Neap

Trial Examination 2023

VCE Environmental Science Unit 3

Written Examination

Suggested Solutions

SECTION A – MULTIPLE-CHOICE QUESTIONS

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**

Question 1 C

C is correct. Regulating services control the natural balance in an ecosystem and include water purification, pollination and decomposition.

A is incorrect. This option refers to provisioning services.

B is incorrect. This option refers to cultural services.

D is incorrect. This option refers to supporting services.

Question 2 D

D is correct. A population with high genetic diversity is more likely to have a greater range of alleles available and, therefore, more likely to survive rapid environmental changes.

A is incorrect. DNA mutations do not always create new alleles and thus do not always increase genetic diversity.

B is incorrect. In a large population with high genetic diversity, inbreeding is unlikely, but not impossible.

C is incorrect. Having a low genetic diversity will decrease a population's resistance to new diseases.

Question 3 A

A is correct. The movement of liquid magma in Earth's mantle layer causes tectonic plates to move, which, in turn, causes continental drift.

B, **C** and **D** are incorrect. These options refer to processes that occur on or above Earth's crust (lithosphere). Therefore, they are not able to cause the movement of tectonic plates.

Question 4 C

In 2010, there were 23 threatened reptile species.

In 2022, there were 48 threatened reptile species.

The difference between these values is 48 – 23 = 25.

$$\frac{25}{23} = 1.0869$$

$$1.0869 \times 100 = 109\%$$

Note: Students may also use 22 for the 2010 value and 49 for the 2022 value; in this case, 110% is still the closest value of the 4 options.

Question 5 A

A is correct. Declining reptile species become threatened over time, causing an increase in the number of threatened reptile species.

B is incorrect. Although advancements in technology have lead to the improvement of biodiversity assessment technology, this option refers to a specific period in time and is not the most likely reason for the increase in the number of threatened reptile species.

C is incorrect. Funding for captive breeding programs has increased since 2001.

D is incorrect. Although loss of native vegetation would lead to a loss of reptile species, it would not allow for improved assessment of reptile species.

Question 6 B

B is correct. Extinct In The Wild is the category of the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species assigned to species that only survive in captivity; it is a greater threat than Critically Endangered.

A and **C** are incorrect. Endangered and Vulnerable are categories of lesser threat than Critically Endangered.

D is incorrect. Threatened is a category of the *Flora and Fauna Guarantee Act* (Vic), not the IUCN Red List of Threatened Species.

Question 7 D

D is correct. Ecocentrism is a perspective that intrinsically values all of nature. Alex and Jamie's plan of revegetating the land and restoring it to its original state suggests they hold ecocentric values.

A is incorrect. The scenario does not indicate that any legal or governmental considerations are involved in the planning of this project.

B is incorrect. Anthropocentric values are those that regard humankind, rather than nature, as the central or most important element of existence. The scenario does not reflect Alex and Jamie holding anthropocentric values.

C is incorrect. The need to appease other stakeholders would assume an anthropocentric view, which Alex and Jamie do not have.

Question 8 A

A is correct and **B** is incorrect. The independent variable in an investigation is the variable changed or manipulated to see how the dependent variable changes as a result. In this case, Alex and Jamie are investigating how the presence or absence of tussock grasses (independent variable) impacts the height of basalt greenhood orchids (dependent variable).

C and **D** are incorrect. Both the height of tussock grasses and the presence or absence of basalt greenhood plants are variables that are not controlled in this investigation.

Question 9 B

B is correct. Intragenerational equity refers to equity amongst people in the current generation. In this study, all current residents will be able to access the benefits of the development.

A is incorrect. Intergenerational equity refers to equitable distribution of natural resources across the current and all future generations. The benefits for future generations are not mentioned in the scenario.

C is incorrect. Economic equity is not a principle of sustainable development.

D is incorrect. Efficiency of resource use refers to using Earth's limited resources in a sustainable manner while minimising impacts on the environment. The use of resources is not mentioned in this scenario.

Question 10 C

C is correct. The precautionary principle states that projects should not proceed without proving that minimal or no environmental damage will occur and without taking measures to prevent environmental harm. In this scenario, the Yarra Ranges Council is required to take measures that will prevent harm to the Leadbeater's possum and Mount Donna Buang wingless stonefly, and provide evidence that minimal damage will occur.

A, **B** and **D** are incorrect. While consulting Warburton residents and local First Nations peoples and performing a biodiversity survey will inform the development of the project, the precautionary principle only applies to measures that will be taken to prevent environmental damage.

Question 11 D

D is correct. Sustainable development has an ecological dimension, a sociocultural dimension and an economic dimension.

A, **B** and **C** are incorrect. These options do not list the three dimensions of sustainable development.

Question 12 A

A is correct. Local fishermen may hold an interest in the project and contribute ideas via public forums; however, they would not be involved in the final stages of the restoration project.

B is incorrect. The Department of Environment, Land, Water and Planning is the department of the state government that is responsible for managing the environment. Therefore, they would work with the First Nations peoples leading the project during its final stages.

C is incorrect. As one of the aims of the project is to restore water to a catchment area, the local water authority would work with the First Nations peoples leading the project during its final stages.

D is incorrect. As Lake Condah is located in a national park, Parks Victoria would work with the First Nations peoples leading the project during its final stages.

Question 13 C

C is correct. The hydrosphere is the system that includes all water on Earth. As this stage of the rehabilitation project involves filling the mining pit with water to create an artificial lake and taking water from an underground aquifer, it mostly affects the hydrosphere.

A, **B** and **D** are incorrect. The biosphere is the system that includes all life on Earth; the lithosphere is the system that includes all land and rock on Earth; and the atmosphere is the system that includes all gases on Earth. These systems will be affected by this stage of the rehabilitation project in some way, but they are not the systems most significantly affected.

Question 14 B

B is correct. Circular economy thinking is driven by the idea that environmental impacts can be reduced by minimising consumption and productively using natural resources. In this case, using the cleared timber to build the education centre minimises waste, resources and energy consumption.

A is incorrect. In this scenario, the living trees have not been preserved, meaning that the natural resources provided by the trees will not be available for future generations.

C is incorrect. The precautionary principle states that projects should not proceed unless there is enough evidence to prove that minimal or no environmental damage will occur. There is no reference to potential environmental damage in the scenario.

D is incorrect. An environmental impact assessment evaluates the likely environmental impacts of the project. There is no reference to an environmental impact assessment in the scenario.

Question 15 D

D is correct. The number of people visiting the lake may impact the health of the lake; however, this measurement would not monitor changes to the lake that are relevant to the rehabilitation project.

A, **B** and **C** are incorrect. These measurements would be used to monitor different aspects of the lake's health, which would contribute to an understanding of whether the rehabilitated mine is affecting the local environment.

SECTION B

Question 1 (13 marks)

a. *For example, any one of:*

- One possible threat is introduced predators. Foxes may enter the orange-bellied parrot's habitat from nearby farmland and hunt the parrot.
- One possible threat is introduced predators. Domestic cats may enter the orange-bellied parrot's habitat from the new housing estates and hunt the parrot.
- One possible threat is inbreeding. Due to its small population size, orange-bellied parrots may breed with close genetic relatives, increasing their susceptibility to disease.
- One possible threat is loss of habitat. The loss of the Tasmanian old-growth forests due to deforestation may impact the orange-bellied parrot's breeding cycle.

2 marks
1 mark for identifying a possible threat.
1 mark for describing the threat.

b. *Any one of:*

- Cultural services are non-material benefits of an ecosystem that are valuable to the social and mental well-being of humans, such as recreational services or cultural identity. The orange-bellied parrot contributes to cultural services as bird watchers may enjoy observing and photographing them, leading to social and recreational benefits for the bird watchers.
- Ecosystems can provide supporting services to humans through the transformation of environmental resources. The orange-bellied parrot disperses the seeds of native plant species such as beaded glasswort, which assists the health of the saltmarsh ecosystem and may protect local towns from coastal flooding.

3 marks
1 mark for identifying a relevant ecosystem service.
1 mark for describing the ecosystem service.
1 mark for linking the ecosystem service to the orange-bellied parrot.

c. The orange-bellied parrot is legally protected from harm in Victoria. 1 mark

d. Genetic diversity could be maintained by selectively mating the captive orange-bellied parrots to prevent inbreeding. 1 mark

This could be achieved by using detailed genetic records or genetic material from a gene bank to ensure that unrelated, or less closely related, orange-bellied parrots breed in the captive population. 1 mark

e. *Any one of:*

- Natural and introduced predators are still found in the orange-bellied parrot's Victorian habitat, meaning that the reintroduced parrots may continue to be preyed upon in their habitat.
- Due to the speed at which housing estates are constructed, reintroduced orange-bellied parrots may not be able to adapt to the speed at which their habitat and food sources are lost.
- Other animal species will compete for the orange-bellied parrot's food sources, meaning that the reintroduced parrots may be dominated by these competitors and thus lose access to their food sources.

2 marks
1 mark for providing an appropriate reason.
1 mark for explaining why this reason makes reintroduction programs unsuccessful.

f. *For example:*

Protection through legislation would involve legally protecting the saltmarsh areas in which the orange-bellied parrot lives. By legislating protection, the saltmarsh areas would be safeguarded against being used for the construction of new housing estates. Therefore, this would protect the habitat and food sources of the orange-bellied parrot.

3 marks

1 mark for identifying a relevant strategy.
1 mark for describing the strategy.
1 mark for explaining how the strategy assists with the conservation of the orange-bellied parrot.
Note: Accept responses that refer to removing predators by baiting, building predator-proof fences or removing livestock to protect food sources.

Question 2 (17 marks)

a.

Species recorded at site B	$\mathbf{n_i}$	$\mathbf{n_i - 1}$	$\mathbf{n_i(n_i - 1)}$
spiny rice-flower	0		
kangaroo grass	38	**38 – 1 = 37**	**38 × 37 = 1406**
feather heads	12	**12 – 1 = 11**	**12 × 11 = 132**
common billy button	12	**12 – 1 = 11**	**12 × 11 = 132**
common rice-flower	15	**15 – 1 = 14**	**15 × 14 = 210**
wallaby grass	10	**10 – 1 = 9**	**10 × 9 = 90**
spear grass	33	**33 – 1 = 32**	**33 × 32 = 1056**
sun orchid	2	**2 – 1 = 1**	**2 × 1 = 2**
N =	**122**		$\mathbf{\sum[n_i(n_i - 1)] = 3028}$
N(N – 1)	**14 762**		

Therefore:

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

$$= 1 - \frac{\mathbf{3028}}{\mathbf{14\ 762}}$$

$$= 1 - \mathbf{0.2051}$$

The Simpson's Index of Diversity (SID) for site B is: **0.795**

3 marks

Award 1 mark for some correct table entries and calculations.
Award 2 marks for correct table entries and significant progress in the calculation (including minor errors that result in an incorrect final answer).
Award 3 marks for correct table entries, correct calculations and correct final answer.

b. Site B has a higher species diversity. 1 mark

Site A has a SID value of 0.776, while site B has a SID value of 0.795. As a higher SID value equates to a higher species diversity, site B has a higher species diversity. 1 mark

Note: Students must refer to SID values to receive full marks.
Consequential on answer to ***Question 2a.***

c. *For example, any one of:*

- Data collected from only two sites can limit the data recorded about species in the area.
- The SID only considers the quantitative values of species, which does not account for endangered species.

2 marks
1 mark for identifying an appropriate limitation.
1 mark for outlining how the limitation may impact the study.

d. *For example:*

A toll road could be created from the new road project, meaning that drivers would be paying for its use.

2 marks
1 mark for identifying an appropriate strategy.
1 mark for explaining how the strategy meets the user pays principle.

e. *Any one of:*

- Site A should be used for the new road project. Site B should be protected as it has a greater SID value than site A and therefore a greater species diversity. Thus, site A should be used, despite the presence of the spiny rice-flower.
- Site B should be used for the new road project. Site A should be protected as it houses a population of the critically endangered spiny rice-flower. Thus, site B should be used, despite its greater species diversity.

3 marks
1 mark for identifying which site should be used.
1 mark for explaining why the other site should be protected.
1 mark for explaining the effect of using the identified site for the road project.

f. **i.** temperature of incubator (°C) 1 mark

ii. *Any one of:*

- The number of seeds in each incubator should have been controlled to ensure that each average height calculated at the end of the investigation used the same amount of data.
- The length of time the seeds were in the incubator should have been controlled to ensure each seed was evenly exposed to the independent variable.
- The amount of water given to each seed should have been controlled to ensure that each seed was exposed to the same abiotic factors.
- The type of soil used in each incubator should have been controlled to ensure each seed was growing in the same environment.

2 marks
1 mark for identifying a variable that should have been controlled.
1 mark for explaining why the variable is important to control.

g. As the temperature increases, the height of the seedlings increases up to a certain point. 1 mark

For example, at 5°C the seedlings did not grow at all. At 25°C, the seedlings grew to a height of 53 mm. At 30°C, the seedlings grew to only 30 mm. 1 mark

Question 3 (15 marks)

a. energy 1 mark

b. *For example, any one of:*

- The mine provides stable work opportunities for mine workers, allowing them to support their families.
- Land that is culturally significant to First Nations peoples may be destroyed by the new mine.
- Litchfield National Park may be degraded by the new mine, which will negatively impact visitation to the area.

1 mark

c. The lithium mine will maintain natural resources that may benefit future generations 1 mark
by promoting the development of renewable resource infrastructure such as electric vehicles. 1 mark

d. The mine will extensively damage the land on which it is built, 1 mark
which will negatively impact the native species in the area. 1 mark

e. Rock and earth will be extracted to create the mine, 1 mark
which can cause long term damage to the lithosphere such as creating sinkholes or changing aquifers and bedrock. 1 mark

f. *For example, any one of:*

- First Nations stakeholders could contribute to the decision-making process by providing ideas that involve traditional land management values and practices. This contribution could be ongoing, as part of the Environmental Management System of the project, or occur once, as an initial consultation during the stakeholder consultation phase of the project planning.
- First Nations stakeholders could contribute knowledge and values about traditional land practices during the consultation process. This can help the developers understand the cyclical nature of the landscape and how traditional land management practices may be implemented.

2 marks

1 mark for identifying a way that First Nations stakeholders could be involved in the project.
1 mark for providing further detail of how First Nations stakeholders would share knowledge and values.

g. *For example:*

Endemic species are found only in one specific geographic location and do not exist anywhere else in the world.

The orange leaf-nosed bat is found only in northern Australia. They are important to consider as their endemic nature means they are vulnerable to environmental changes.

The large-scale land changes involved with the construction of an open cut mine may alter the caves that the orange leaf-nosed bat lives in, leading to loss of biodiversity in Litchfield National Park.

3 marks

1 mark for defining 'endemic species'.
1 mark for explaining why the orange leaf-nosed bat is important to consider.
1 mark for linking the orange leaf-nosed bat to the lithium mine project.

h. Wastes, toxins and other pollutants from the mine may leak into nearby waterways, degrading the environment and local species. 1 mark

Monitoring the waterways for the duration of the project can ensure that any negative impacts are minimised. 1 mark

