



Trial Examination 2023

Question and Response Booklet

QCE Biology Units 3&4

Paper 1

Student's Name: _____

Teacher's Name: _____

Time allowed

- Perusal time – 10 minutes
- Working time – 90 minutes

General instructions

- Answer all questions in this question and response booklet.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (25 marks)

- 25 multiple choice questions

Section 2 (25 marks)

- 5 short response questions

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2023 QCE Biology Units 3&4 Written Examination.

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SECTION 1

Instructions

- Choose the best answer for Questions 1–25.
- This section has 25 questions and is worth 25 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	A	B	C	D
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SECTION 2

Instructions

- Write using black or blue pen.
 - If you need more space for a response, use the additional pages at the back of this booklet.
 - 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.
 - This section has five questions and is worth 25 marks.
-

DO NOT WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

QUESTION 26 (8 marks)

Biologists studied the process of succession in an area west of Brisbane over 10 years. They used quadrat sampling to monitor the plant species diversity of a creek bank site. At the commencement of the study, the species diversity index was determined using Simpson’s diversity index (SDI). The table shows the results.

Species	Population count	
	Commencement of study	10 years after commencement
native flax	19	23
brigalow grass	10	20
white cypress pine	0	18
western silver wattle	5	20
various exotic weed species	55	12
Diversity index	0.563	?

- a) Calculate the diversity index for the area after ten years using the SDI formula,

$$SDI = 1 - \left(\frac{\sum n[n-1]}{N(N-1)} \right),$$

where n is the number of organisms of one species and N is the number of organisms of all species. Give your answer correct to three decimal places.

[2 marks]

- b) Using the data provided and the value obtained in Question 26a), contrast the site at the commencement of the study with the site 10 years later.

[4 marks]

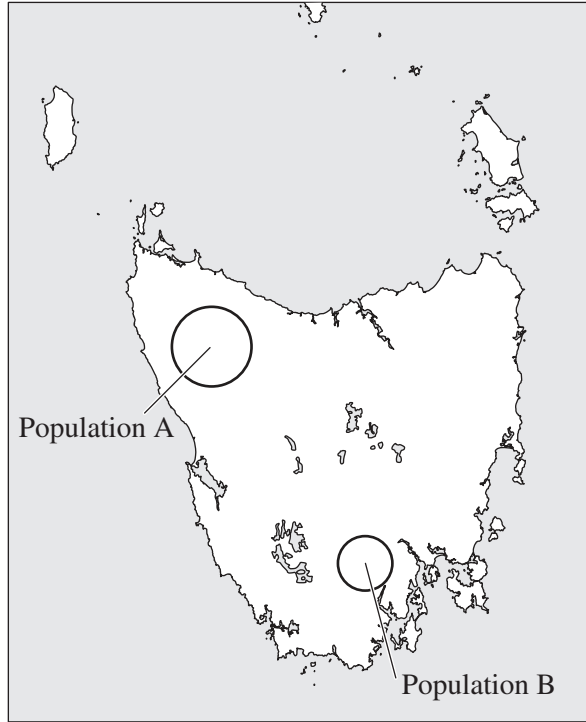
- c) Contrast species diversity and ecosystem diversity.

[2 marks]

QUESTION 27 (5 marks)

The Tasmanian Devil (*Sarcophilus harrisii*) is a carnivorous marsupial found only in Tasmania. Due to an infectious cancer known as Devil Facial Tumour Disease (DFTD), this animal faces extinction.

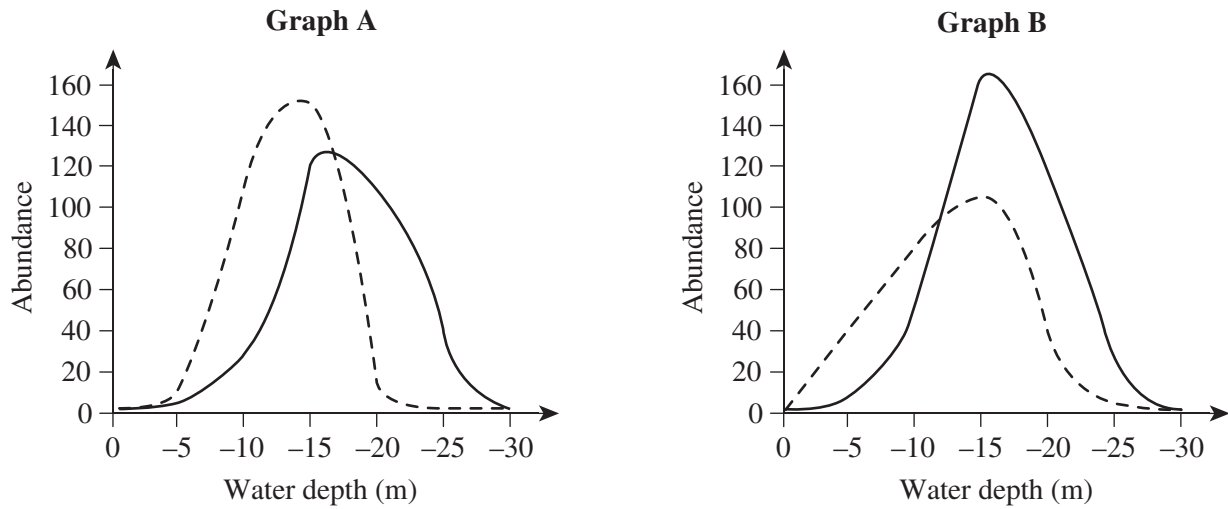
The map of Tasmania shows two different populations of Tasmanian Devils. Population A is a population of 500 Tasmanian Devils that show little evidence of the DFTD mutation. Population B is a population of 50 Tasmanian Devils that have the mutation.



Explain, in terms of genetic diversity, how a breeding program between healthy individuals in populations A and B could prevent the extinction of population B.

QUESTION 28 (3 marks)

The Speckled Damsel and Obscure Damsel are two types of fish species that live along the top of a reef. Graph A shows the natural distribution of the two species living together. Graph B shows the results of an experiment where the species were separated from each other and lived in independent environments.



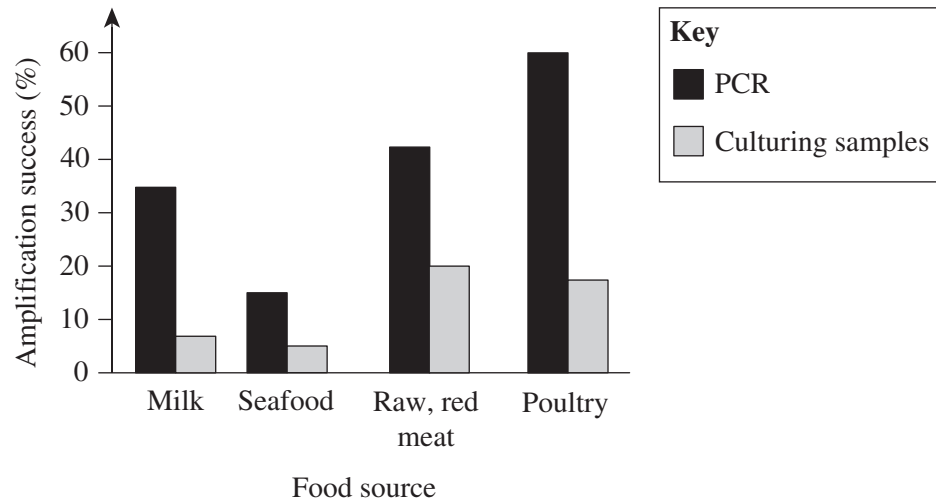
<p>Key</p> <p>— Speckled Damsel</p> <p>- - - Obscure Damsel</p>
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Describe the impact of the Speckled Damsel on the niche of the Obscure Damsel.

QUESTION 29 (2 marks)

Food poisoning can be caused by the bacteria *Salmonella*, which can be found in milk, red meat, poultry and seafood. The presence of *Salmonella* in different food sources can be detected faster using polymerase (PCR), rather than the conventional method of culturing samples of bacteria on agar plates. The conventional method is time consuming and can often only detect large quantities of the bacteria, whereas PCR is quicker, sensitive to low quantities and very specific.

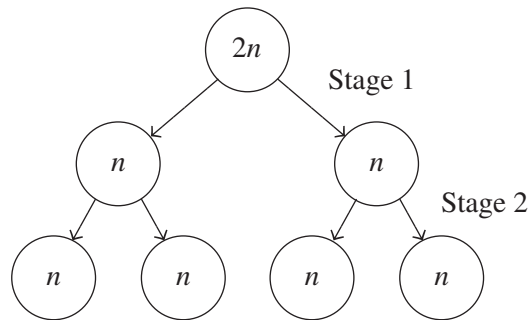
The graph shows the results of an experiment where both PCR and culturing samples were used to detect the presence of *Salmonella* in different food sources.



Determine which method (PCR or culturing samples) was more successful. Justify your response with reference to the data.

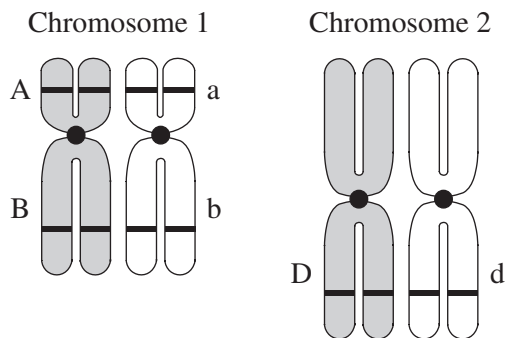
QUESTION 30 (7 marks)

In humans, gametes are produced by spermatogenesis and oogenesis. The diagram shows some of the stages of spermatogenesis, leading up to the development of spermatozoa.



- a) With reference to the stages shown in the diagram, describe the processes of crossing over and recombination in spermatogenesis that contribute to genetic variation. [4 marks]

- b) The diagram shows two pairs of homologous chromosomes that can be found at the $2n$ stage:
- chromosome 1 with two genes
 - chromosome 2 with one gene identified.



Using the diagram, explain how crossing over and independent assortment can produce gametes with new combinations of the alleles in an offspring.

[3 marks]

END OF PAPER

REFERENCES

QUESTION 27

Adapted from NordNordWest/Wikipedia (2010), *Location map of Tasmania, Australia* [map]. Accessed January 2023. https://commons.wikimedia.org/wiki/File:Australia_Tasmania_location_map_blank.svg. Licensed under CC BY-SA 3.0 DE, <https://creativecommons.org/licenses/by-sa/3.0/de/legalcode>.