

External assessment 2023

Question and response book

Biology

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.





Section 1 (43 marks)

- 9 short response questions
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School code

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Section 1

Instructions

- If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
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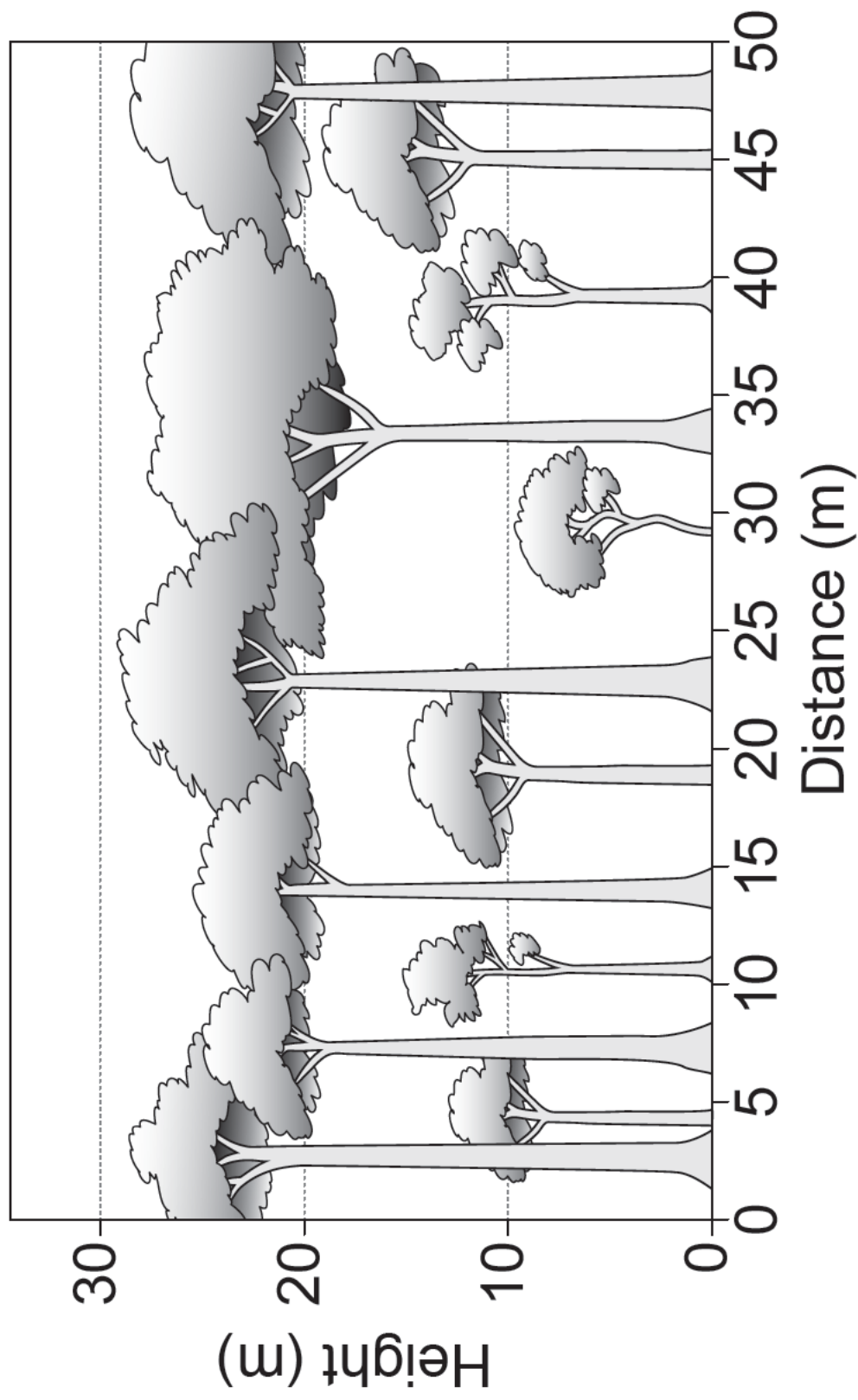
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Question 1 (6 marks)

The profile diagram shows a representative section of an ecosystem.



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This table can be used to classify ecosystems based on Specht's classification system.

Foliage cover of tallest plant layer			
Life form and height of tallest stratum	Dense (70–100%)	Mid-dense (30–70%)	Sparse (10–30%)
Trees >30 m	Tall closed-forest	Tall open-forest	Tall woodland
Trees 10–30 m	Closed-forest	Open-forest	Woodland
Trees 5–10 m	Low closed-forest	Low open-forest	Low woodland
Shrubs 2–8 m	Closed-scrub	Open-scrub	Tall shrubland

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a) Classify the ecosystem on page 2. [1 mark]

b) Describe how field data could be collected for the purpose of classifying this ecosystem using Specht's classification system. Include at least one strategy to minimise bias. [3 marks]

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c) Explain how Specht's classification system could be used to monitor how the ecosystem recovers after a logging event that removes 80% of trees from the tallest plant layer. [2 marks]

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Question 2 (4 marks)

The diagram shows feeding relationships for an Australian ecosystem.

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a) Use the data to explain why dingoes are a keystone species. [2 marks]

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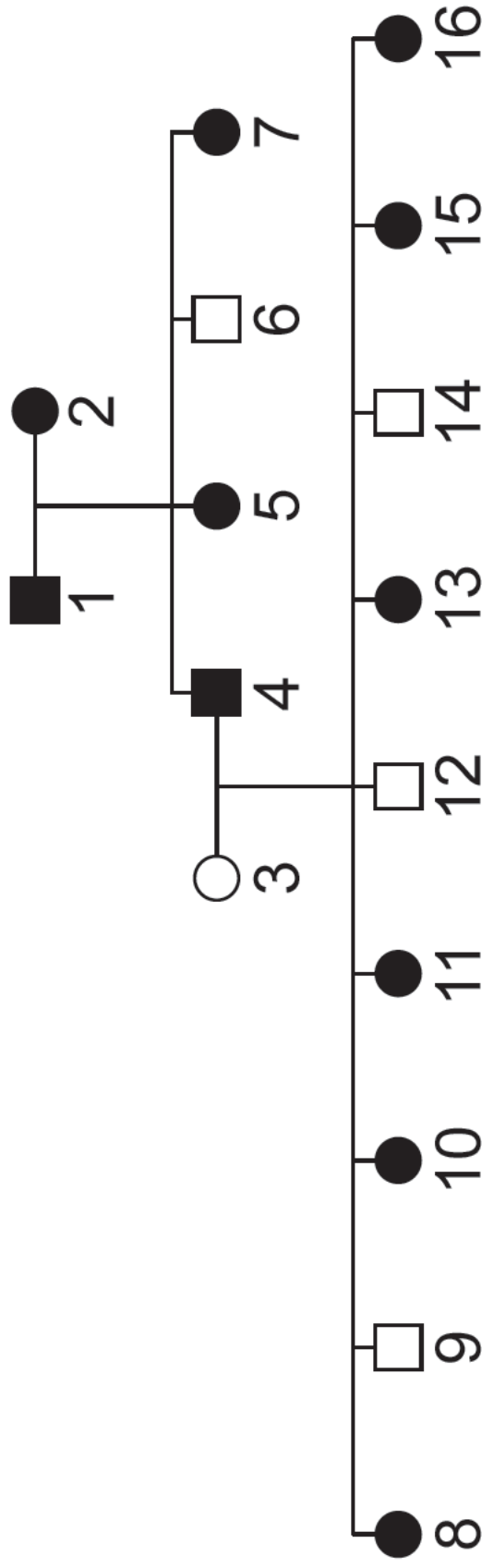


b) Predict the effect a drastic reduction in the number of dingoes would have on the termite population. Justify your response. [2 marks]

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Question 3 (7 marks)

The chart shows the inheritance pattern of a trait, which is thought to be sex-linked dominant.



Key

■ Male with the trait

● Female with the trait

□ Male without the trait

○ Female without the trait

□○ Parents

□○ Offspring

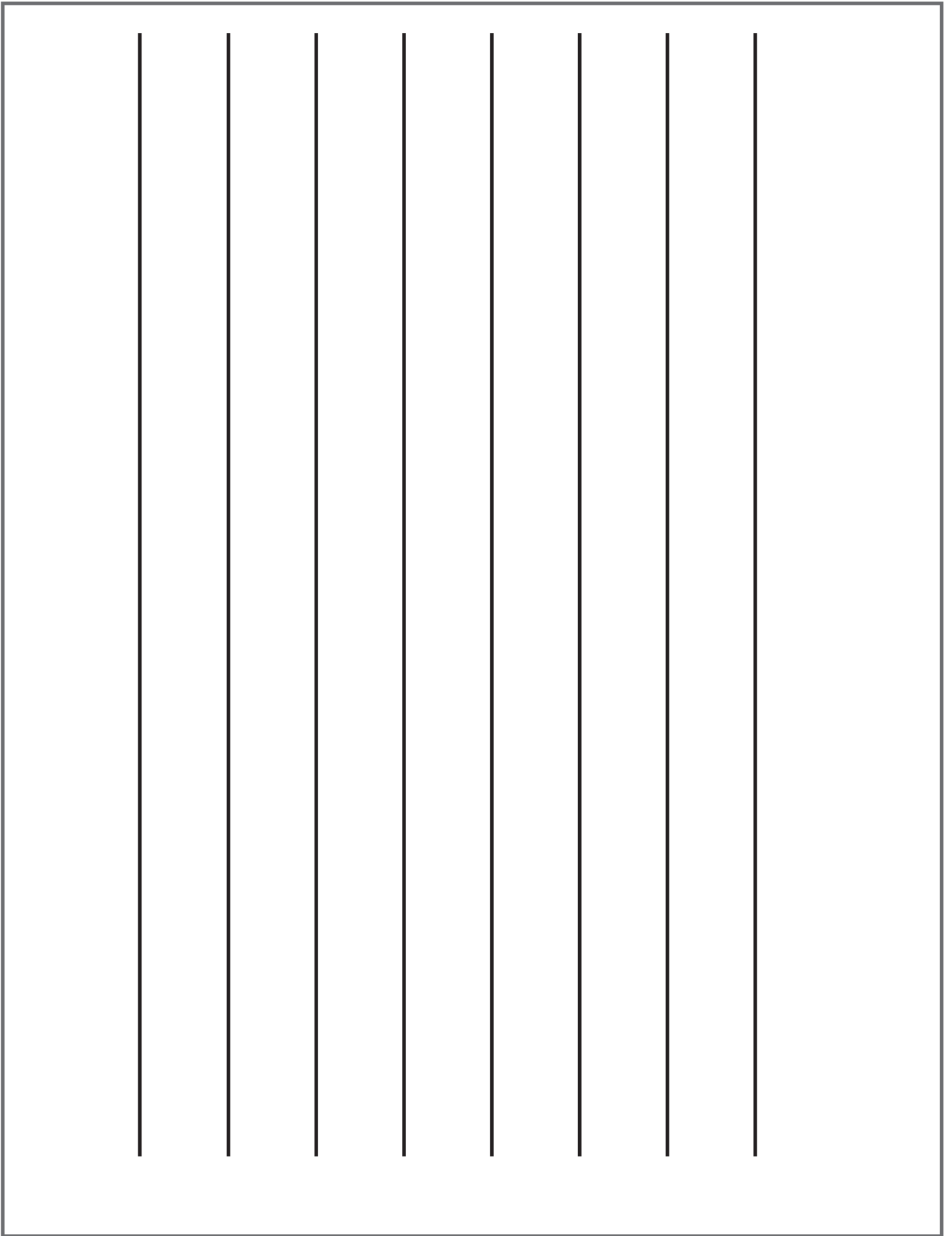
1–16 used to identify each individual

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a) Identify how many offspring of individuals 1 and 2 have the trait. [1 mark]

b) Identify evidence to support the conclusion that the trait is sex-linked dominant. Justify your response using a Punnett square. [4 marks]

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c) Infer the genotype of individual 6. Explain your reasoning. [2 marks]

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Question 4 (5 marks)

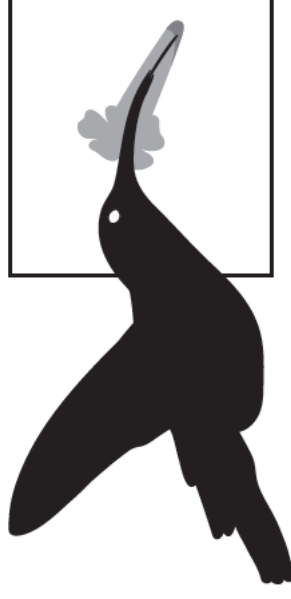
The hummingbird hawkmoth (phylum: *Arthropoda*) is named for its similarity to hummingbirds (phylum: *Chordata*).

The two species have independently developed similar feeding structures, which they use to draw nectar from tube-shaped flowers. Both species help plants reproduce by distributing their pollen.

Hummingbird hawkmoth

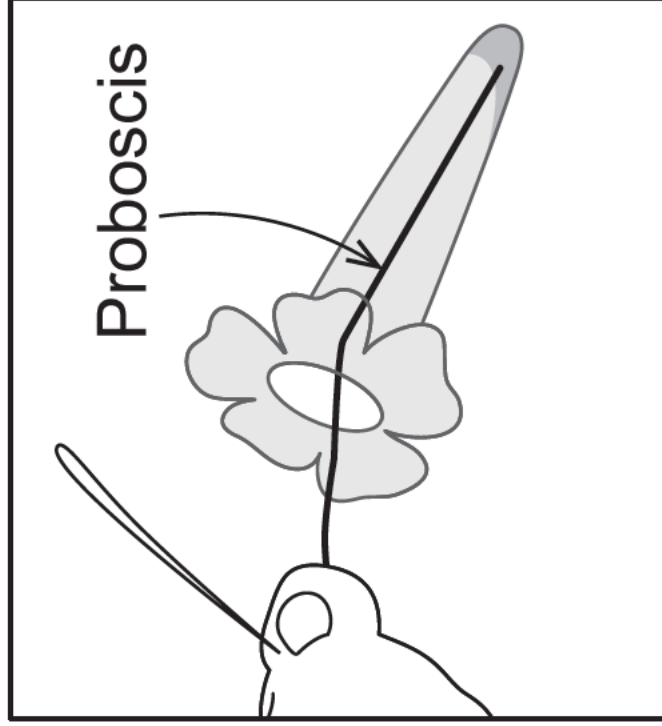


Hummingbird

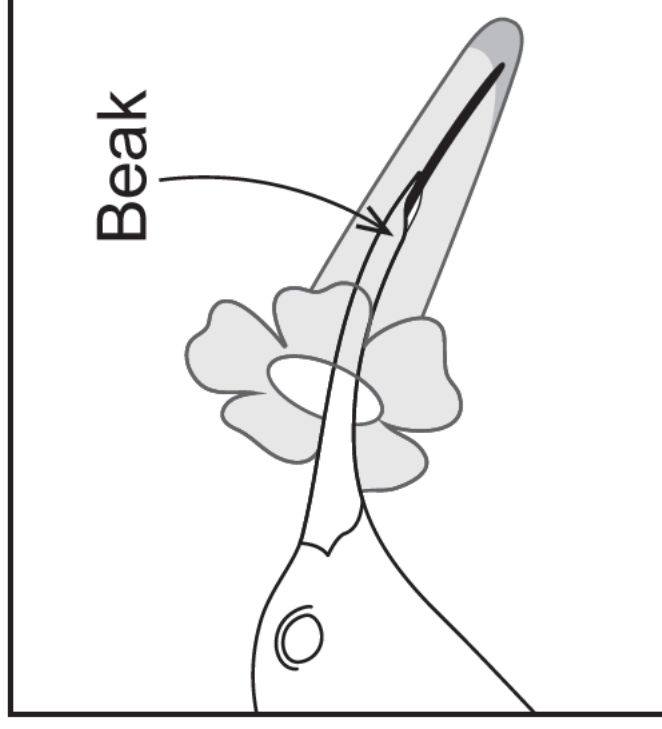


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Hummingbird hawkmoth



Hummingbird



a) Identify the diversification pattern demonstrated by the hummingbird and the hummingbird hawkmoth. [1 mark]

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b) Use the principles of natural selection to explain the similarities between the two species. [2 marks]

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c) Explain how coevolution of the hummingbird hawkmoth and tube-shaped flowers may have occurred.
[2 marks]

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Question 5 (3 marks)

Nucleic acid sequences were used to investigate evolutionary relationships between four species.

Species	Nucleic acid sequence
<i>B. bartonus</i>	G A C C G C A T T T A C G T A
<i>B. deakinii</i>	G A C G T C A T A T C C G T A
<i>B. reidus</i>	G A C C G C A T T T C C G T A
<i>B. watsonii</i>	G A C G G C A T A T C C G T A

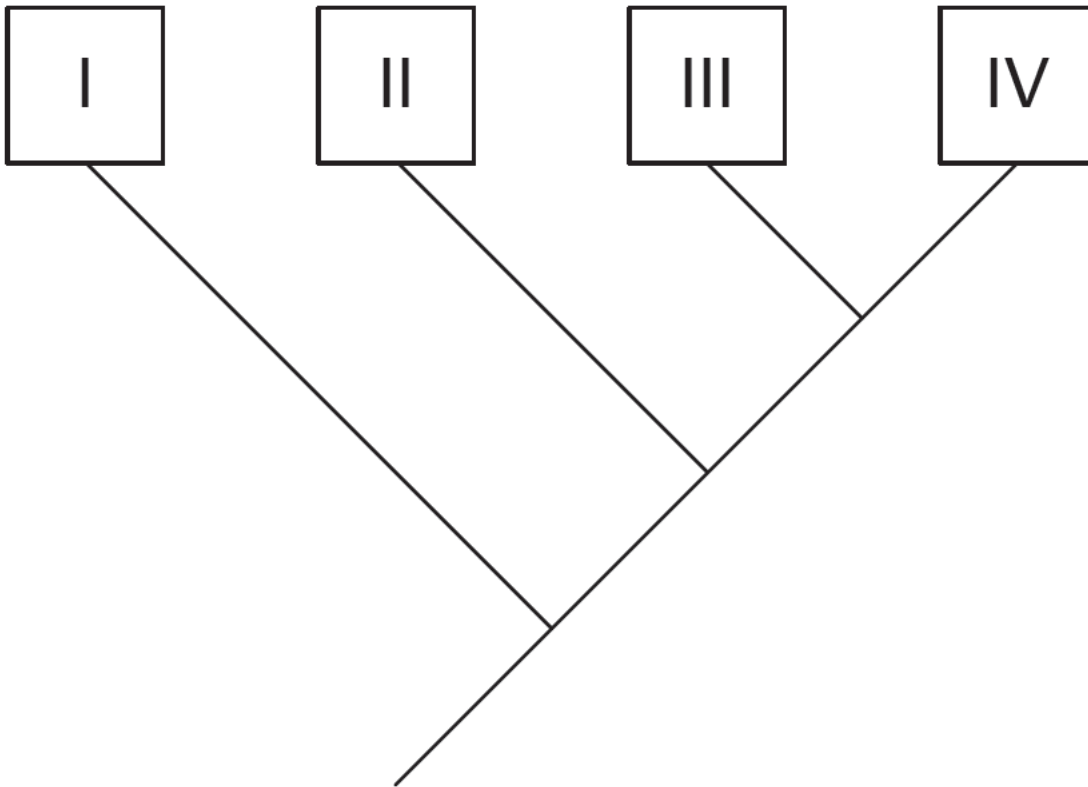
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a) Explain how data from conserved molecular sequences can be used to estimate time since divergence.
[2 marks]

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b) Use the data to infer species II–IV in the cladogram. [1 mark]

Species Species Species Species



I: *B. bartonus*

II: _____

III: _____

IV: _____

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Question 6 (3 marks)

Explain how twin studies can be used to investigate the effect of the environment on gene expression.

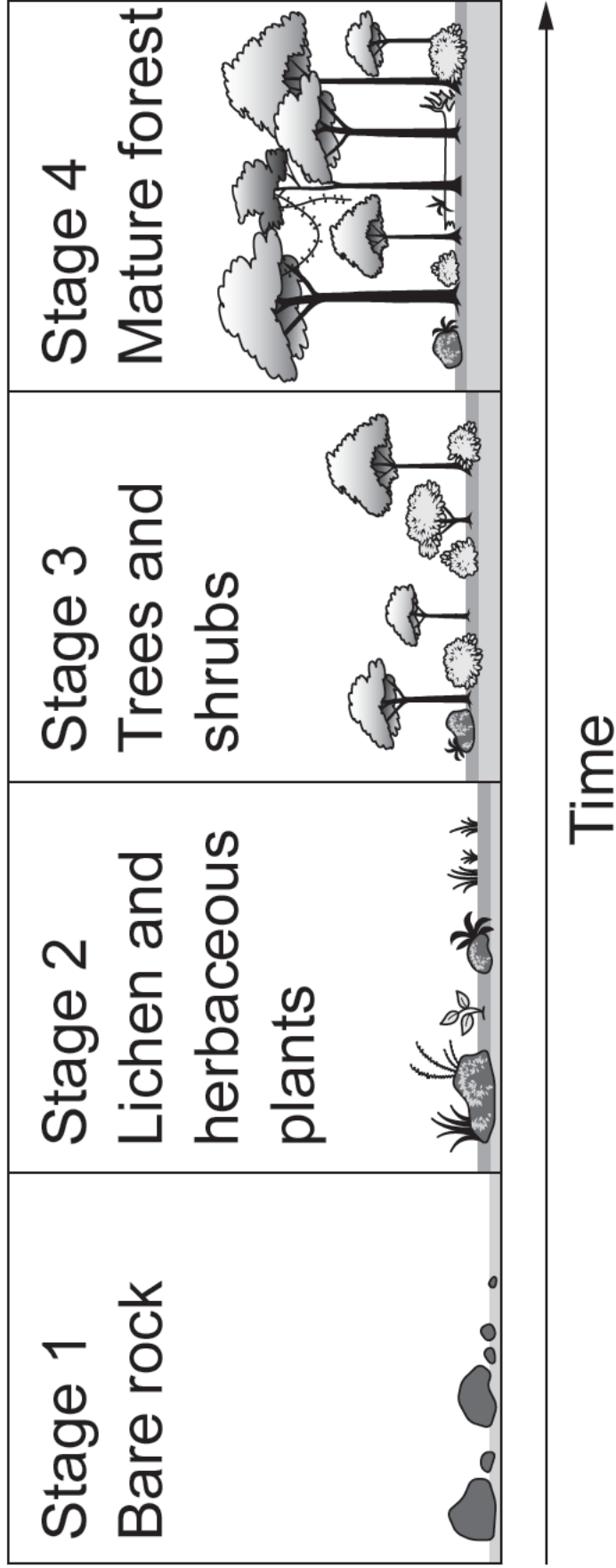
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Question 7 (5 marks)

The diagram shows the stages of succession in an ecosystem.



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a) Identify the type of ecological succession depicted.
Explain your reasoning. [2 marks]

b) Infer two features of the species in stage 2 and describe the role of these species in ecological succession. [3 marks]

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Question 8 (3 marks)

Explain how temporal isolation can lead to speciation.

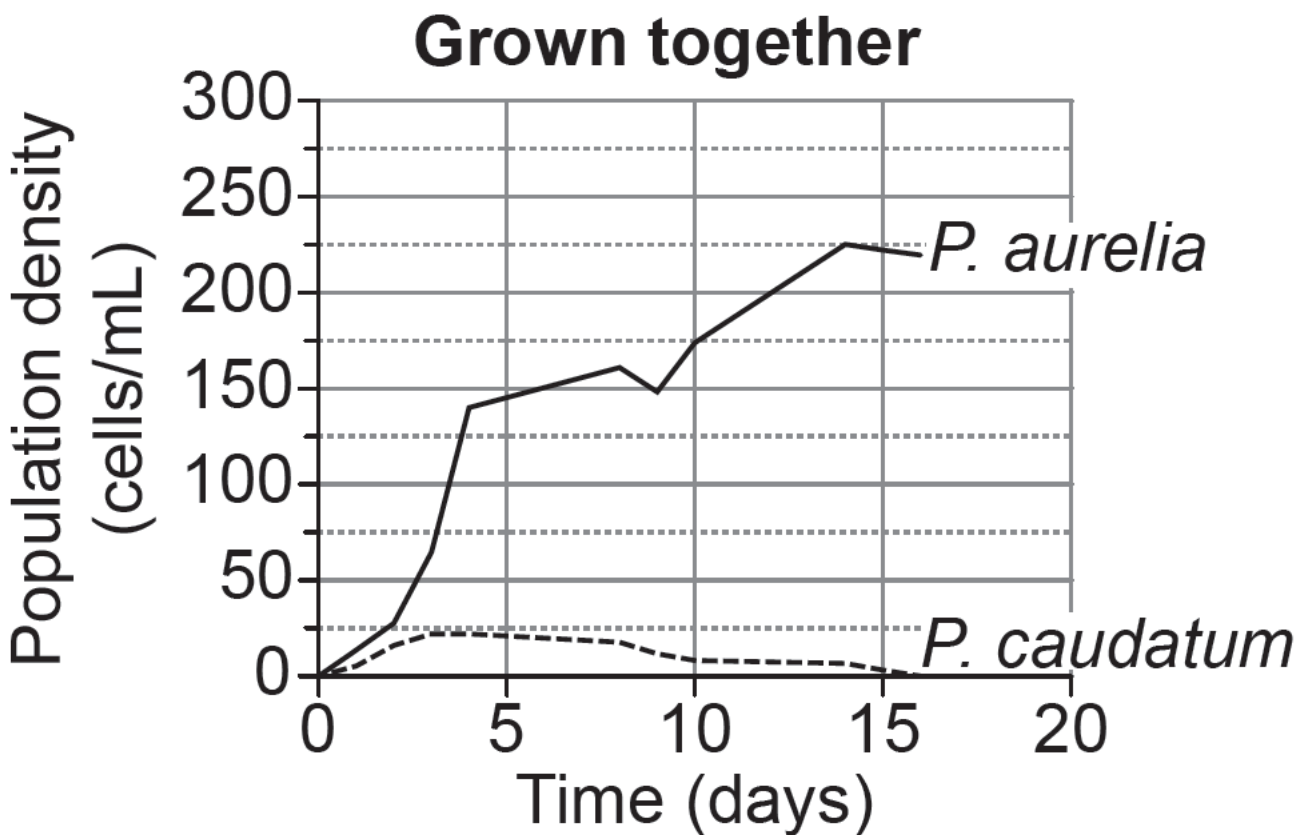
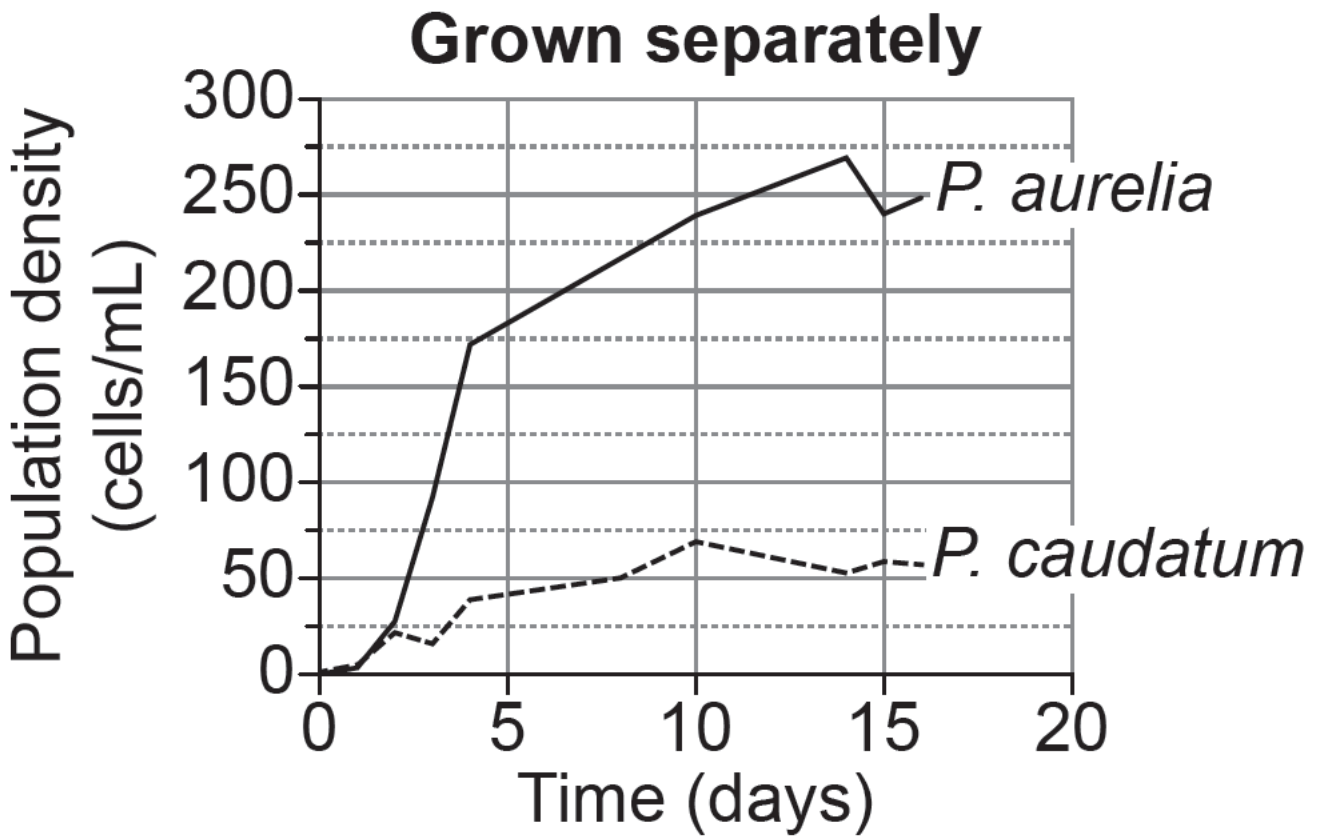
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Question 9 (7 marks)

The graphs on the next page show the findings of an experiment investigating the competitive exclusion principle.

Two species of protozoa (*P. aurelia* and *P. caudatum*) were grown separately and together under identical conditions.

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a) Identify the population density of *P. caudatum* on day 10 when grown separately. [1 mark]

b) Compare the growth of *P. aurelia* in the two graphs. [3 marks]

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c) Use the data to explain the competitive exclusion principle. [3 marks]

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Additional page for student responses

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References

Question 1

Figure inspired by Lowman, MD 1995,

‘Herbivory in Australian forest — a comparison of dry sclerophyll and rain forest canopies’, *Proceedings of the Linnean Society of New South Wales*, vol. 115, pp. 77–87, <https://canopymeg.com/PDFs/papers/0049.pdf>.

Table of Specht’s 1970 classification scheme found at Australian National Herbarium 2015, ‘A simplified look at Australia’s vegetation’, www.anbg.gov.au/aust-veg/veg-map.html.

Question 2

Adapted from The Savage Savanna, *Food web of Australian tropical savanna*, <https://visitthesavannahtoday.weebly.com/food-web.html>.

Question 4

Hummingbird moth: Ahisgett, 'Hummingbird moth 3', *Openverse*, <https://search-production.openverse.engineering/image/c0e5f29f-948f-4fb8-9716-c2b4f9be744f>.

Hummingbird: Sharp Photography 2010, 'Purple-throated carib hummingbird feeding', *Wikimedia Commons*, <https://commons.wikimedia.org/w/index.php?curid=12374160>.


Question 7

Image adapted from:

2009, 'Figure: Secondary succession in abandoned agricultural land', Mr G's *Environmental Systems*, http://sciencebitz.com/?page_id=41

Rcole17 2015, 'Primary succession diagram', *Wikimedia Commons*, https://commons.wikimedia.org/wiki/File:Primary_Succession_Diagram.svg

LucasMartinFrey 2011, 'Forest succession depicted over time', *Wikimedia Commons*, https://commons.wikimedia.org/wiki/File:Forest_succession_depicted_over_time.png

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