

91429R



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD  
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

## Level 3 Geography 2022

**91429 Demonstrate understanding of a given environment(s) through selection and application of geographic concepts and skills**

Credits: Four

### RESOURCE BOOKLET

Refer to this booklet to answer the questions for Geography 91429.

Check that this booklet has pages 2–9 in the correct order and that none of these pages is blank.

**YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.**

## **Relevant geographic concepts**

### **Environments**

May be natural and/or cultural. They have particular characteristics and features, which can be the result of natural and/or cultural processes. The particular characteristics of an environment may be similar to and/or different from another. A cultural environment includes people and/or the built environment.

### **Perspectives**

Ways of seeing the world that help explain differences in decisions about, responses to, and interactions with environments. Perspectives are bodies of thought, theories, or worldviews that shape people's values and have built up over time. They involve people's *perceptions* (how they view and interpret environments) and *viewpoints* (what they think) about geographic issues. Perceptions and viewpoints are influenced by people's *values* (deeply held beliefs about what is important or desirable).

### **Processes**

A sequence of actions, natural and/or cultural, that shape and change environments, places, and societies. Some examples of geographic processes include erosion, migration, desertification, and globalisation.

### **Patterns**

May be spatial (the arrangement of features on the Earth's surface) or temporal (how characteristics differ over time in recognisable ways).

### **Interaction**

Involves elements of an environment affecting each other and being linked together. Interaction incorporates movement, flows, connections, links, and interrelationships, which work together and may be one- or two-way interactions. Landscapes are the visible outcome of interactions. Interaction can bring about environmental change.

### **Change**

Involves any alteration to the natural or cultural environment. Change can be spatial and/or temporal. Change is a normal process in both natural and cultural environments. It occurs at varying rates, at different times, and in different places. Some changes are predictable, recurrent, or cyclic, while others are unpredictable or erratic. Change can bring about further change.

### **Sustainability**

Involves adopting ways of thinking and behaving that allow individuals, groups, and societies to meet their needs and aspirations without preventing future generations from meeting theirs. Sustainable interaction with the environment may be achieved by preventing, limiting, minimising, or correcting environmental damage to water, air, and soil, as well as considering ecosystems and problems related to waste, noise, and visual pollution.

## LITHIUM EXTRACTION IN BOLIVIA

### RESOURCE A: Bolivia

Bolivia has a population of 11 million people. It is the fifth largest country in South America, with an area of 1,098,581 km<sup>2</sup>.

Among the country's most valuable assets are its mineral deposits such as lithium found in the Salar de Uyuni (Uyuni salt flat), hydrocarbons (petroleum and natural gas), and its natural resources such as soybeans and Brazil nuts. Its economic development has been limited by high production costs and lack of investment due, in part, to being landlocked. Average per capita income is low, and Bolivia remains one of the poorest countries in South America.



### RESOURCE B: Salar de Uyuni (Uyuni salt flat), Bolivia



Salar de Uyuni is the world's largest salt flat, at over 10,000 square kilometres in area, with lithium sitting just a few centimetres below the surface.

The Salar de Uyuni is near the town of Uyuni in southwest Bolivia, near the crest of the Andes.

The salt flat of Uyuni is speculated to have formed after a huge prehistoric lake, called Lake Minchin, dried up over 40,000 years ago. It is covered by a few metres of salt crust, which has an extraordinary flatness, with the average elevation variation within one metre over the entire area of the Salar. The crust serves as a source of salt and covers a pool of brine (concentrated salt water), which is exceptionally rich in lithium.

**RESOURCE C: Size and location of the Salar de Uyuni****RESOURCE D: Lithium – the ‘green fossil fuel’?**

Lithium, the so-called “white petroleum”, drives much of the modern world.



The Bolivian government claims that it has 70% of the world’s lithium reserves, attracting the interest of many international companies. Supplying a raw material needed to develop the electric car industry will help to reduce reliance on fossil fuels, and could provide a much-needed economic boost for one of South America’s poorest countries.

**RESOURCE E: Lithium abundance in Bolivia**

Lithium can be found in rock and in salt flats, but extracting lithium out of brine (concentrated salt water) at a salt flat is cheaper and more energy-efficient than mining it out of rock.



**RESOURCE F: Climate characteristics of Salar de Uyuni and surrounding region**



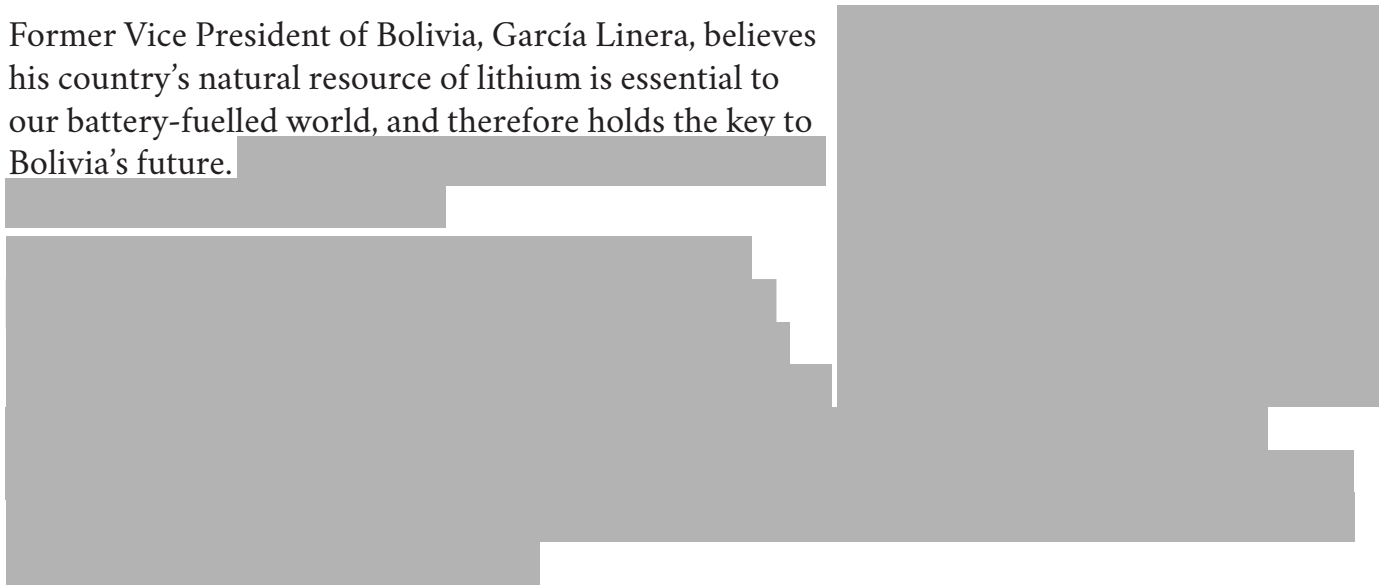
**Figure 1:** Climate classification map for Bolivia




**Figure 2:** Average rainfall graph for Uyuni town

**RESOURCE G: The white gold rush – lithium extraction in Salar de Uyuni**

Former Vice President of Bolivia, García Linera, believes his country's natural resource of lithium is essential to our battery-fuelled world, and therefore holds the key to Bolivia's future.



The lithium processing plant officials have acknowledged that there are few jobs for unskilled workers in lithium processing. Young people are advised to go to universities and come back with degrees in order to become employed.

**RESOURCE H: Tourism in Salar de Uyuni**

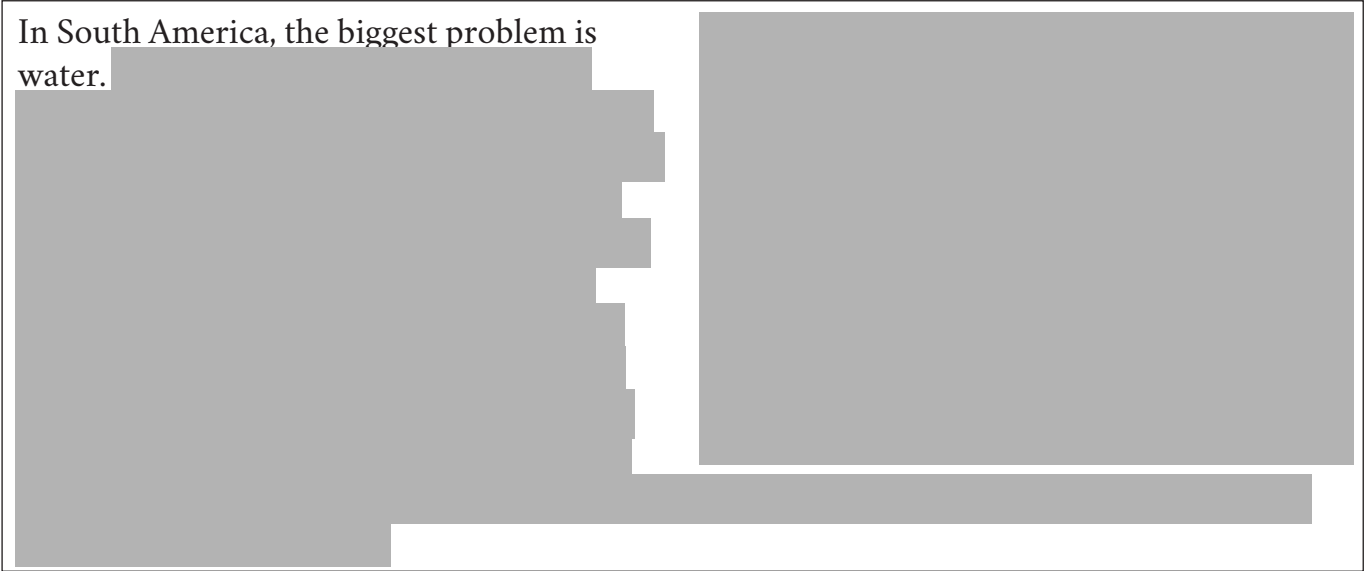
Tourism is an emerging industry in Bolivia and is the fourth most important activity in the country.



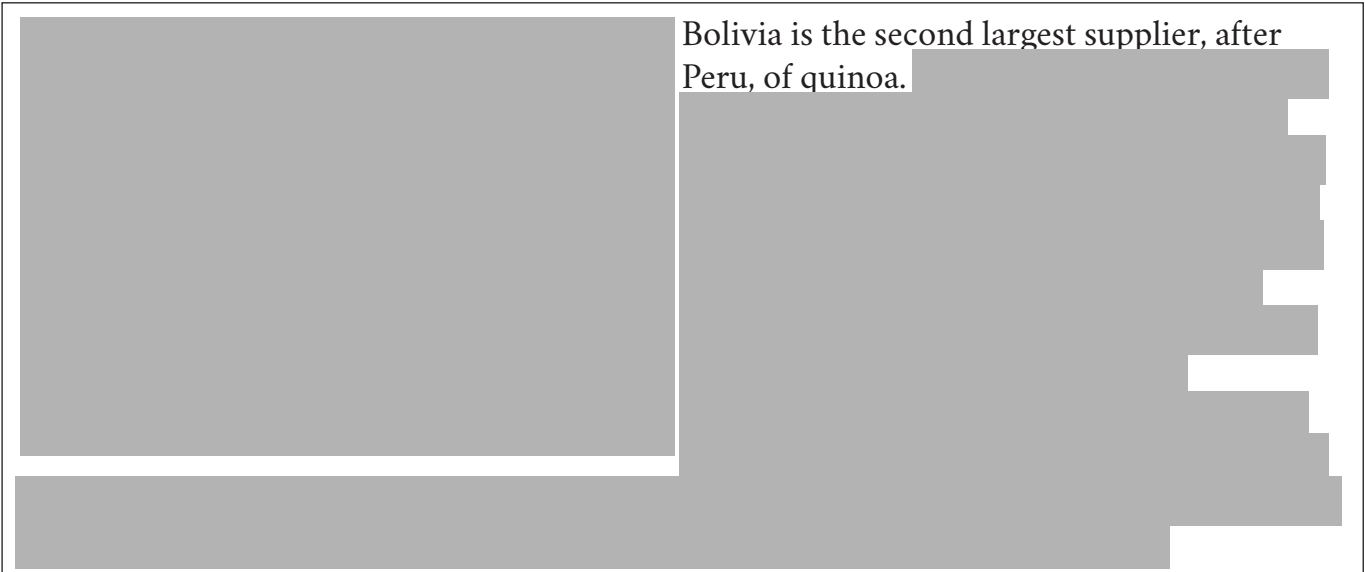
**RESOURCE I: The environmental cost of our lithium battery addiction**

As the world scrambles to replace fossil fuels with clean energy, the environmental impact of finding all the lithium required to enable that transformation could become a serious issue in its own right.

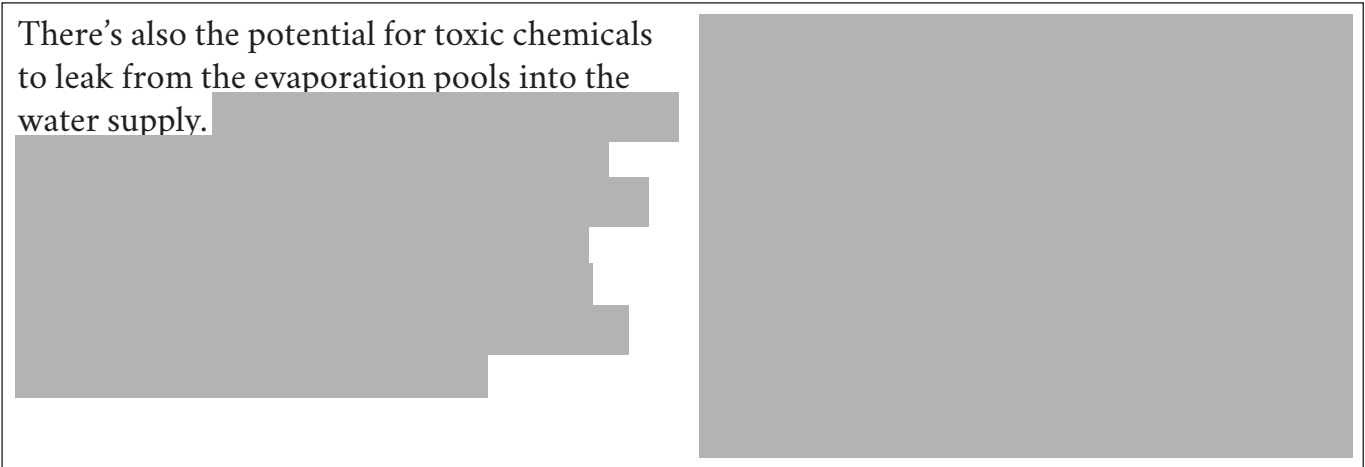
In South America, the biggest problem is water.



Bolivia is the second largest supplier, after Peru, of quinoa.



There's also the potential for toxic chemicals to leak from the evaporation pools into the water supply.





**Acknowledgements**

Material from the following sources has been adapted for use in this assessment:

**Resource A**

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<https://www.britannica.com/place/Bolivia/Languages-and-religion#ref21686>  
<https://en.wikipedia.org/wiki/Bolivia>

**Resource B**

[https://en.wikipedia.org/wiki/Salar\\_de\\_Uyuni](https://en.wikipedia.org/wiki/Salar_de_Uyuni)  
<https://www.enjoyuyuni.com/es/tours/>  
<https://www.exoticca.com/us/blog/bolivias-magical-salt-flats/>

**Resource C**

[https://www.researchgate.net/figure/Map-of-the-study-area-southwest-of-the-Bolivian-Altiplano-Location-of-the-studied\\_fig1\\_310513152](https://www.researchgate.net/figure/Map-of-the-study-area-southwest-of-the-Bolivian-Altiplano-Location-of-the-studied_fig1_310513152)

**Resource D**

<https://www.theguardian.com/technology/2016/mar/23/battery-lithium-south-america-chile-argentina-bolivia>  
<https://www.solar.com/learn/how-green-are-home-batteries-the-environmental-impact-of-lithium-ion/>  
<https://www.newscientist.com/article/mg22830430-300-lithium-dreams-the-surreal-landscapes-where-batteries-are-born/>  
<https://www.theguardian.com/sustainable-business/2017/jan/17/white-gold-companies-search-lithium-bolivia>  
<https://www.nationalgeographic.com/magazine/2019/02/lithium-is-fueling-technology-today-at-what-cost/>  
<https://www.humanrightspulse.com/mastercontentblog/bolivian-indigenous-people-lose-out-on-lithium>  
<https://www.visualcapitalist.com/lithium-fuel-green-revolution/>

**Resource E**

<https://www.newscientist.com/article/mg22830430-300-lithium-dreams-the-surreal-landscapes-where-batteries-are-born/>  
<https://www.nationalgeographic.com/magazine/2019/02/lithium-is-fueling-technology-today-at-what-cost/>

**Resource F**

[https://en.wikipedia.org/wiki/Bolivia#/media/File:Koppen-Geiger\\_Map\\_BOL\\_present.svg](https://en.wikipedia.org/wiki/Bolivia#/media/File:Koppen-Geiger_Map_BOL_present.svg)  
<https://www.worldweatheronline.com/uyuni-weather-averages/potosi/bo.aspx>

**Resource G**

<https://www.nationalgeographic.com/magazine/2019/02/lithium-is-fueling-technology-today-at-what-cost/>

**Resource H**

<https://bolivianthoughts.com/2014/06/29/in-bolivia-one-million-people-live-from-tourism/>  
<https://www.theguardian.com/technology/2016/mar/23/battery-lithium-south-america-chile-argentina-bolivia>  
<https://www.theguardian.com/sustainable-business/2017/jan/17/white-gold-companies-search-lithium-bolivia>

**Resource I**

<https://www.wired.co.uk/article/lithium-batteries-environment-impact>  
<https://www.nationalgeographic.com/magazine/2019/02/lithium-is-fueling-technology-today-at-what-cost/>  
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