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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Biology, 2009

90717 Describe processes and patterns of evolution

Credits: Three
2.00 pm Thursday 19 November 2009

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 answer ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 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.

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe processes and patterns of evolution. ☐	Describe processes and explain patterns of evolution. ☐	Describe processes and discuss patterns of evolution. ☐
Overall Level of Performance ☐		

You are advised to spend 40 minutes answering the questions in this booklet.

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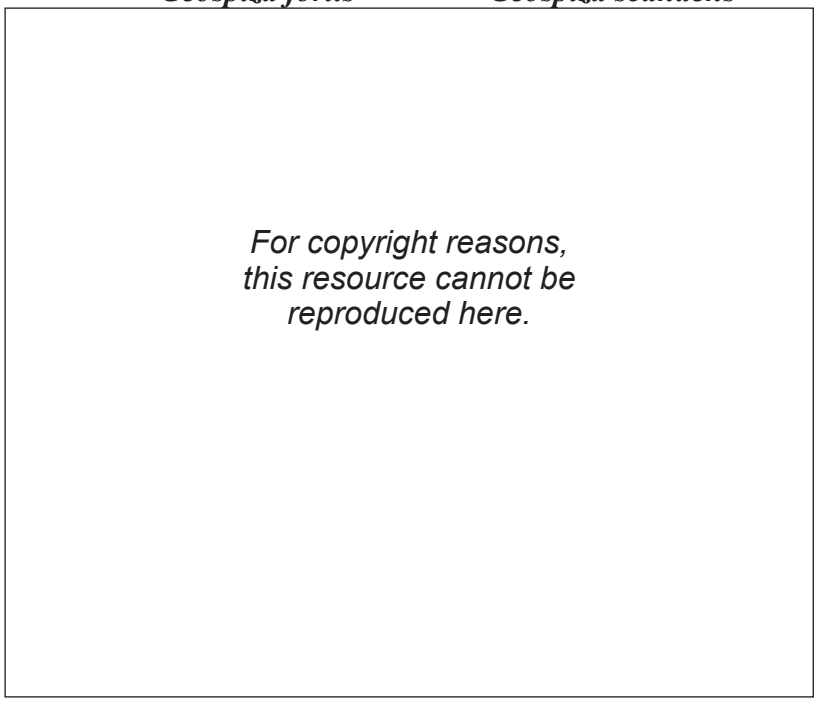
QUESTION ONE

Finches on one of the Galapagos Islands have been studied since 1973. Each year all birds on the island are (re)captured and identified, when they are measured and data collected on body size, beak size, and beak shape. The graphs below show changes in beak size and shape in the species *Geospiza fortis* (B, C) and *Geospiza scandens* (E, F). **Note** that the *y*-axis scales for each of the two species are different.

Geospiza fortis ***Geospiza scandens***



From: P.R.Grant & B.R.Grant, 'Unpredictable evolution in a 30-year study of Darwin's finches', *Science*, 296 (2002), pp 707–711.

Over the first 30 years of the study, there was no overall change in beak size for *Geospiza fortis*, but their beak shape became more pointed. During the same period, in *Geospiza scandens*, beak size trended downwards over time, and beak shape became more blunt.

Climate on the island is unpredictable, with weather patterns having significant impact on food availability. There was a severe drought in the mid-1970s (indicated with the grey arrows on the graphs) that killed many plants on the island. **Both species of finch rely primarily on seeds for food**.

(a) Describe the pattern(s) of natural selection operating on each of these species of finch.

(b) Discuss the causes of any long-term evolutionary changes that have occurred in the two species of finch.

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In your answer you should consider:

- the impact of competition on finch evolution
- the role of environmental changes
- a possible impact of prolonged drought on the finch populations.

QUESTION TWO

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Giant petrels are found throughout the Southern Ocean. There are two closely related species of giant petrel, *Macronectes halli* and *M. giganteus*. They breed sympatrically on a number of sub-Antarctic islands.

The two species are very similar in appearance and behaviour, with no obvious differences in courtship and mating behaviour.
Macronectes halli females begin laying eggs about six weeks before *M. giganteus* females. Some inter-specific pairs successfully mate and produce young.

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http://icestories.exploratorium.edu/dispatches/avian-island-in-pictures/

Identify and discuss the reproductive isolating mechanism separating these two species.

In your answer you should consider:

- timing of breeding
- the evolutionary significance of any differences in timing of breeding
- presence or absence of other reproductive isolating mechanisms.

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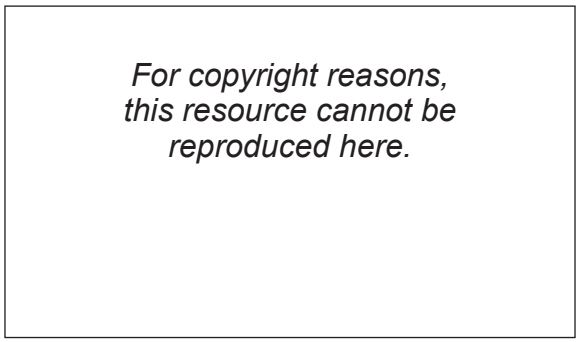
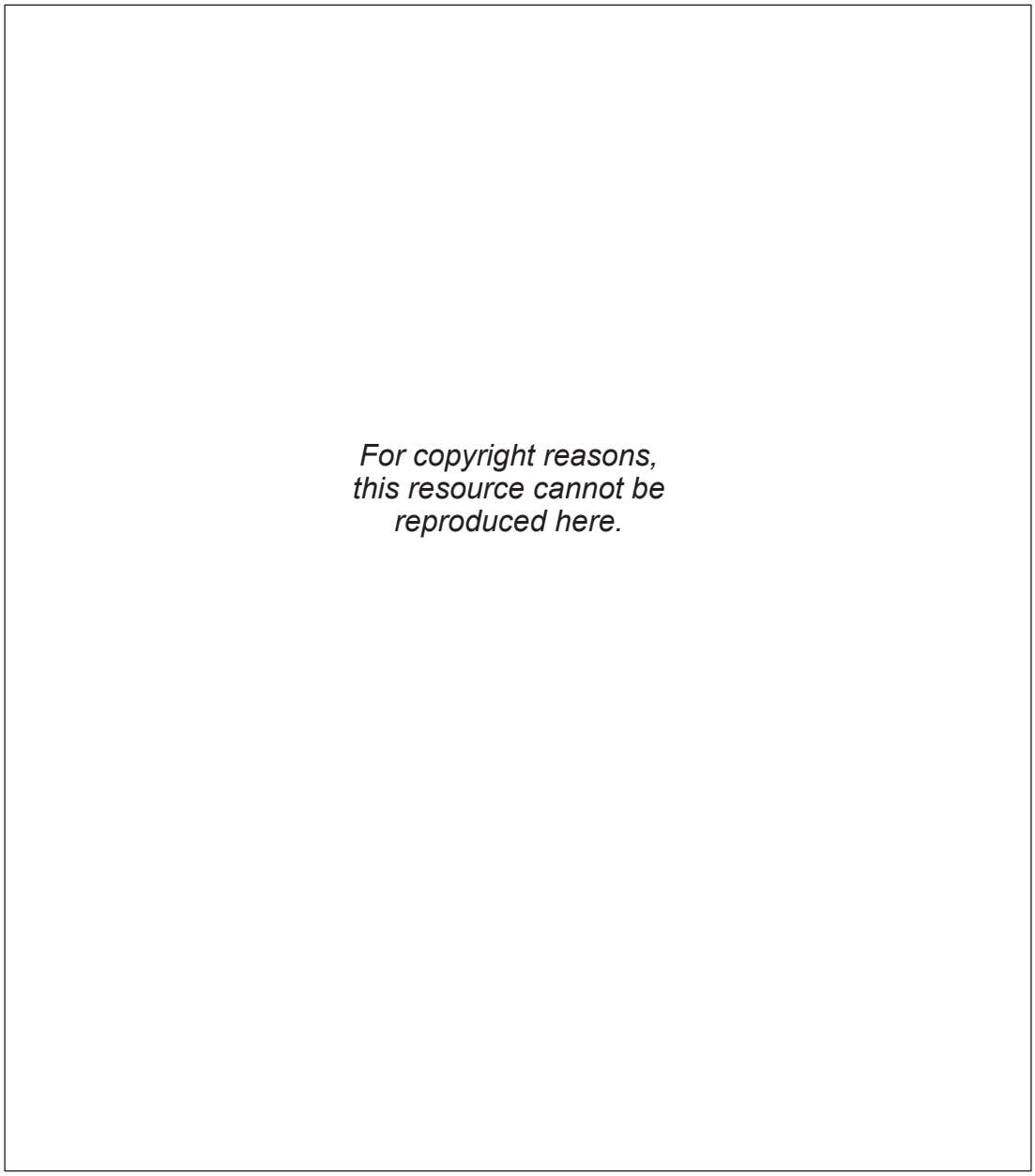
QUESTION THREE

Molecular techniques have been used to determine relationships among New Zealand geckos, and between New Zealand geckos and those found in Australia and New Caledonia.



http://www.nhc.net.nz/index/lizards-new-zealand/Northland-green-gecko

The results of this research are shown in the following phylogenetic tree, where branch lengths are proportional to the amount of genetic change allowing dating.



Adapted from: Gibbs, G., *Ghosts of Gondwana* (Nelson: Craig Potton Publishing, 2006), p. 160.

Discuss the pattern of evolution in geckos, and the factors that have affected gecko evolution **in New Zealand**.

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In your answer, consider:

- the cause and effect of climate changes
- the cause and effect of geological changes
- the role of isolating mechanisms and natural selection.

Extra paper for continuation of answers if required.
Clearly number the question.

Assessor's use only

Question number