Neap

Trial Examination 2022

Suggested Solutions

QCE Biology Units 3&4

Paper 2

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SECTION 1

QUESTION 1 (4 marks)

a) Succession type is determined by the presence of soil after an event. Primary ecological succession starts without soil present and secondary ecological succession starts with soil present.

[1 mark]
1 mark for identifying the difference between primary and secondary ecological succession.

b) the first organisms to establish a community during ecological succession

[1 mark]
1 mark for defining pioneer species.

c) **Factor 1:** tolerate extreme conditions

Factor 2: undergo photosynthesis

Factor 3: fixate nitrogen

Factor 4: undergo rapid growth/reproduction

[2 marks]
1 mark for providing 2–3 factors.
2 marks for providing four factors.
Note: Factors may be given in any order to receive full marks.

QUESTION 2 (2 marks)

The only organism that eats small fish is the azure kingfisher. If it were removed, the fish population could grow unsustainable as the fish would eat plants and algae and outcompete other primary consumers. As other secondary consumers rely upon the plants and algae as a food source, their numbers would be affected as well.

[2 marks]
1 mark for identifying the keystone species.
1 mark for explaining why the chosen species is a keystone species.
Note: Other responses are acceptable if the removal of the suggested keystone species has a cascading effect on other organisms.

QUESTION 3 (4 marks)

a) **C:** ATCCGG (possibility must have two changes from ancestor 3)

D: ATGCGG (possibility must have one change from ancestor 4)

[2 marks]
1 mark for providing one possible DNA sequence for species C.
1 mark for providing one possible sequence for species D.
Note: Other correct DNA sequences are acceptable. Responses should show two changes from species B and must be different to species A, B and E.

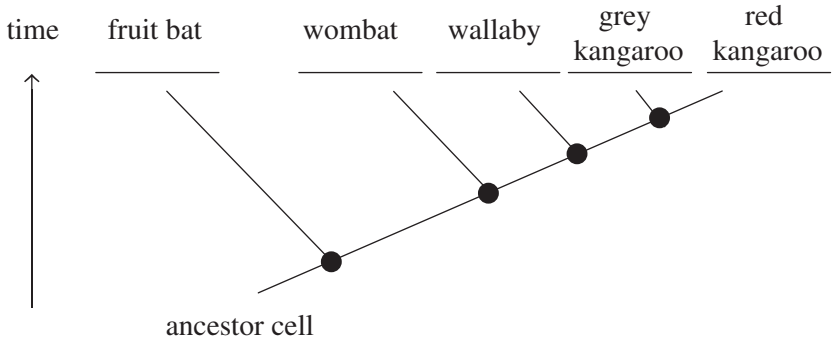
b) Species A and B diverged from ancestor 2 around two million years ago, and species A and E diverged from ancestor 1 around three million years ago.

[2 marks]
1 mark for stating that species A and B diverged two million years ago.
1 mark for stating that species A and E diverged three million years ago.

QUESTION 4 (5 marks)

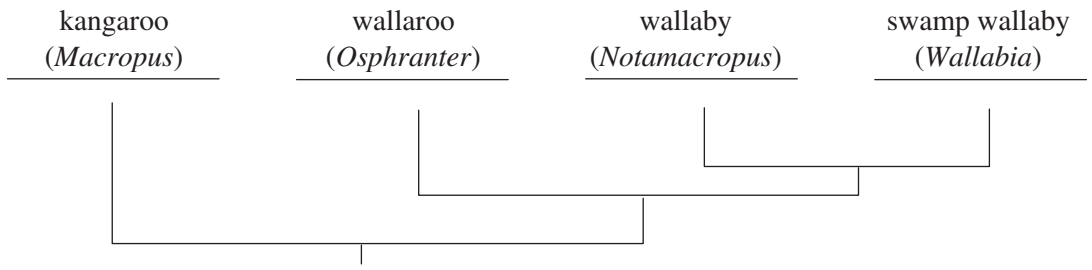
a)

Organism	DNA sequence	Mutations
ancestor cell	ATTAGCGACCAGTATATCCTACAATCCGTCTACTTCATT	0
fruit bat	ATTAGCGACCACTATATCCTAGAATCCGTCTACTTCATT	2
wombat	ATTTGCGACCACTATATGCTAGAATCCGTCTCCTTCATT	5
wallaby	ATTTGCGACCACTATTTGCTAGAATCCGTCTCCTTCCTT	7
grey kangaroo	ATTTGCGTCCACTATTTGCTAGAATCCGTCTCCTTCCTT	**8**
red kangaroo	ATTTGCGTCCACTATTTGCTAGAATCCGTCTCCTTCCTT	**8**



[3 marks]
1 mark for completing each cell in the table (two required).
1 mark for completing the cladogram.

b)



[2 marks]
1 mark for labelling 2–3 organisms.
2 marks for labelling four organisms.
Note: Responses can include either the common name or the genus name to achieve full marks. Both names are not required.

QUESTION 5 (4 marks)

Punnett square A shows incomplete dominance as the homozygous offspring are different colours to both parents.

Punnett square B shows dominant/recessive inheritance as only tall and short plants are seen in the offspring of heterozygous parents.

Punnett square C shows multiple alleles as three alleles are present (A, B and o), which results in four different phenotypes in the offspring.

Punnett square D shows sex-linked inheritance due to genes being carried on the X chromosome and the differences seen in male and female offspring phenotypes.

[4 marks]
1 mark for explaining the phenotypic results of Punnett square A.
1 mark for explaining the phenotypic results of Punnett square B.
1 mark for explaining the phenotypic results of Punnett square C.
1 mark for explaining the phenotypic results of Punnett square D.

QUESTION 6 (3 marks)

AABBCC has six dominant alleles present, so it has the reddest colouring, and **aabbcc** has no dominant alleles present, so it has the palest colouring.

It is also possible for one, two, three, four and five dominant alleles to be present in the wheat grains, which results in the gradient of colours seen in the pattern of inheritance.

For example, **Aabbcc** has one dominant allele and **AABBCc** has five dominant alleles.

[3 marks]
1 mark for identifying that AABBCC and aabbcc have the reddest and palest colouring because of the number of dominant alleles they possess.
1 mark for stating that varying amounts of dominant alleles are possible.
1 mark for providing an example.

QUESTION 7 (14 marks)

a) As the population numbers are continually increasing, the mode of population growth would be considered exponential.

[2 marks]
1 mark for identifying the mode of population growth.
1 mark for providing a reason why this mode of population growth is shown in the graph.

b) Carrying capacity refers to the size of a population that can be supported indefinitely using the available resources and services of its ecosystem.

The graph has not yet reached carrying capacity as levelling off has not occurred.

[2 marks]
1 mark for defining carrying capacity.
1 mark for explaining that the carrying capacity cannot be determined.

c) *For example:*

A biotic factor is the food source and its abundance.

An abiotic factor is the physical presence of the fence.

Biotic and abiotic factors relate to the available resources and services found within the ecosystem.

[3 marks]
1 mark for providing one biotic limiting factor.
1 mark for providing one abiotic limiting factor.
1 mark for explaining how biotic and abiotic factors affect carrying capacity.
Note: Responses may include other appropriate biotic and abiotic factors.

d) Reading from the graph: 162 wombats (2011) – 137 wombats (2007) = 25 wombats

The 2011 figure would have been larger; however, six wombats died and 15 were removed to the new colony. Therefore, six births must be added to account for the six deaths, and 15 births must be added to account for the emigration to the other colony.

Adding these values to the 2011 figure from the gragh indicates how many wombats were born between 2007 and 2011:

162 + 6 + 15 = 183

183 – 137 = 46

Therefore, 46 births must have occured between 2007 and 2011.

[2 marks]
1 mark for correctly reading values from the graph.
1 mark for stating how many births must have occured.

e) $240 = \frac{48 \times 10}{m}$

$m = \frac{480}{240}$

$m = 2$ individuals caught were marked

[2 marks]
1 mark for providing the correct working.
1 mark for providing the correct answer.

f) *Any three of:*

- research and monitoring of the wombats
- fire management
- maintenance of the predator-proof fence
- control of predators and competitors
- weed control

[3 marks]
1 mark for providing each correct management action.

QUESTION 8 (9 marks)

a) Sample 1:

$A = \frac{21}{24}$

$= 0.875$

Therefore, a must be 1 – 0.875 = 0.125.

Sample 2:

$A = \frac{15}{24}$

$= 0.625$

Therefore, a must be 1 – 0.625 = 0.375.

Allele	Allele frequencies	
	Sample 1	Sample 2
A	**0.875**	**0.625**
a	**0.125**	**0.375**

[3 marks]
1 mark for calculating the frequency of A and a in sample 1.
1 mark for calculating the frequency of A and a in sample 2.
1 mark for completing the table.

b) Positive allele frequency selection is an increase in allele frequency over time; for example, the increase in allele a from 0.125 to 0.375.

Negative allele frequency selection is a decrease in allele frequency over time; for example, the decrease in allele A from 0.875 to 0.625.

[2 marks]
1 mark for explaining positive allele frequency selection and providing an example.
1 mark for explaining negative allele frequency selection and providing an example.

c) As there is an increase in allele a and genotype aa, there is a shift towards short plant height over time. This is an example of directional selection.

[2 marks]
1 mark for explaining the trend toward short plant height in the two samples.
1 mark for identifying the type of phenotypic selection.

d) As we are seeing an increase of heterozygotes compared to a decrease of homozygotes over time, the phenotypic selection that is occurring must be stabilising selection.

[2 marks]
1 mark for explaining the trend of the graph over time.
1 mark for identifying the type of phenotypic selection.