Neap

Trial Examination 2022

VCE Environmental Science Unit 3

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing time: 1 hour

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	15	15	15
B	3	3	45
			Total 60

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question and answer booklet of 20 pages

Answer sheet for multiple-choice questions

Additional space is available at the end of the booklet if you need extra paper to complete an answer.

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 VCE Environmental Science Units 3&4 Written Examination.

SECTION A – MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

Which one of the following best describes ecosystem diversity?

A. the variety of plants, animals and microorganisms found in a specific ecosystem
B. the number of different species found in a specific ecosystem
C. the variety of habitats, natural communities and ecological processes in the biosphere
D. the number of different ecosystems in the lithosphere

Question 2

Which one of the following statements about evolution is **not** correct?

A. Evolution may result in an increase in the percentage of well-adapted individuals in the population.
B. Evolution may lead to the appearance of new genes in the gene pool.
C. Evolution may result in an increase in the frequency of favourable genes in a gene pool.
D. Evolution may occur in stable environmental conditions.

Question 3

Which one of the following statements about genes is correct?

A. Genes are the same length as chromosomes.
B. Genes are composed of deoxyribonucleic acid (DNA).
C. Genes are identical in every person.
D. Genes are important for preventing genetic drift.

Question 4

Ecosystems are a source of renewable services that impact human health and well-being. One example is the pollination of crops by various insects; the crops are then consumed by humans.

Which ecosystem service does pollination (or crops) provide?

A. provisioning service
B. regulating service
C. cultural service
D. pollinating service

Use the following information to answer Questions 5–8.

Merran's sun orchid (*Thelymitra merraniae*) is a ground-dwelling orchid that can grow to approximately 40 cm tall. The plant inhabits heathlands and woodlands in coastal areas of southern Victoria. Only four small populations of Merran's sun orchid are known: two can be found at Moggs Creek along the south-west coast of Victoria and two can be found at Crib Point on the Mornington Peninsula. This plant is listed as endangered under the *Flora and Fauna Guarantee Act* (Vic).

As part of her field studies, an Environmental Science student has chosen to monitor the two populations of Merran's sun orchid found on the Mornington Peninsula.

Question 5

Which one of the following correctly outlines the benefit of the orchid being listed in the *Flora and Fauna Guarantee Act* (Vic)?

A. It is illegal to trade or sell individual Merran's sun orchid plants in Victorian nurseries.

B. Merran's sun orchid is legally protected from harm throughout Australia.

C. Coastal land developers must apply for permission before beginning any new building projects in Moggs Creek.

D. It is illegal to remove any individual plants in each of the four remaining populations of Merran's sun orchid.

Question 6

Merran's sun orchid is

A. endemic to Victoria.

B. at risk of genetic swamping.

C. at risk of severe inbreeding.

D. extinct in the wild in New South Wales.

Question 7

Which one of the following is the most appropriate sampling technique for the student to use?

A. transect sampling

B. mark-recapture sampling

C. quadrat sampling

D. collection method

Question 8

Which one of the following would **not** be an appropriate safety or ethical consideration for the student's field-study method?

A. taking precaution against sun damage by wearing a hat

B. taking care to count all individual orchid plants that the student sees on a given day

C. taking care not to disturb any mammal species found in the area

D. taking precaution against insect bites

Use the following information to answer Questions 9 and 10.

A proposal has been made to reopen the disused gold mining pits in Nagambie, which is located in central Victoria. The managers of this project aim to minimise the impact of the mines on the upper soil and rock layers of the Earth's crust. Before this development is approved, the government guidelines state that an environmental impact assessment must be completed.

Question 9

Which of the Earth's components is the key focus of this project?

A. hydrosphere

B. biosphere

C. atmosphere

D. lithosphere

Question 10

Which one of the following would **not** be included in the environmental impact assessment?

A. an estimation of any environmental changes as a result of the project

B. the opinions of the residents of Nagambie about the reopening of the mines

C. an overall recommendation about whether the mines should reopen

D. recommendations on ways to monitor the surrounding environment after the mines have reopened

Use the following information to answer Questions 11 and 12.

A marine scientist completed an eight-year field study in which they recorded all of the southern right whales (*Eubalaena australis*) that enter the Point Addis Marine National Park each day during the breeding season (July and August).

Question 11

The dependent variable of this study may have been the

A. time of day when the scientist took the recordings.

B. number of whales sighted during the study period.

C. number of people using the marine national park for recreation activities when the whales were sighted.

D. number of calves that each whale produced in one particular year.

Question 12

Point Addis Marine National Park, along with 12 other marine national parks in Victoria, is legally protected from fishing, oil and gas exploration, dredging and waste disposal.

The creation and legal protection of these areas can be considered

A. anthropocentric.

B. ecocentric.

C. biocentric.

D. gene-centric.

Use the following information to answer Questions 13–15.

A proposal has been made to a local council by a private developer. The developer plans to build a boardwalk and viewing platform on the cliff above a heavily-used surf reserve.

The area in and around the reserve is currently protected from any development as part of the local council's environmental management plan. A gravel walking trail already exists along the coastline. Currently, the entire surf reserve is regularly visited by local surfers, hikers and sightseers, and accommodates heavy tourist traffic. Additionally, the surf reserve is used once annually for an international surfing contest, during which large, temporary judging booths are constructed with stages for presentations and seats for spectators.

The development proposal states that the boardwalk and viewing platform will be utilised by the local general public and tourists, and will provide extra space for the temporary structures to be built during the surfing contest.

However, local coast care groups and conservationists argue that this development would endanger the fragile vegetation along the cliff-face and would set a precedent for larger projects in the future.

Question 13

How could the user pays principle be applied to this proposed development?

A. Local residents should hold a fundraiser to collect the funds needed to construct the boardwalk.

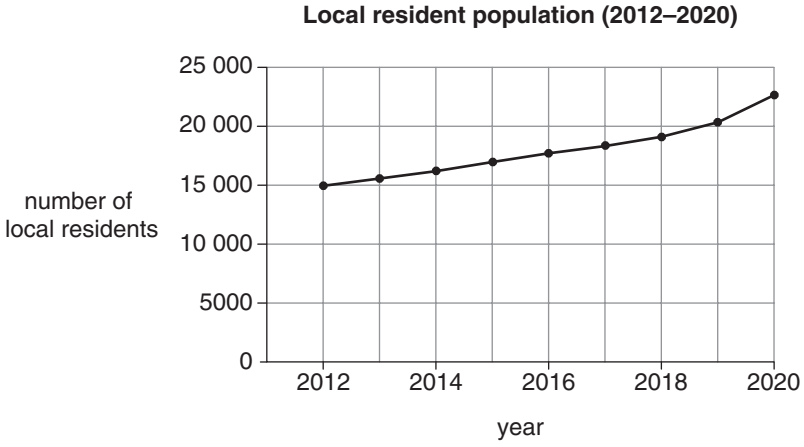
B. The local council should provide the funds to construct the boardwalk.

C. Tourists should be charged a fee to enter the surf reserve.

D. The developer should provide the funds to construct the temporary structures for the annual surfing contest.

Question 14

The developer argues that his proposal should be approved due to the huge increase in the local resident population in the area over recent years. The graph below shows the local resident population growth between 2012 and 2020.



What was the percentage increase of the local population of this town from 2012 to 2020?

A. 40%

B. 50%

C. 150%

D. 400%

Question 15

A decision to reject the proposal would be mainly based on

A. economic sustainability concerns.

B. intragenerational equity.

C. stakeholder interest.

D. intergenerational equity.

END OF SECTION A

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (16 marks)

A group of marine ecology students have been studying two locations along Victoria's south-west coastline. Their aim is to complete a 10-year study to determine whether the recent construction of several new housing developments will affect local marine populations.

Two study sites are chosen, which are both 10 kilometres in radius. The study sites are located in the intertidal zone of areas along the coastline that contain rocky-platform ecosystems.

Site A contains the weedy seadragon (*Phyllopteryx taeniolatus*). This species is endemic to Victoria and is listed as Near Threatened (NT) by the International Union for Conservation of Nature (IUCN).

Both site A and site B contain populations of the Northern Pacific seastar (*Asterias amurensis*). This organism is considered a marine pest in all Australian waters as it aggressively preys on local marine molluscs.

As part of their study, the students surveyed the two sites and used the Simpson's Index of species diversity to compare the diversity of the marine plant, animal and algae species at each site.

The Simpson's Index (D) can be calculated using the following formula.

$$\text{Simpson's Index of species diversity: } D = 1 - \frac{\sum\left[n_i\left(n_i - 1\right)\right]}{N(N-1)}$$

Note: $\sum$ refers to the 'sum of'

n_i refers to the total number of organisms of each individual species

N refers to the total number of organisms of all species

This formula should produce a value between 0 and 1. A higher index value (that is, a number closer to 1) indicates higher species diversity.

The results from the first year of the survey is shown in the tables below.

Species recorded at site A	$\mathbf{n_i}$	$\mathbf{n_i - 1}$	$\mathbf{n_i(n_i - 1)}$
weedy seadragon	2	2– 1 = 1	2 × 1 = 2
chiton	34	34 – 1 = 33	34 × 33 = 1122
elephant snail	7	7 – 1 = 6	7 × 6 = 42
sea hare	7	7 – 1 = 6	7 × 6 = 42
decorator crab	12	12 – 1 = 11	12 × 11 = 132
common seastar	23	23 – 1 = 22	23 × 22 = 506
Northern Pacific seastar	25	25 – 1 = 24	25 × 24 = 600
N	110		$\mathbf{\sum\left[n_i\left(n_i - 1\right)\right] = 2446}$
N(N – 1)	11 990		

Therefore:

$$D = 1 - \frac{\sum\left[n_i\left(n_i - 1\right)\right]}{N(N-1)}$$

$$D = 1 - \frac{2446}{11\,990}$$

$$D = 1 - 0.204$$

$$D = 0.796$$

Simpson's Index (D) for site A is 0.796.

a. Use the figures in the table below and the spaces provided to calculate Simpson's Index (D) for site B. 3 marks

Species recorded at site B	$\mathbf{n_i}$	$\mathbf{n_i - 1}$	$\mathbf{n_i(n_i - 1)}$
weedy seadragon	0		
chiton	30		
elephant snail	12		
sea hare	8		
decorator crab	15		
common seastar	10		
Northern Pacific seastar	33		
N			$\sum\left[n_i\left(n_i - 1\right)\right] =$
N(N – 1)			

Therefore:

$$D = 1 - \frac{\sum\left[n_i\left(n_i - 1\right)\right]}{N(N-1)}$$

$D = 1 -$ _____

$D = 1 -$ [ ]

Simpson's Index (D) for site B is [ ].

b. Which site (A or B) has a higher species diversity? Explain your answer. 2 marks

c. Suggest **one** improvement to the study that may increase the validity of the results. 2 marks

d. Discuss what the presence of an endemic species means in terms of a qualitative assessment of the health and biodiversity of the ecosystem. 2 marks

e. The marine ecology students hypothesise that, over the course of their 10-year study, the species diversity at both site A and site B will decline.

Suggest why the students have made this hypothesis. 2 marks

f. Compare the species richness and ecological integrity of site A and site B. 3 marks

g. Outline a possible management strategy that could be employed to control the spread of the Northern Pacific seastar. 2 marks

Question 2 (13 marks)

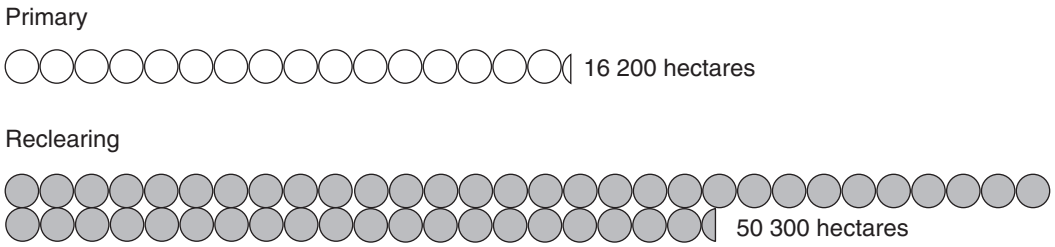
The swift parrot (*Lathamus discolor*) is a migratory bird that moves annually between mainland Australia and Tasmania. The bird breeds only in Tasmania, where it has access to its food source, the Tasmanian blue gum (*Eucalyptus globulus*).

The swift parrot nests in the hollows of both living and dead *Eucalyptus* trees. Their preferred nesting trees are the messmate stringybark (*Eucalyptus obliqua*) and the Tasmanian blue gum. Most of the remaining breeding individuals are found in remnant patches of forest that are smaller than 0.01 km^2.

The main threat to this species is the logging of Tasmania's old growth forests for timber plantations and agriculture. Recent estimations suggest that fewer than 300 swift parrots remain in the wild.

The diagram below shows the amount of Tasmanian forest cleared between 2010 and 2018. One circle represents 1000 hectares.

Amount of Tasmanian forest cleared (2010–2018)



a. What percentage of the forest cleared in Tasmania between 2010 and 2018 was primary forest? 1 mark

b. State the meaning of the term 'primary forest'. 1 mark

c. When primary, old-growth forests are logged, they are replaced with timber plantations. This means that trees will still exist in the locations where the swift parrots nest.

Discuss why logging is still considered a major threat for this species despite the statement above. 3 marks

One proposed action for the protection of the swift parrot is the addition of Tasmanian blue gum seeds to a seed bank.

d. **i.** What is a seed bank? 1 mark

ii. Explain how this action could act as a conservation strategy for the swift parrot. 2 marks

iii. Suggest and outline **one** other conservation technique that could be implemented to protect the swift parrot populations from extinction. 2 marks

e. An Environmental Science student set up an experiment to test the effect that temperature has on the germination of Tasmanian blue gum seeds.

She set up five petri dishes, labelled A–E, each containing 10 Tasmanian blue gum seeds in a soil medium. Each petri dish was subjected to the same light, water and pH conditions daily.

The student placed each of the petri dishes in different temperature environments for the duration of the experiment, as shown in the table below.

Petri dish	A	B	C	D	E
Temperature	room temperature	0°C	10°C	20°C	30°C

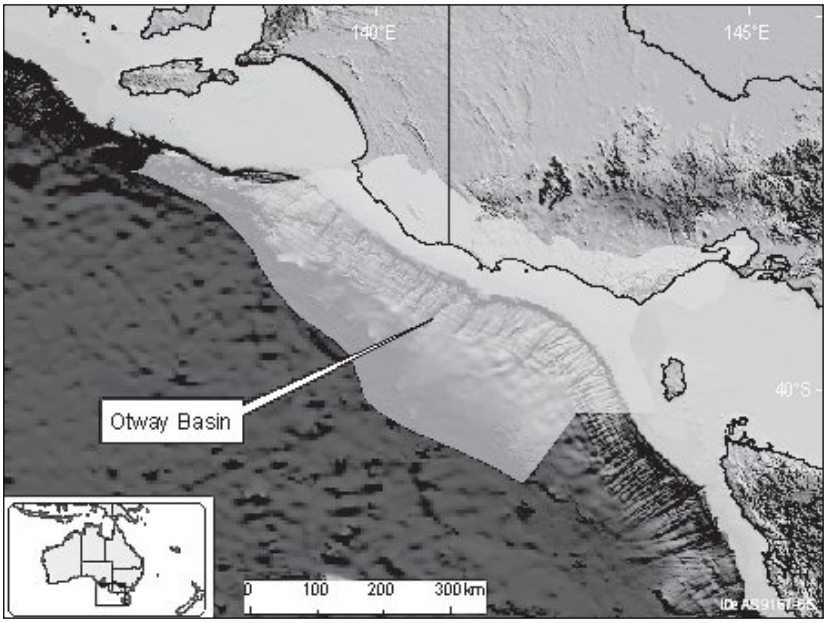
The student noted the day in which the seeds germinated over a 30-day period.

i. Write a hypothesis that is relevant to the experiment. 2 marks

ii. State the independent variable for the experiment. 1 mark

Question 3 (16 marks)

The Otway Basin is part of the Bass Strait and covers an area of approximately 155 000 km^2. It is mostly offshore in the south-west waters of Victoria and runs to the north-west waters of Tasmania. King Island also sits in this part of the Bass Strait. The Otway Basin is highlighted in the map below.



Source: © Commonwealth of Australia (Geoscience Australia) 2021. 'Otway Basin'. Accessed 25 October 2021. https://www.ga.gov.au/scientific-topics/energy/province-sedimentary-basin-geology/petroleum/offshore-southern-australia/otway. Licensed under CC BY 4.0, https://creativecommons.org/licenses/by/4.0/legalcode.

The basin has been explored for its natural gas reserves for many years and currently contains some developed natural gas fields south of Port Campbell. The natural gas is extracted and piped to the Otway Gas Plant, where it is processed and sold to a variety of energy companies in Australia. The extraction, processing and selling of natural gas leads to the employment of many local residents.

The government authority in charge of offshore oil and gas exploration in Australia has recently approved a project for seismic testing to occur approximately 25 km west of King Island. The testing involves sending large blasts of sound waves to the seafloor with compressed air-guns. The echoes are measured and used to map any undiscovered reserves of oil or gas.

There is some likelihood that humpback whales (*Megaptera novaeangliae*), southern right whales (*Eubalaena australis*), pilot whales (*Globicephala melas*) and the endangered pygmy blue whales (*Balaenoptera musculus brevicauda*) may be present during testing. This area of the Bass Strait is also used by the fishing industry to catch the Tasmanian giant crab (*Pseudocarcinus gigas*) and the southern rock lobster (*Jasus edwardsii*), which contributes significantly to the economy through domestic and overseas sales.

a. Evaluate whether this project meets the principles of intergenerational equity and intragenerational equity. 4 marks

b. Describe **one** negative impact this project could have on the biosphere. 2 marks

c. State **one** challenge to upholding sustainability and explain how this project would address that challenge. 3 marks

d. Explain how the precautionary principle could be used when making decisions regarding this project. 3 marks

e. Identify **one** group of stakeholders and outline their interest in this project. 2 marks

f. Local Environmental Science students have been asked to assist in the collection of data on the Tasmanian giant crab and the southern rock lobster.

State **one** safety and **one** ethical consideration that should be considered when undertaking this field work. 2 marks

Safety consideration _____

Ethical consideration _____

END OF QUESTION AND ANSWER BOOKLET

Extra space for responses

Clearly number all responses in this space.

Neap

Trial Examination 2022

VCE Environmental Science Unit 3

Written Examination

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out. Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: [A] B C D

Use pencil only

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D