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90717

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Biology, 2004

90717 Describe patterns of evolution

Credits: Two
9.30 am Thursday 25 November 2004

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 pages provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–7 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.

Achievement Criteria *For Assessor's use only*		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe biological concepts and processes relating to patterns of evolution.	Explain biological concepts and processes relating to patterns of evolution.	Discuss biological concepts and processes relating to patterns of evolution.
Overall Level of Performance		

You are advised to spend 30 minutes answering the questions in this booklet.

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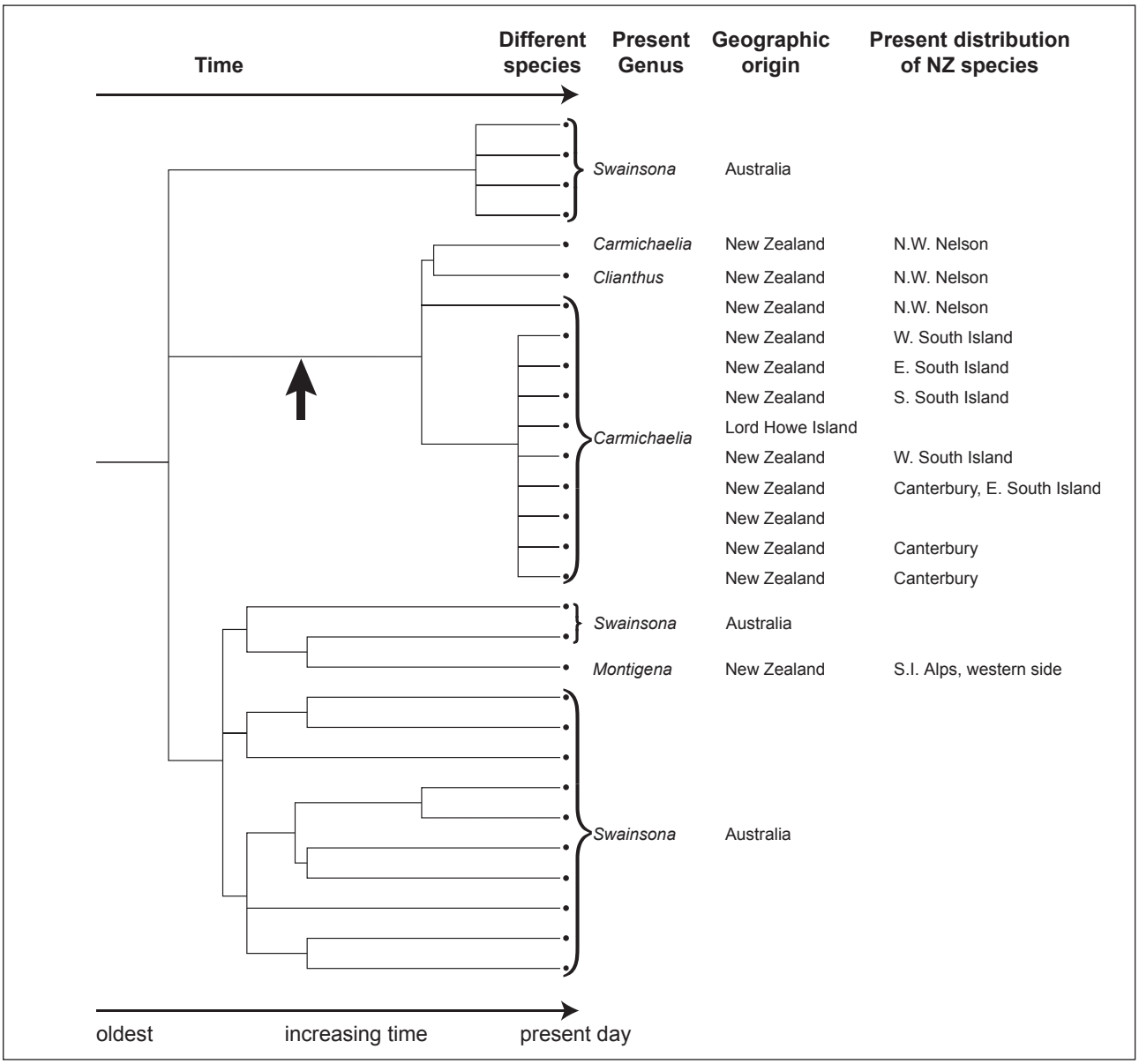
QUESTION ONE

There is a group of legumes that has a large number of species endemic to New Zealand. The New Zealand representatives show patterns of evolution similar to other plant groups found here. This group includes:

- a large group commonly referred to as native brooms (genus *Carmichaelia*) which show features such as no leaves at maturity, flattened photosynthetic stems and well developed xeromorphic wood anatomy: these features are associated with drought and cold
- our rare kakabeak (genus *Clianthus*) which grows in a rocky habitat but is not xeromorphic (adapted for very dry conditions). As a mature plant, it has leaves similar to a large-leaved dwarf kowhai but with bright red flowers
- a succulent rosette plant with its own genus, *Montigena*, found only on the scree slopes of the Southern Alps
- another group of mimosa-leaved plants found in many parts of Australia (genus *Swainsona*).

An evolutionary pattern for these plants, showing their present distribution, follows.



based on diagram p.1357, *American Journal of Botany*, Vol. 86 (9) 1999

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(a) Describe the evolutionary pattern shown by this group of plants.

(b) There are aspects of this pattern that support the idea of Punctuated Equilibrium. Explain how the pattern shown supports the idea of Punctuated Equilibrium. You may draw additions on the diagram of the pattern and refer to these additions in your answer.

(c) The species that developed from the point indicated by the bold arrow on the diagram on page 2, occur or originated in New Zealand. All of the species of *Carmichaelia*, except two, show little genetic variation yet are morphologically different enough to be separate species. Discuss how the pattern shown by the New Zealand plants from the arrow developed and compare it to the pattern shown by the rest of the group.

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(d) One species of *Carmichaelia,* (*C. exsul*), has recently dispersed from New Zealand to Lord Howe Island. This is a volcanic island that emerged from the sea nearly half-way between the northern tip of New Zealand and Australia about 6 million years ago. Prevailing wind and water currents from Australia to New Zealand during this time suggest this is an unusual dispersion. Explain how the ancestor of *Carmichaelia exsul* could have dispersed to Lord Howe Island and become established there.

(e) Some of the *Carmichaelia* species show polyploidy. Explain how polyploidy can result in speciation.

QUESTION TWO

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Tree weta are large robust flightless insects. Many species are found throughout New Zealand. Some of these species cannot be easily distinguished by comparing their anatomy or habitat, yet they have different chromosomes, and hybrids between these species do not breed. Two such species live on Banks Peninsula in the South Island. They are the Canterbury tree weta (*Hemideina femorata*) and the rare Banks Peninsula tree weta (*Hemideina ricta*).They do differ in the number of stridulatory ridges that they have on their abdomen to produce characteristic sounds or song. *H. ricta* have more than 20 (total for both sides of the body) and *H. femorata* have less than 16 (total for both sides of the body).

(a) Discuss how this information can be used to justify why groups of tree weta that appear to be similar are considered to be different species.

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

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Question number