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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Scholarship 2014
Earth and Space Science

2.00 pm Wednesday 19 November 2014
Time allowed: Three hours
Total marks: 24

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

Resource Booklet 93104R is included in your pack..

You should answer 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 2–15 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.

Question	Mark
ONE	
TWO	
THREE	
TOTAL	/24

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QUESTION ONE: IO AND EUROPA

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Use the information provided on pages 2 and 3 of your Resource Booklet to answer this question.

Io and Europa are two of Jupiter's four Galilean moons.

Discuss in detail why Io and Europa have geologically new surfaces that are continuously being renewed.

Consider in your answer:

- the mechanism for and the role of tidal heating
- why Io has so many violent volcanoes
- why Europa's icy crust has many cracks
- how thick Europa's ocean may be compared with its icy crust.

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QUESTION TWO: POLYNYAS, NATURE'S SEA ICE FACTORIES

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Use the information provided on pages 4 and 5 of your Resource Booklet to answer this question.

Discuss in detail the global importance of coastal polynyas around Antarctica.

Consider in your answer:

- how polynyas continuously produce ice and brine
- the role of dense water in global ocean circulation and climate
- the role of polynyas in the global carbon cycle
- the impact of any reduction in sea ice production.

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QUESTION THREE: TWO LINES OF VOLCANOES AND DEEP-SEA MINING

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Use the information provided on pages 6 and 7 of your Resource Booklet to answer this question.

There is much interest in mining the metals found in sea-floor massive sulfides that have resulted from hydrothermal activity at the bottom of the ocean. The demand for mineral resources is increasing because such metals are used in electronic products like smart phones, solar panels, and hybrid cars. However, these vents are also home to unique ecosystems about which very little is known.

(a) Compare and contrast the formation of the Louisville Seamount Chain and Kermadec Arc lines of volcanoes, considering which is most likely to have usable amounts of sea-floor massive sulfides.

(b) Justify whether the sea-floor massive sulfides being deposited by the black smokers could be considered a renewable resource or not.

(c) What are the implications of using sea-floor massive sulfides as a resource?

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

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