

VCE Environmental Science Unit 3

Question and Answer Booklet

2024 Trial Examination

Reading time: 15 minutes

Writing time: 1 hour

Student's Name: _____

Teacher's Name: _____

Approved materials

- Pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator

Materials supplied

- Question and Answer Booklet of 16 pages
- Answer Sheet for multiple-choice questions

Instructions

- Write your responses in English.
- Write **your name** and your **teacher's name** in the space provided above on this page.
- Unless otherwise indicated the diagrams in this booklet are **not** drawn to scale.
- Place the Answer Sheet for multiple-choice questions inside the front cover of this booklet after the examination.

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

Contents

	pages
Section A (15 questions, 15 marks)	2–7
Section B (3 questions, 45 marks)	8–16

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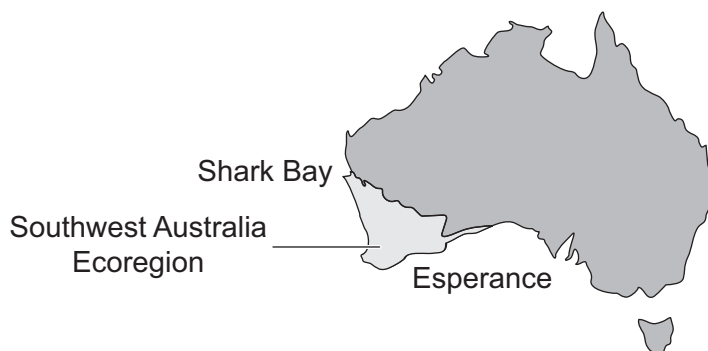
Section A – Multiple-choice questions

Instructions

- 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.

Use the following information to answer Questions 1 and 2.

The Southwest Australia Ecoregion covers 356 700 square kilometres from Shark Bay to Esperance, as shown in the following diagram. The region has been isolated for millions of years from the rest of the country by desert ecosystems and is classified as a biodiversity hotspot. It is home to around 8000 plant species, of which 75% are endemic. Approximately 34 species of reptiles are also endemic to the region. Agriculture and a plant fungal disease are the region's greatest threats, with only 30% of the original vegetation remaining intact.



Question 1

Which one of the following is a key reason why the Southwest Australia Ecoregion is classified as a biodiversity hotspot?

- A. It covers 356 700 square kilometres of land.
- B. It has been isolated for millions of years from the rest of Australia.
- C. 75% of its 8000 plant species are endemic.
- D. Agriculture is a major threat to its survival.

Question 2

Agriculture is a major threat to the survival of the Southwest Australia Ecoregion.

This is most likely because

- A. the crops grown on agricultural land outcompete native plants for space.
- B. the methane released from cattle disrupts the photosynthesis cycles of native plants.
- C. Australian crops are sprayed with pesticide containing dichlorodiphenyltrichloroethane (DDT), which disrupts the breeding cycles of reptiles.
- D. land must be cleared for agriculture, leading to habitat loss for native species.

Question 3

Photosynthesis is an example of a

- A. supporting service.
- B. provisioning service.
- C. regulating service.
- D. cultural service.

Question 4

Following a mass extinction event, there is mass diversification of species due to

- A. a wide range of ecological niches being open.
- B. a change in predator–prey relationships.
- C. increased gene flow between populations of the same species.
- D. a reduction in photosynthesis.

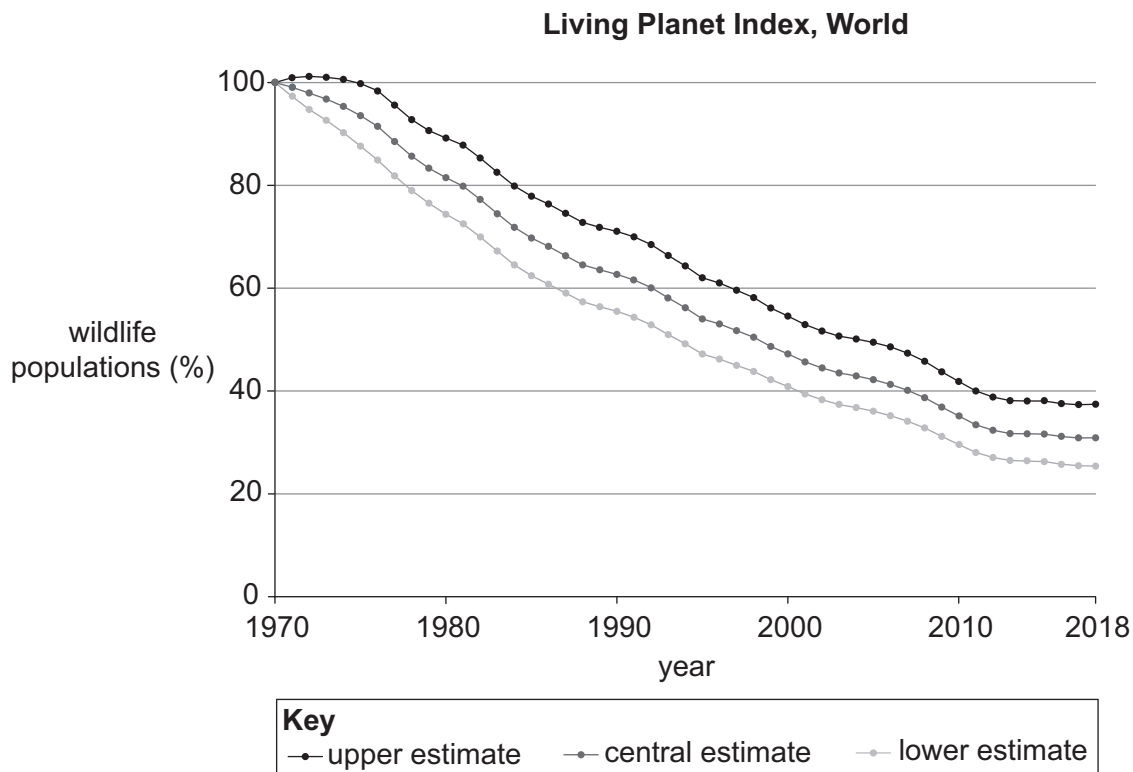
Question 5

Which one of the following is a reason why the genetic diversity in populations should be protected and conserved?

- A. Populations with high genetic diversity are susceptible to inbreeding.
- B. Populations with high genetic diversity are likely to survive environmental disruption.
- C. Populations with low genetic diversity will interbreed with other species, causing illness in their offspring.
- D. Mutations do not occur in populations with high genetic diversity.

Use the following information to answer Questions 6 and 7.

The following graph shows the average change in global wildlife populations compared to a baseline figure taken in 1970. It includes figures from 30 000 different wildlife populations from all biomes on Earth.



Source: Adapted from Ritchie H, Spooner F and Roser M (n.d.), 'Living planet index, World' [chart], *Biodiversity*, Our World in Data website. Accessed April 2024. <https://ourworldindata.org/biodiversity>.
 Licensed under CC BY 4.0, <https://creativecommons.org/licenses/by/4.0/legalcode.en>.
 Data from World Wildlife Fund (WWF) (2022), *Living Planet Report 2022 – Building a nature-positive society* and Ledger SEH et al (2022), *Wildlife Comeback in Europe: Opportunities and challenges for species recovery*.

Question 6

According to the central estimate in the graph, the percentage decrease in global wildlife populations from 1970 to 2018 was closest to

- A. 30%
- B. 70%
- C. 130%
- D. 170%

Question 7

Which one of the following is the most likely reason why the data is presented as a range of estimates?

- A. The data collated for the graph is based solely on qualitative evidence.
- B. The values in the graph account for systematic errors that may have been made during data collection.
- C. The data in the graph is not based on evidence.
- D. Although the data is based on evidence and quantitative values, there is always uncertainty in measurements.

Use the following information to answer Questions 8 and 9.

The orange-bellied parrot (*Neophema chrysogaster*) migrates annually between Tasmania and mainland Australia; it breeds in Tasmania then migrates to Victoria during winter to feed in the coastal dunes of the Bellarine Peninsula and Port Phillip Bay. The orange-bellied parrot is listed as Critically Endangered on both the IUCN Red List of Threatened Species and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). In 2010, it was estimated that there were 50 orange-bellied parrots remaining in the wild. In 2022, it was reported that 74 orange-bellied parrots were located in the Tasmanian wilderness.

Question 8

Although the number of orange-bellied parrots in the wild increased by approximately 48% from 2010 to 2022, the species is still classified as Critically Endangered.

This is most likely because the

- A. population estimates are inaccurate.
- B. current population is still low and so the species is still at extreme risk of extinction.
- C. orange-bellied parrot is at risk of genetic swamping.
- D. stakeholders involved in the protection and conservation of the species are still concerned about the species's survival.

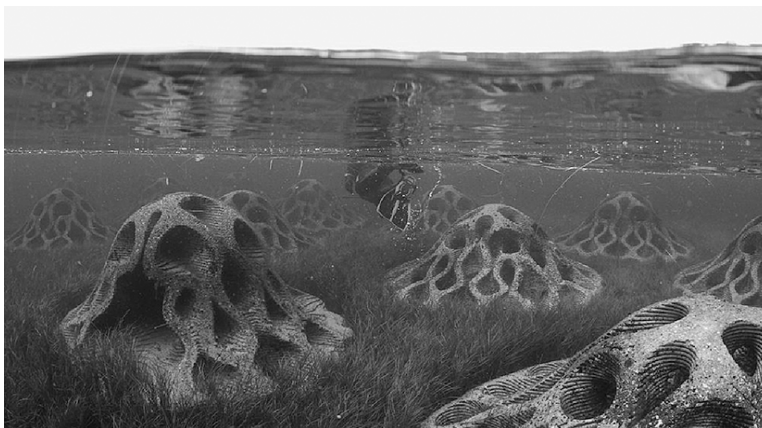
Question 9

Which one of the following describes the degree of endemism of the orange-bellied parrot?

- A. The orange-bellied parrot is endemic to south-eastern Australia.
- B. The orange-bellied parrot is endemic to Tasmania.
- C. The orange-bellied parrot is endemic to Victoria.
- D. The orange-bellied parrot is not endemic because it migrates.

Use the following information to answer Questions 10–12.

As part of the City of Greater Geelong's Climate Change Response Plan, an artificial reef was installed in Clifton Springs. The reef is composed of 46 Erosion Mitigation Units (EMUs), which are made of a concrete mixture that includes recycled shells. Examples of these EMUs are shown in the photograph below. Each unit is designed to provide habitats for fish and marine invertebrates, as well as protection against coastal erosion.



Source: Reproduced from Reef Design Lab (2023), *EMU Erosion mitigation units*, Reef Design Lab website. Accessed November 2023. <https://www.reefdesignlab.com/emu>.

Question 10

The City of Greater Geelong stands to benefit from the artificial reef because the reef may attract tourists looking to snorkel in the waters of Clifton Springs.

This is an example of

- A. a sociocultural value system.
- B. an ecocentric dimension of sustainable development.
- C. an anthropocentric value system.
- D. a circular economy project plan.

Question 11

Which one of the following best describes the project's application of intragenerational equity?

- A. Future generations will need to replace the EMUs as they erode over time.
- B. The current generation will benefit from a decrease in seafood prices, while future generations will benefit from a decrease in coastal erosion.
- C. The current generation will benefit from the ability to snorkel with increased marine diversity in the region.
- D. Future generations will see a reduction in greenhouse gas emissions due to the use of recycled products in the EMUs.

Question 12

Which one of the following statements is the most true regarding the long-term management of the artificial reef?

- A. Stakeholders should be regularly consulted to establish their ongoing support for the project.
- B. Ongoing biodiversity surveys should be undertaken to monitor ecosystem health.
- C. Long-term management of the reef is unnecessary, as the EMUs will become native habitats over time.
- D. The long-term economic benefits of the project outweigh the ecological benefits.

Question 13

Which one of the following statements regarding sustainable development is correct?

- A. Sustainable development is implemented to achieve global sustainability in the face of a growing population.
- B. Sustainable development is a value system established to negate the effects of global energy use.
- C. The sociocultural dimension of sustainable development ensures that all humans have equal access to food security.
- D. Water scarcity issues will be eradicated for future generations when sustainable development is implemented globally.

Use the following information to answer Questions 14 and 15.

Two Environmental Science students designed a project that aimed to monitor the health of their local river, which is fed from an underground aquifer. Once per day for five weeks, the students used a pH probe to measure the acidity of the water at three points along the river and collected the data.

Question 14

The students' project focused mainly on Earth's

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

Question 15

Which one of the following is a systematic error that could have been made during the project?

- A. On the second day of measuring the acidity of the water, the students realised that the batteries in the pH probe needed to be replaced.
- B. High rainfall occurred during week 1 of the project, impacting the pH levels of the water over a one-week period.
- C. The pH probe was not calibrated for the duration of the project.
- D. Each day, there were slight alterations in the points at which the students measured the acidity of the water.

End of Section A

Section B

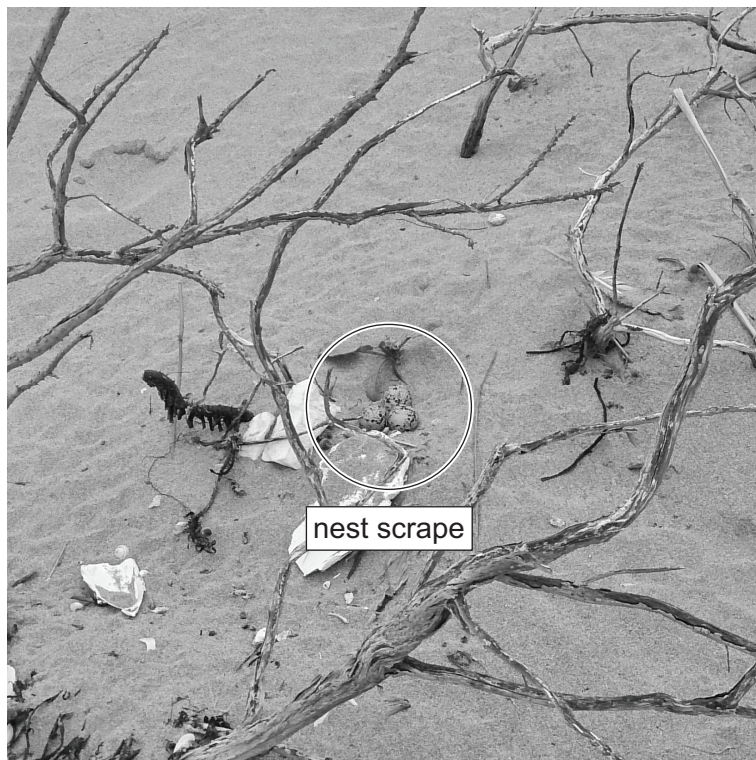
Instructions

- Answer **all** questions in the spaces provided.
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Question 1 (13 marks)

The hooded plover (*Thinornis cucullatus*) is a Vulnerable coastal bird species that is endemic to southern and south-eastern Australia. It inhabits open sandy beaches and feeds on invertebrates near the water's edge.

Hooded plover pairs nest from August through to March each year, building small scrapes (shallow depressions) in the sand above the high-tide mark, as shown in the photograph below. They prefer open areas with little to no vegetation for their nests, in which their eggs incubate for 28 days. Once hatched, it takes a further 35 days for the chicks to learn to fly.



Source: Reproduced with permission from Crowcroft, Pete (2014).

The main threats to the hooded plover are low breeding success and predation from non-native species. Conservationists suggest that rising sea levels due to climate change will also impact species numbers in the near future.

Attempts at captive breeding of the hooded plover have been unsuccessful. Other conservation strategies that have been attempted include community engagement and education, managing the population of foxes in the areas inhabited by the hooded plover and limiting beach use around nesting areas.

- a. Explain why the hooded plover's nesting habits may lead to low breeding success. 3 marks

- b. Why will rising sea levels pose a threat to the hooded plover? 1 mark

- c. Explain how limiting beach use around nesting areas could help to protect and maintain hooded plover populations. 2 marks

- d. Describe **one** way in which the hooded plover provides a cultural ecosystem service. 2 marks

- e. The hooded plover is listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988* (Vic).
What does this mean for the hooded plover? 1 mark

- f.** Outline **one** reason why captive breeding has been unsuccessful as a conservation strategy.

2 marks

- g.** As part of the community engagement and education conservation strategy, volunteer groups record hooded plover population numbers throughout breeding seasons.

Identify **one** limitation of this strategy and how it affects the data collected.

2 marks

Question 2 (14 marks)

The local council of a rural coastal region in Victoria has begun a long-term fieldwork study in a section of heathland, with an aim to assess long-term changes in biodiversity and ecological integrity.

Initial data was collected from three sites in the heathland. Table 1 shows the raw data, and table 2 shows the processed data. The data was processed by calculating the Simpson's Index of Diversity (SID) for each site.

Table 1: Abundance of species at each site

Species	Site 1	Site 2	Site 3
sweet wattle	1	0	1
Angahook pink fingers orchid (endangered)	4	0	1
common flat-pea	1	8	2
thatch saw-sedge	3	4	1
black garden ant (introduced)	4	45	0
scented sundew	10	2	4
common heath	2	4	4
twig looper moth	1	5	1
coast bush-pea (rare)	1	0	0

Table 2: Simpson's Index of Diversity (SID) for each site

Site	SID
1	0.83
2	0.54
3	0.86

- a. Evaluate the species diversity of the three sites.

3 marks

- b.** Explain how the raw data in table 1 impacted the calculated values in table 2. 2 marks

- c.** Compare the ecological integrity of the three sites. 2 marks

- d.** A local conservation group has offered to use an organic pesticide to eradicate the population of black garden ants at site 2 and subsequently improve the diversity of native insects.

Would this process be successful? Justify your answer.

2 marks

- e.** Explain why initial data collection is an important part of fieldwork. 2 marks

- f. It has been suggested that the initial data is insufficient to ensure a valid study. Explain whether this suggestion is correct. In your response, make clear your understanding of the term 'valid'.

3 marks

Question 3 (18 marks)

In recent years, electric vehicles have become more popular in Australia; however, public infrastructure to charge electric vehicles remains scarce.

A local council has proposed the construction of a new electric vehicle charging station along a major freeway. The proposal includes a purchase of solar photovoltaic cells to cover the roof of the station.

The local council is considering the following two sites for the station.

- Site A is on land that is already owned by the council. It contains several large native eucalypt trees, and recent biodiversity surveys have noted that the striped legless lizard (*Delma impar*), which is categorised as Endangered, can be found at the site. The site sits along a section of the freeway, and there is an existing exit ramp that leads to the site.
- Site B is on land that would need to be purchased from a local landowner. It was used for sheep grazing in the 1960s and is therefore clear of large trees and vegetation. The site sits along a section of the freeway that would require the construction of an exit ramp to allow vehicle access to the site.

- a. Does this project meet the sustainability principle of intergenerational equity? Justify your answer.

2 marks

- b. Using examples, explain how this project could proceed in a way that demonstrates circular economy thinking. In your response, make clear your understanding of the term 'circular economy thinking'.

3 marks

- c. Evaluate which site (A or B) would be the better option for the construction of the charging station, with reference to the three dimensions of sustainable development. In your response, make clear your understanding of the term 'sustainable development'.

6 marks

[illegible]

- d.** Describe how a qualitative risk analysis could be used as part of the environmental impact assessment of this project. 2 marks

- e.** Explain why this project is an example of a technocentric value system. 2 marks

- f. i.** Define 'precautionary principle'. 1 mark

- ii.** Suggest how the precautionary principle may be triggered in this project. Justify your answer. 2 marks

End of Question and Answer Booklet