

Trial Examination 2023

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

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
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 18 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 2023 VCE Environmental Science Units 3&4 Written Examination.

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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 booklet are **not** drawn to scale.

Question 1

Healthy ecosystems provide renewable services to humans. These services can be divided into four categories: provisioning, regulating, supporting and cultural.

Regulating services

- A. provide resources to individuals in the ecosystem.
- B. benefit the social well-being and mental health of humans.
- C. provide mechanisms to control the natural balance in an ecosystem.
- D. sustain the underlying natural processes of an ecosystem.

Question 2

Which one of the following statements about genetic diversity is correct?

- A. The genetic diversity of a population is always increased by DNA mutations.
- B. Inbreeding is impossible in a population with high genetic diversity.
- C. A population with low genetic diversity is highly resistant to new diseases.
- D. Rapid environmental changes are less likely to impact a population with high genetic diversity.

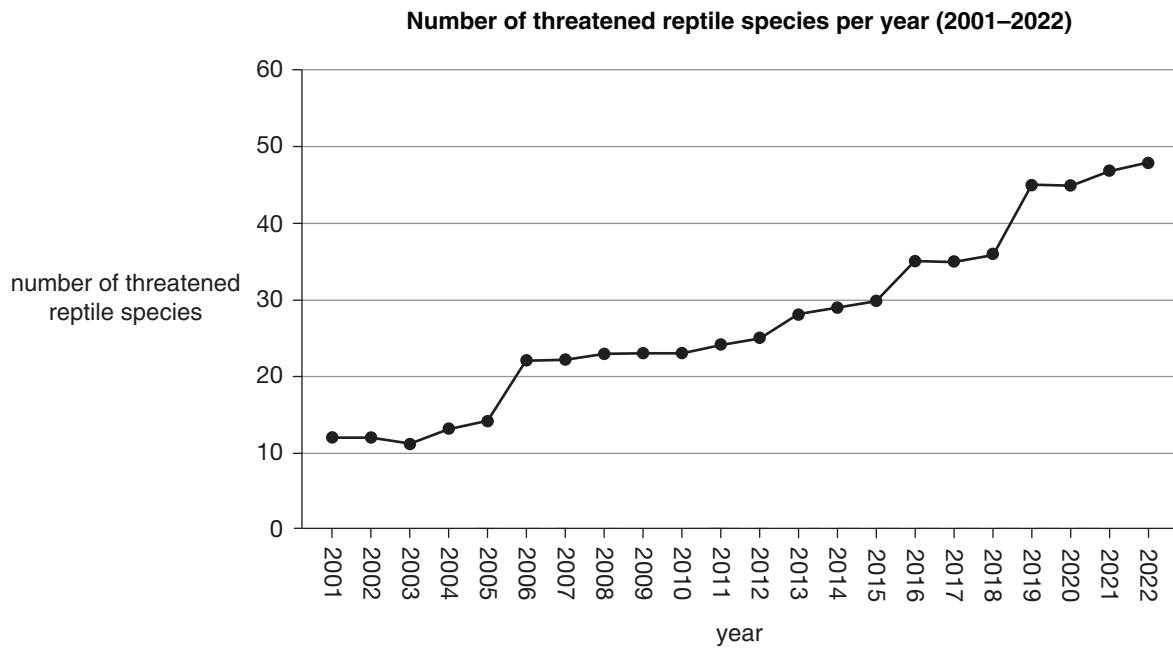
Question 3

Continental drift is caused by

- A. the movement of Earth's tectonic plates.
- B. the loss of Antarctic sea ice.
- C. the El Niño climactic cycle.
- D. changes in bushfire intensity.

Use the following information to answer Questions 4 and 5.

An environmental conservation group undertook a long-term study to track the amount of threatened reptile species in their local region over a period of 22 years. Their data is shown in the graph below.



Question 4

The percentage increase of threatened reptile species between 2010 and 2022 is closest to

- A. 47%
- B. 52%
- C. 110%
- D. 208%

Question 5

Which one of the following is the most likely reason for the increase in the number of threatened reptile species between 2001 and 2022?

- A. Reptile species declined in the region due to anthropocentric threats.
- B. Biodiversity assessment technology improved between 2001 and 2006.
- C. Funding for captive breeding programs has decreased.
- D. Loss of native vegetation in the region means it is easier to locate and assess reptile species.

Question 6

Which category of the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species represents a greater threat than Critically Endangered?

- A. Endangered
- B. Extinct In The Wild
- C. Vulnerable
- D. Threatened

Use the following information to answer Questions 7 and 8.

Alex and Jamie have purchased a property in the Western Victorian Volcanic Plains. There are only two remaining populations of basalt greenhood orchids (*Pterostylis basaltica*) in this area, which each consist of approximately 1000 individual plants. Alex and Jamie's property has several small patches of remnant grassland and a recent survey found 10 individual basalt greenhood orchids on their land.

Question 7

Alex and Jamie value sustainability and have purchased the property with the intent to revegetate the land as part of the critically endangered grassland ecosystem of the Western Victorian Volcanic Plains.

Their plan was likely based on

- A. the application of a regulatory framework.
- B. anthropocentric values.
- C. the need to appease all stakeholders.
- D. ecocentric values.

Question 8

As part of their conservation efforts, Alex and Jamie clear part of their property of invasive tussock grasses. They monitor the height of basalt greenhood orchids on the part of their property that has been cleared of tussock grasses and compare this to the height of basalt greenhood orchids on the uncleared part of the property. Alex and Jamie hope that this data will be useful in their revegetation planning.

The independent variable in this scenario is the

- A. presence or absence of tussock grasses.
- B. height of basalt greenhood orchids.
- C. height of tussock grasses.
- D. presence or absence of basalt greenhood orchids.

Use the following information to answer Questions 9–11.

The Yarra Ranges Council is planning the construction of a mountain bike trail in Warburton, which will include 170 kilometres of trails spanning across Mount Donna Buang, Mount Little Joe and Mount Tugwell. The Yarra Ranges National Park provides a habitat for the critically endangered Leadbeater’s possum and the endemic Mount Donna Buang wingless stonefly. The Yarra Ranges Council argues that the project will benefit the economy of the region by attracting tourists and improve the physical and mental well-being of residents by providing nature-based activities.

Question 9

The Yarra Ranges Council states in their proposal that both older and younger residents will benefit from the mountain bike trail.

Which principle of sustainable development is shown in the scenario?

- A. intergenerational equity
- B. intragenerational equity
- C. economic equity
- D. efficiency of resource use

Question 10

According to the precautionary principle, the project should

- A. proceed without consulting the Warburton residents about their opinions.
- B. proceed after completing a biodiversity survey of the Yarra Ranges National Park.
- C. not proceed until the Yarra Ranges Council can prove that environmental damage will be prevented.
- D. not proceed until local First Nations peoples have been consulted.

Question 11

To inform their decisions on the project, the Yarra Ranges Council will need to consider the three dimensions of sustainable development.

Which one of the following lists the three dimensions of sustainable development?

- A. social, sustainable and medical
- B. economic, environmental and sustainable
- C. environmental, social and generational
- D. ecological, sociocultural and economic

Question 12

Lake Condah is located in Budj Bim National Park in southwest Victoria. A First Nations-led restoration project was recently completed at Lake Condah. The restoration project involved the construction of a weir (a low dam built across a river), which aimed to restore water levels and return native aquatic species to the area.

Which one of the following groups of stakeholders is **not** likely to have been involved in the final stages of the restoration project?

- A. local fishermen
- B. the Department of Environment, Land, Water and Planning
- C. the local water authority
- D. Parks Victoria

Use the following information to answer Questions 13–15.

An open-cut coal mine on the coast of south-west Victoria has been closed due to the exhaustion of the coal seams. As part of the rehabilitation process, the mining company plans to fill the mining pit with water to create an artificial lake. To produce the lake, they will pump water from an aquifer that lies beneath the mine and its surrounding town. The aquifer feeds a 20-kilometre river that begins on the southern border of the mining site and ends at the ocean.

Question 13

Which of Earth's systems is most affected by this stage of the rehabilitation project?

- A. biosphere
- B. lithosphere
- C. hydrosphere
- D. atmosphere

Question 14

After the area has been rehabilitated, the local council approves plans to convert the site into a park. The project involves clearing an additional five acres of land from the mining site and building a series of boardwalks around the newly created lake. The park will include an education centre that provides information on local geology, ecosystems and First Nations history. The education centre will be built using timber that has been cleared from the mining site.

The building of the education centre is an example of

- A. intergenerational equity.
- B. circular economy thinking.
- C. an application of the precautionary principle.
- D. a response to an environmental impact assessment.

Question 15

Which one of the following is **not** an appropriate measurement for monitoring the health of the lake?

- A. dissolved oxygen
- B. temperature
- C. pH
- D. number of people visiting the lake

END OF SECTION A

SECTION B**Instructions for Section B**

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

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

Question 1 (13 marks)

The orange-bellied parrot (*Neophema chrysogaster*) migrates annually between Tasmania and mainland Australia. The bird breeds in Tasmanian old-growth forests then migrates to Victoria during winter to feed in the coastal dunes and saltmarshes of the Bellarine Peninsula and Port Phillip Bay. Beaded glasswort (*Sarcocornia quinqueflora*) and southern sea-heath (*Frankenia pauciflora*) are the orange-bellied parrot's preferred food sources; this benefits both plants as the parrot disperses their seeds over a large area.

The orange-bellied parrot is listed as Critically Endangered on the IUCN Red List of Threatened Species. The Victorian habitat of the orange-bellied parrot is under threat due to increased numbers of grazing livestock and the construction of housing estates in the area, both of which impact the growth of food sources.

- a. Identify and describe **one** possible threat to the orange-bellied parrot that is **not** mentioned in the information provided. 2 marks

- b. Identify **one** ecosystem service to which the orange-bellied parrot contributes. Justify your response. 3 marks

- c. The orange-bellied parrot is listed in the *Flora and Fauna Guarantee Act* (Vic). Outline what this means for the orange-bellied parrot. 1 mark

Zoos Victoria maintains a population of orange-bellied parrots as part of a national conservation strategy. This strategy includes conservation approaches such as captive breeding and reintroduction programs.

- d.** Outline **one** technique for maintaining genetic diversity in the captive population of orange-bellied parrots. 2 marks

- e.** Suggest **one** reason why a reintroduction program for the orange-bellied parrot may be unsuccessful. 2 marks

- f.** Identify and explain **one** strategy, other than captive breeding and reintroduction, that may assist with the conservation of the orange-bellied parrot. 3 marks

Question 2 (17 marks)

A rural Victorian council is planning to construct a five-kilometre road due to a recent increase in housing development in the area. There are two potential sites for the new road. Both sites house temperate grassland ecological communities that are listed as critically endangered by the *Environment Protection and Biodiversity Conservation Act 1999* (Australia).

As part of an environmental impact assessment, the two sites are surveyed and the Simpson's Index of Diversity (SID) is used to compare the plant species at each site. The index can be calculated using the following formula.

$$\text{SID} = 1 - \frac{\sum [n_i(n_i - 1)]}{N(N - 1)}$$

Note: Σ 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.

Site A contains a small population of the spiny rice-flower (*Pimelea spinescens*). This small shrub is endemic to Victoria and listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Australia). The results from the survey of site A are shown in the table below.

Species recorded at site A	n_i	$n_i - 1$	$n_i(n_i - 1)$
spiny rice-flower	2	$2 - 1 = 1$	$2 \times 1 = 2$
kangaroo grass	34	$34 - 1 = 33$	$34 \times 33 = 1122$
feather heads	7	$7 - 1 = 6$	$7 \times 6 = 42$
common billy button	8	$8 - 1 = 7$	$8 \times 7 = 56$
common rice-flower	4	$4 - 1 = 3$	$4 \times 3 = 12$
wallaby grass	23	$23 - 1 = 22$	$23 \times 22 = 506$
spear grass	28	$28 - 1 = 27$	$28 \times 27 = 756$
sun orchid	0		
$N =$	106		$\sum [n_i(n_i - 1)] = 2496$
$N(N - 1) =$	11 130		

Therefore:

$$\begin{aligned} \text{SID} &= 1 - \frac{\sum [n_i(n_i - 1)]}{N(N - 1)} \\ &= 1 - \frac{2496}{11\,130} \\ &= 1 - 0.224 \\ &= 0.776 \end{aligned}$$

The SID for site A is 0.776.

- a. Use the figures in the table below and the spaces provided to calculate the SID for site B. 3 marks

Species recorded at site B	n_i	$n_i - 1$	$n_i(n_i - 1)$
spiny rice-flower	0		
kangaroo grass	38		
feather heads	12		
common billy button	12		
common rice-flower	15		
wallaby grass	10		
spear grass	33		
sun orchid	2		
$N =$			$\sum [n_i(n_i - 1)] =$
$N(N - 1) =$			

Therefore:

$$SID = 1 - \frac{\sum [n_i(n_i - 1)]}{N(N - 1)}$$

$$= 1 - \frac{\quad}{\quad}$$

$$= 1 - \frac{\quad}{\quad}$$

The SID for site B is:

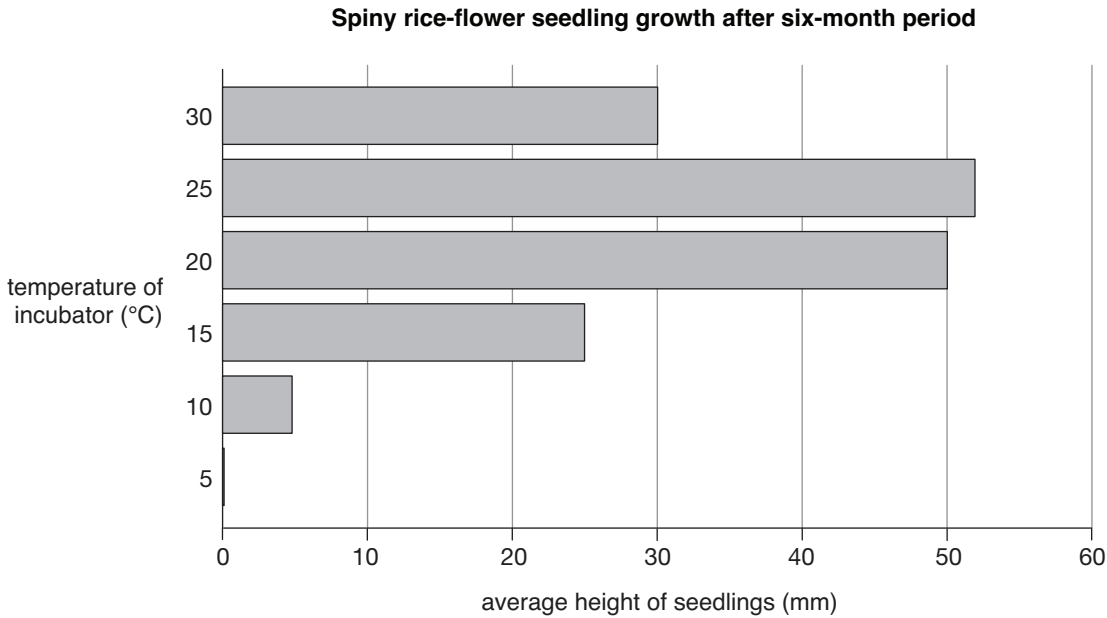
- b. Identify which site (A or B) has a higher species diversity. Justify your response. 2 marks

c. Outline **one** limitation of this study. 2 marks

d. Suggest **one** strategy the new road project could use to meet the user pays principle of sustainability. 2 marks

e. Which site (A or B) should be the location of the new road project? Explain your reasoning. 3 marks

Two scientists have been studying the spiny rice-flower as part of their conservation efforts in the area. They decided to investigate the optimal growing temperature of the spiny rice-flower. In their investigation, 100 spiny rice-flower seeds were divided into a range of incubators that were set to different temperatures. After six months, the heights of the seedlings were measured. The average height of the seedlings at each temperature is shown in the graph below



f. i. Identify the independent variable in this study. 1 mark

ii. Name **one** controlled variable in this experiment and explain why it was important to control. 2 marks

g. Describe the pattern that can be seen in the graph. Use data to support your answer. 2 marks

Question 3 (15 marks)

Lithium is a natural mineral that is used in the batteries of electric vehicles, which are capable of storing large amounts of solar energy. Some of the largest global deposits of lithium are found in the Northern Territory.

Despite the recent closures of uranium, iron ore and manganese mines in the Northern Territory, the construction of an open cut lithium mine on the border of Litchfield National Park has been approved. Litchfield National Park holds cultural significance for the Koongurrukun, Rak Mak Mak Marranunggu, Werat and Warray peoples.

- a.** Which challenge to sustainability does the lithium mine address? 1 mark

- b.** Describe **one** sociocultural impact of the lithium mine. 1 mark

- c.** Explain how the lithium mine meets the sustainability principle of intergenerational equity. 2 marks

- d.** Explain why the lithium mine does **not** meet the sustainability principle of conservation of biodiversity and ecological integrity. 2 marks

- e.** Describe how the lithium mine will affect the lithosphere. 2 marks

- f.** Describe **one** way that First Nations stakeholders could contribute knowledge and values during the decision-making process. 2 marks

- g.** The orange leaf-nosed bat is endemic to northern Australia and inhabits the caves in Litchfield National Park. The species is highly sensitive to environmental changes that impact their roosts.
Define the term ‘endemic species’ and explain why endemic species such as the orange leaf-nosed bat are important to consider in the planning of the lithium mine. 3 marks

- h.** Explain why creeks and waterways near the lithium mine need to be monitored for the duration of the project. 2 marks

END OF QUESTION AND ANSWER BOOKLET

Extra space for responses

Clearly number all responses in this space.

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