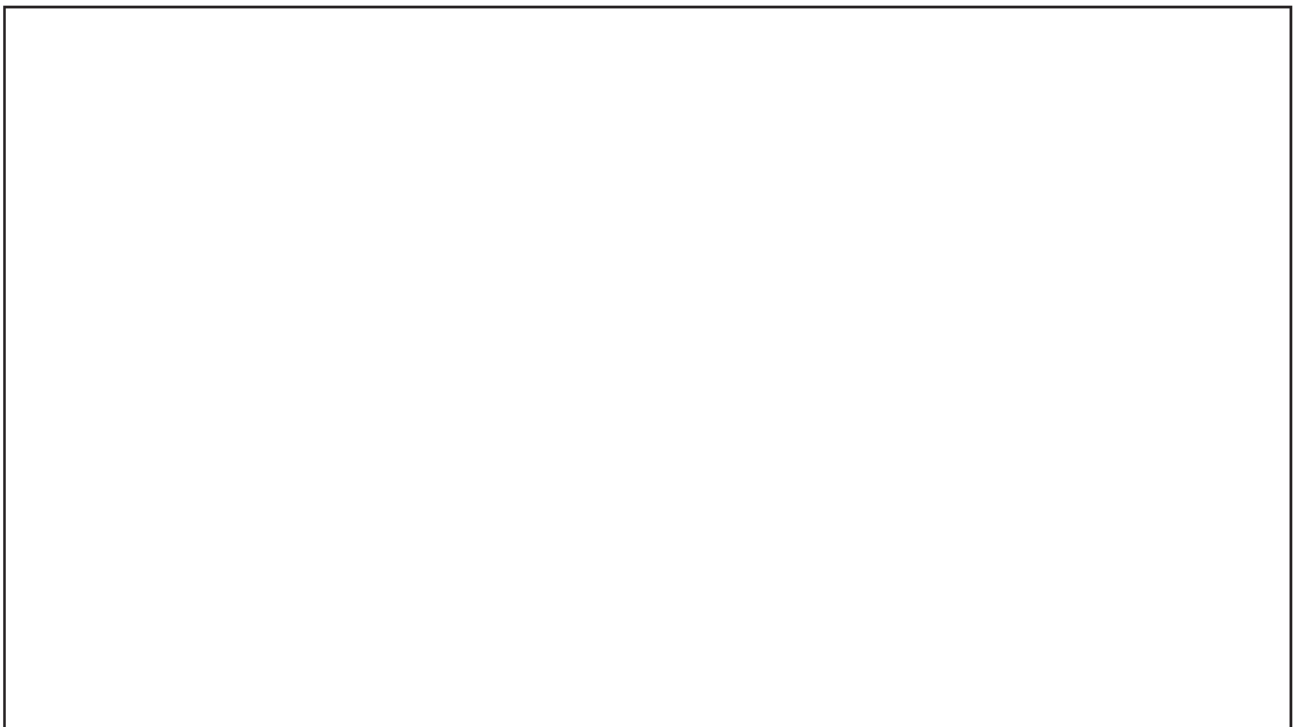
Source: [www.bookme.com.au/things-to-do/cairns-port-douglas/scenic-flight-over-the-great-barrier-reef-40-minutes-guaranteed-window-seat/164105/showReview](http://www.bookme.com.au/things-to-do/cairns-port-douglas/scenic-flight-over-the-great-barrier-reef-40-minutes-guaranteed-window-seat/164105/showReview)

Discuss why the ocean appears blue, and the possible reasons why there are different shades of blue over the Great Barrier Reef.

In your answer you should consider:

- the scattering of light
- why the ocean appears blue from above
- how shallow and deep water affects blue wavelengths.

*An annotated diagram may assist your explanation.*





**QUESTION TWO: MELTING PERMAFROST AND CLIMATE CHANGE**

Permafrost is described as ground that remains permanently frozen throughout the year. These permanently frozen grounds are typically found in high mountain areas, and at the Earth's higher latitudes, such as the Arctic Circle.



Lakes formed from permafrost melt in the Canadian Arctic.

Source: <https://e360.yale.edu/features/how-melting-permafrost-is-beginning-to-transform-the-arctic>

Climate warming has been linked to the melting of permafrost, which releases large quantities of greenhouse gases into the atmosphere.

(a) Define what is meant by a “greenhouse gas”.

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(b) Explain the energy-transfer process that warms the Earth’s atmosphere.

In your answer you should consider:

- solar radiation
- radiation emitted from the Earth’s surface
- wavelength.

*An annotated diagram may assist your explanation.*



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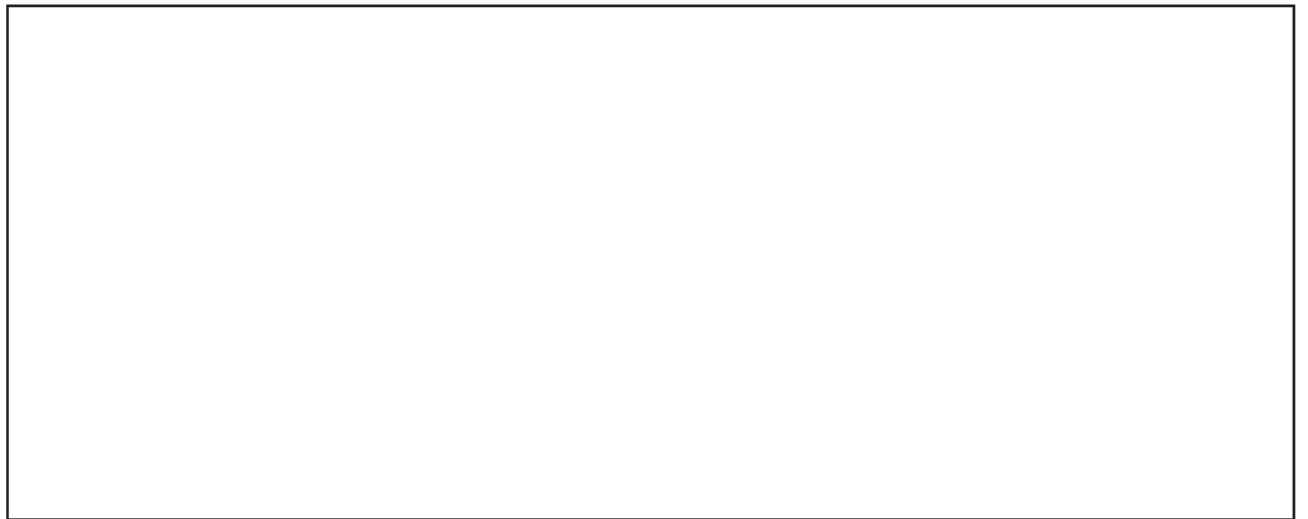
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- (c) Discuss the effect that additional greenhouse gases from melting permafrost will have on the energy processes that warm the Earth’s atmosphere.

*An annotated diagram may assist your explanation.*



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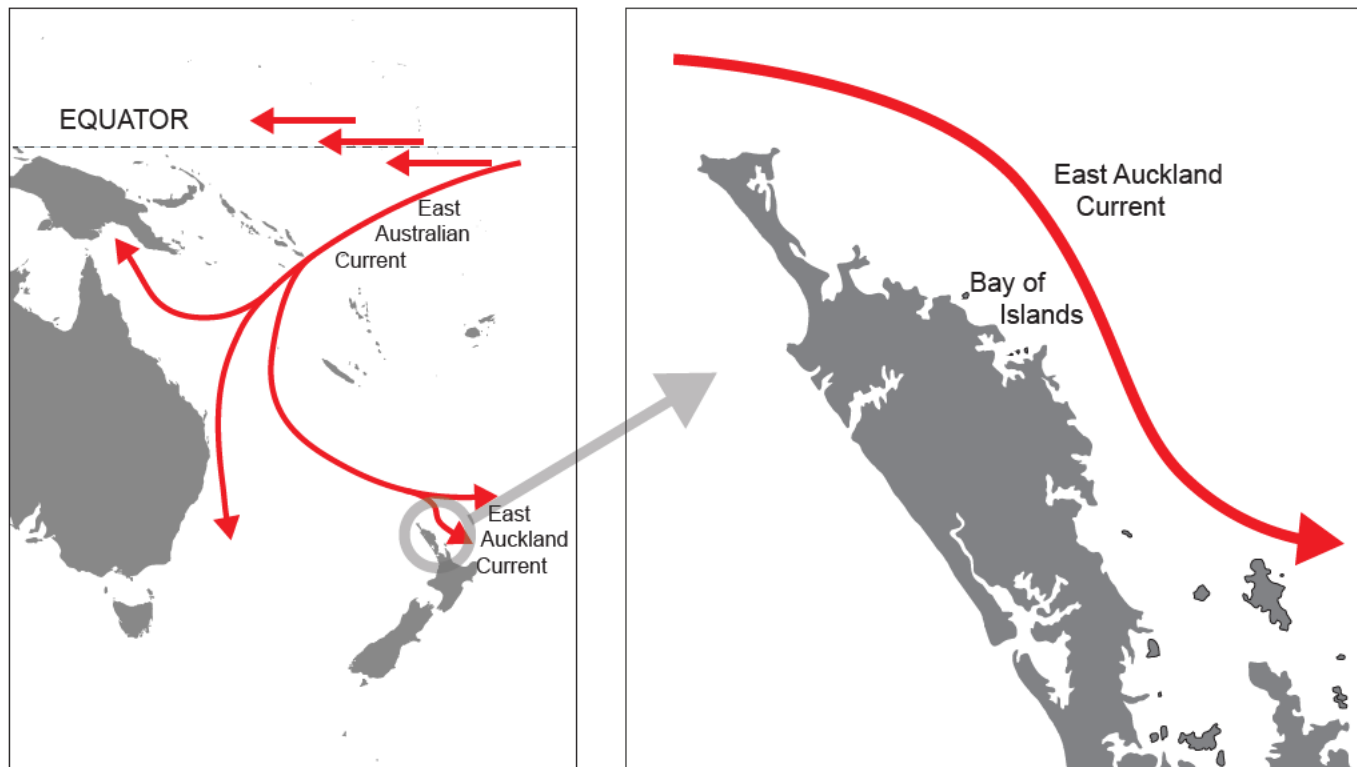




### QUESTION THREE: WINTER IN THE BAY OF ISLANDS

One of the Bay of Islands' main attractions is its warmer winters, which are influenced by the East Auckland Current.

The maps below show the origin, and flow of the warm East Auckland Current.



- (a) Name THREE factors that influence surface ocean currents.

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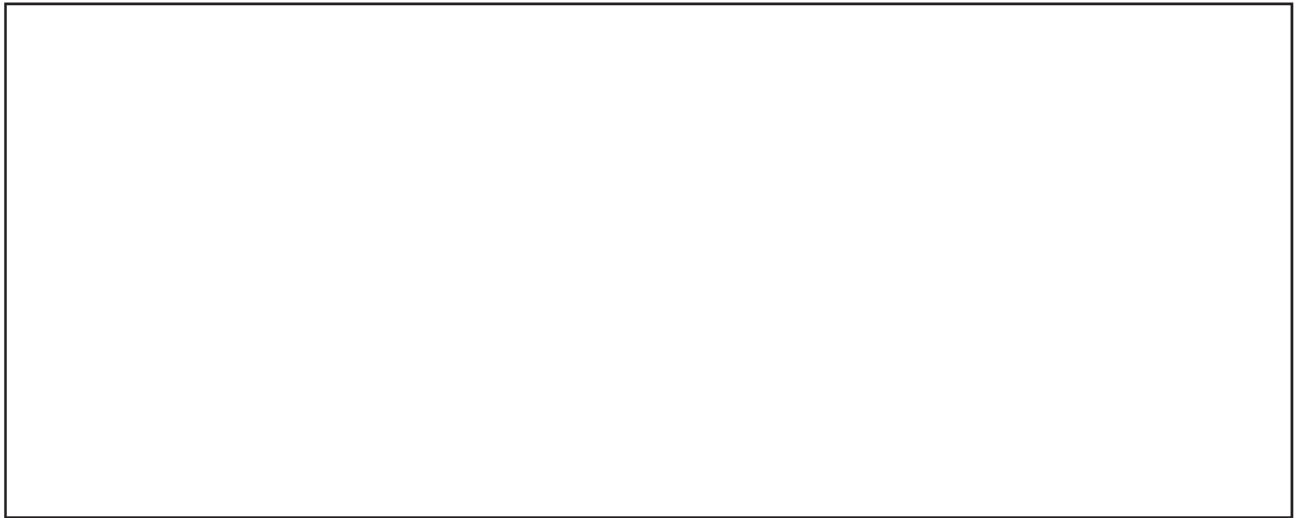
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(b) Explain why the ocean is warmer at the Equator.

*An annotated diagram may assist your explanation.*



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(c) Discuss how the East Auckland Current influences the atmospheric temperatures of the Bay of Islands.

In your answer you should consider:

- why the ocean is still warm when it has travelled so far from the Equator
- how heat is transferred from the ocean to the atmosphere.

*An annotated diagram may assist your explanation.*



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Write the question number(s) if applicable.**

QUESTION  
NUMBER

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