



**Test Papers
Hub.**

QCAA Biology Unit 3 Practice Paper 1

Internal Assessment 1 (10%) — Biodiversity and Ecosystem Dynamics

Perusal 5 minutes · Working time 60 minutes · Internal Assessment 1 (Unit 3) · 45 marks in all

How to use this booklet

- Perusal time – 5 minutes (reading only). Working time – 60 minutes. Write using black pen.
- This is an unseen data test: use the data provided in each question. A QCAA-approved scientific or graphics calculator may be used.
- Attempt ALL questions (1 – 9). Show all working for calculations: marks are awarded for correct method as well as the final answer.
- Worked solutions follow the paper: every question has step-by-step working or model-answer marking points, and a key takeaway.

UNSEEN DATA TEST

45 marks · Attempt ALL questions (1 – 9) · Allow 60 minutes

Use the dataset in each question to respond. Show all working for calculations; marks are awarded for method as well as the answer.

Question 1 (4 marks)

A population of 400 cane toads increases by 5% each year (exponential growth with no limiting factors).

- (a) Calculate the population size after 4 years. [3 marks]

- (b) Calculate the number of individuals added in the first year. [1 mark]

Question 2 (6 marks)

Ten quadrats (0.25 m² each) were placed randomly in a study area. Number of individuals per quadrat — Lomandra: 5, 0, 4, 4, 3, 0, 5, 6, 0, 0; Themeda: 12, 0, 0, 4, 9, 4, 12, 2, 3, 8.

- (a) Calculate the density of Lomandra (individuals per m²). [2 marks]

- (b) Calculate the frequency of occurrence of Lomandra (percentage of quadrats in which it occurred). [2 marks]

(c) Calculate the relative abundance of Lomandra (as a percentage of all individuals counted of both species). [2 marks]

Question 3 (6 marks)

In a temperate grassland the producers fix $15000 \text{ kJ m}^{-2} \text{ y}^{-1}$ of energy by photosynthesis (gross primary productivity, GPP). The producers use $7500 \text{ kJ m}^{-2} \text{ y}^{-1}$ in their own respiration. Primary consumers can assimilate 8% of net primary productivity.

(a) Calculate the net primary productivity ($\text{NPP} = \text{GPP} - \text{R}$). [2 marks]

(b) Calculate the energy available to the primary consumers. [2 marks]

(c) Calculate NPP as a percentage of GPP. [2 marks]

Question 4 (3 marks)

Researchers trap, mark and release 20 water voles in a study area of 5 hectares. A week later they capture 50 water voles, of which 6 are marked.

(a) Use the Lincoln–Petersen method to estimate the population size. [2 marks]

WORKED SOLUTIONS

Answers & worked solutions

UNSEEN DATA TEST

Question 1 (4 marks) [Population dynamics]

A population of 400 cane toads increases by 5% each year (exponential growth with no limiting factors).

(a) Calculate the population size after 4 years.

(a) Answer: 486

- Each year the population is multiplied by $1 + 0.050 = 1.05$.
- $N = 400 \times 1.05^4 = 486$

(b) Calculate the number of individuals added in the first year.

(b) Answer: 20

- $\text{increase} = 400 \times 0.050 = 20$

LOS: Population dynamics

KEY TAKEAWAY

Exponential growth compounds: $N = N_0(1 + r)^n$, which is much faster than adding the same number each year.

Question 2 (6 marks) [Ecology]

Ten quadrats (0.25 m² each) were placed randomly in a study area. Number of individuals per quadrat — Lomandra: 5, 0, 4, 4, 3, 0, 5, 6, 0, 0; Themeda: 12, 0, 0, 4, 9, 4, 12, 2, 3, 8.

(a) Calculate the density of Lomandra (individuals per m²).

(a) Answer: 10.8 per m²

- Total Lomandra counted = 27.
- Total area sampled = $10 \times 0.25 = 2.50 \text{ m}^2$.
- $\text{density} = 27 \div 2.50 = 10.8 \text{ per m}^2$

(b) Calculate the frequency of occurrence of Lomandra (percentage of quadrats in which it occurred).

(b) Answer: 60.0 %

- Lomandra occurred in 6 of the 10 quadrats.
- $\text{frequency} = 6 \div 10 \times 100 = 60 \%$

(c) Calculate the relative abundance of Lomandra (as a percentage of all individuals counted of both species).

(c) Answer: 33.3 %

- Total individuals of both species = $27 + 54 = 81$.
- $\text{relative abundance} = 27 \div 81 \times 100 = 33.3 \%$

LOS: Ecology