



**Test Papers
Hub.**

QCAA Biology Units 3 & 4 Practice Paper 1

External Assessment 2 — Extended Response

Perusal 5 minutes · Working time 90 minutes · Extended response · 50 marks in all

How to use this booklet

- Perusal time – 5 minutes. Working time – 90 minutes. Write using black pen.
- QCAA-approved scientific or graphics calculators may be used. A formula and data sheet (including the genetic code) is provided at the back of the paper.
- Attempt ALL questions (1 – 8). Responses should be in complete sentences using correct biological terminology.
- Worked solutions follow the paper: every question has step-by-step working or model-answer marking points, and a key takeaway.

EXTENDED RESPONSE

50 marks · Attempt ALL questions (1 – 8) · Allow 90 minutes

Answer all questions in the spaces provided. Show relevant biological reasoning and calculations.
Use correct biological terms.

Question 1 (7 marks)

The table shows a cladogram built from a character matrix for four marsupials plus an outgroup.
Characters: pouch, marsupium opening backwards, bipedal hopping, herbivorous diet. The data: wombat (1,1,0,1), kangaroo (1,0,1,1), quoll (1,0,0,0), numbat (1,0,0,0) and the outgroup, platypus (0,0,0,0).

(a) Explain why the platypus has been used as an outgroup. [2 marks]

(b) Identify a derived characteristic shared by all four marsupials and name the clade it defines. [2 marks]

(c) Use the data to determine which two marsupials are most closely related and justify your answer. [3 marks]

Question 2 (8 marks)

Table 3 shows the biomass (g m^{-2}) of the producers and consumers in a salt-marsh ecosystem.
Producers (cordgrass) 1500; herbivores (snails and insects) 150; small carnivores (crabs and fish) 22; top carnivores (birds) 3.

(a) Calculate the biomass of each level as a percentage of the biomass of the level below it. [3 marks]

(b) Explain why the biomass decreases at higher trophic levels. [3 marks]

(c) Predict the effect on the top carnivores of a pollutant that reduces the producer biomass by 30%. [2 marks]

Question 3 (5 marks)

A gene codes for an enzyme in a metabolic pathway. A deletion of three consecutive bases occurs in the middle of the coding region.

(a) Explain why the effect of this deletion may be less severe than the deletion of a single base. [3 marks]

(b) Describe two ways in which a mutation in the gene could still result in a non-functional enzyme. [2 marks]

Question 4 (6 marks)

Coat colour in Labrador retrievers is controlled by two genes. At gene B, black (B) is dominant to brown (b). At gene E, the dominant allele allows pigment to be deposited and the recessive genotype (ee) produces a yellow coat regardless of the B gene.

(a) Identify the type of interaction between the two genes. [1 mark]

WORKED SOLUTIONS

Answers & worked solutions

EXTENDED RESPONSE

Question 1 (7 marks) [Biodiversity]

The table shows a cladogram built from a character matrix for four marsupials plus an outgroup. Characters: pouch, marsupium opening backwards, bipedal hopping, herbivorous diet. The data: wombat (1,1,0,1), kangaroo (1,0,1,1), quoll (1,0,0,0), numbat (1,0,0,0) and the outgroup, platypus (0,0,0,0).

(a) Explain why the platypus has been used as an outgroup.

(a) Answer: It is a related mammal that is not a marsupial, so its characters represent the ancestral state against which derived characters in the marsupials can be identified.

- 1 mark: related but outside the group.
- 1 mark: shows the ancestral characters.

(b) Identify a derived characteristic shared by all four marsupials and name the clade it defines.

(b) Answer: The pouch; it defines the clade of marsupials.

- 1 mark: the pouch.
- 1 mark: marsupial clade.

(c) Use the data to determine which two marsupials are most closely related and justify your answer.

(c) Answer: Wombat and kangaroo, because they are the only pair sharing a derived state other than the pouch (herbivorous diet); quoll and numbat share no derived character beyond the pouch.

- 1 mark: wombat and kangaroo.
- 1 mark: they share the derived herbivorous diet.
- 1 mark: quoll and numbat share no extra derived character.

LOS: Biodiversity

KEY TAKEAWAY

Use shared derived characters and the outgroup to build a cladogram.

Question 2 (8 marks) [Ecology]

Table 3 shows the biomass (g m^{-2}) of the producers and consumers in a salt-marsh ecosystem. Producers (cordgrass) 1500; herbivores (snails and insects) 150; small carnivores (crabs and fish) 22; top carnivores (birds) 3.

(a) Calculate the biomass of each level as a percentage of the biomass of the level below it.

(a) Answer: Herbivores $150 \div 1500 = 10\%$; small carnivores $22 \div 150 = 14.7\%$; top carnivores $3 \div 22 = 13.6\%$.

- 1 mark each for correct percentages (10%, 14.7%, 13.6%).