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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Biology, 2007

90717 Describe processes and patterns of evolution

Credits: Three
9.30 am Tuesday 27 November 2007

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 2–10 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: PATTERNS OF EVOLUTION

Nectar bats feed on the nectar from flowers. One species of nectar bat, *Anoura fistulata*, can extend its tongue more than 80 mm (see below). This is more than twice the tongue length in other species of nectar bat.

The nectar bat *Anoura fistulata*, extending its tongue.

After N. Muchala (2006) Nectar bat stows huge tongue in its ribcage *Nature* 444: 701–702

Anoura fistulata feeding.

http://www.newscientist.com/data/images/ns/cms/dn10721/dn10721-2_742.jpg

(a) Name and describe the **pattern of evolution** shown by the relationship between this nectar bat and its food plant.

_____

_____

(b) Explain the role of **natural selection** in the evolution of the features shown by the bat and its food plant.

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There are many endemic species of cockroach (genus *Celatoblatta*) in the South Island (below), which have undergone adaptive radiation over the last 6 million years. During this time, the region was first warm and wet, and then heavily glaciated during the last ice age (see diagram bottom of this page).

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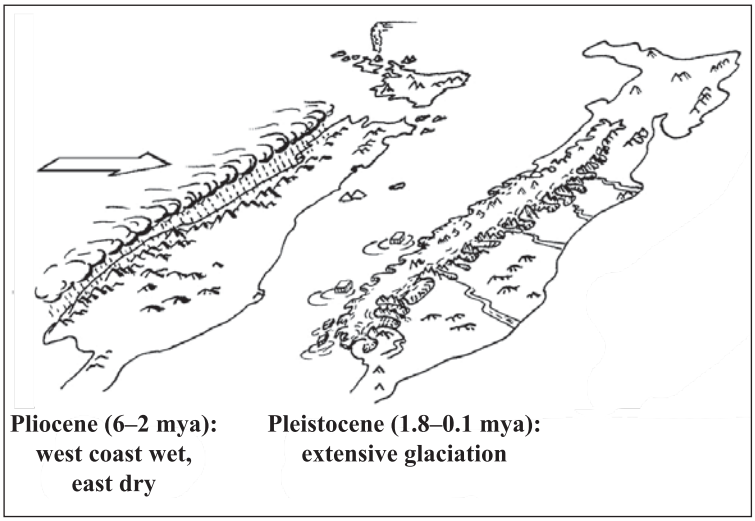
Phylogenetic tree for South Island cockroaches (*Celatoblatta* spp.)
W. Chin & N. Gemmell (2004) *Molecular Ecology* 13:1507–1518



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Locations of *Celatoblatta* species in the South Island
adapted from W. Chin & N. Gemmell (2004) *Molecular Ecology* 13:1507–1518

(c) Discuss how **geological history** has affected the adaptive radiation and distribution of *Celatoblatta* species in the South Island.

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(d) The phylogenetic tree suggests that there are two distinct populations of *C. montana* on Mt Taylor (in the Central region).

Explain the significance of these two populations.

QUESTION TWO: PROCESSES OF EVOLUTION

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Plants in the genus *Libertia* are found throughout New Zealand, Australia, and South America. The table below shows the chromosome numbers for several of these species.

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en.wikipedia.org/wiki/Libertia

Chromosome number for different *Libertia* species.

Location	*Libertia* species	Diploid chromosome number
New Zealand	*L. puchella*	38
	L. grandiflora	114
	L. peregrinans (except from inland Nelson)	114
	L. peregrinans (inland Nelson)	171
	Artificial hybrids between *ixioides* and *grandiflora*	171
	L. ixioides	228
Australia	*L. puchella* (Tasmania)	38
	L. paniculata	76
South America	*L. caerulescens*	38
	L. formosa (Chile)	76

D. J. Blanchon, B. G. Murray, & J. E. Braggins (2000) Chromosome numbers in the genus *Libertia* (Iridaceae). *NZ J. Bot.* 38: 245–250

(a) Use the information from the table to describe how these different *Libertia* species have evolved.

The diploid number of chromosomes in ancestral *Libertia* is 38.

(b) Explain how *L. paniculata* (2n = 76) could have evolved from *L. puchella*.

L. peregrinans, from **inland Nelson**, has a different chromosome number, and is different in appearance, from other populations of this species.

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(c) Explain how this inland Nelson population could have evolved, AND give evidence from the table on the opposite page to support your answer.

Note that Question Two continues on the next page.

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African indigobirds lay their eggs in the nests of various species of finch. Indigobirds are very selective in host choice. There are many species of finch in the area, but each indigobird species has a particular finch host. Indigobird nestlings are reared with the host young and learn their songs. Adult male indigobirds mimic the song of their host species. Adult females use these songs to choose breeding partners and also to choose the nests in which the females lay their eggs.

Taxonomic relationships of indigobirds and their estrilid finch hosts.

Sorenson *et al.* (2003) Speciation by host switch in brood parasitic indigobirds. *Nature* **424**: 928–931

ww.bu.edu/research/ graphics/spotlight/bird.jpg

(d) Explain how the data in the above diagram support the statement that "*indigobird evolution shows adaptive radiation and punctuated equilibrium*".

(e) Indigobird speciation appears to be sympatric.

Discuss how new indigobird species could evolve. You should include the role of song and other isolating mechanisms in your answer.

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

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Question number	

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