Neap

Trial Examination 2022

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. Ecosystem diversity refers to the variety of all habitats, ecosystems and processes in the living world (biosphere).

A is incorrect. This option refers to living things that are found in only one ecosystem.

B is incorrect. This option describes species richness.

D is incorrect. This option refers to the lithosphere (land only) rather than the biosphere.

Question 2 D

D is correct. When environmental conditions change, existing traits in the population may become beneficial, neutral or detrimental. Over time, natural selection results in organisms with beneficial traits increasing in frequency relative to those organisms without the traits or vice versa. Selection pressures do not change in stable environmental conditions, so evolution will not occur.

A is incorrect. Evolution does result in a greater number of individuals better suited or adapted to an environment.

B is incorrect. Evolution may favour new genes via mutation, which would lead to new genes in a gene pool.

C is incorrect. Favourable genes are reproduced during evolution.

Question 3 B

B is correct. Genes are a sequence of nucleotides in deoxyribonucleic acid (DNA) that give instructions for making a protein.

A is incorrect. A chromosome can hold many genes of different lengths.

C is incorrect. Each person has their own individual DNA sequence.

D is incorrect. Genetic drift refers to alleles leaving a population due to chance events. This cannot be prevented by genes.

Question 4 A

A is correct. Provisioning services are those that work to keep the individuals in an ecosystem healthy; pollination allows for the provision of resources such as crops.

B is incorrect. Regulating services are those that work to keep the ecosystem in balance.

C is incorrect. Cultural services refer to social benefits that humans obtain from resources.

D is incorrect. 'Pollinating services' is not a relevant term.

Question 5 D

D is correct. The *Flora and Fauna Guarantee Act* (Vic) ensures that populations are legally protected from harm in Victoria.

A is incorrect. Nurseries may still cultivate and sell protected species if they have access to seeds prior to the plant being listed in the *Flora and Fauna Guarantee Act* (Vic).

B is incorrect. The *Flora and Fauna Guarantee Act* (Vic) only protects species in Victoria, not throughout Australia.

C is incorrect. While two populations of Merran's sun orchid are found in Moggs Creek and are protected, this would not affect the land in the rest of Moggs Creek.

Question 6 A

A is correct. Merran's sun orchid is stated to be found only in Victoria, which means it is not found anywhere else in the world.

B and **C** are incorrect. There not enough information provided to assume that the orchid could be susceptible to genetic swamping or inbreeding.

D is incorrect. While Merran's sun orchid is currently only found in Victoria, there is no information to suggest it was ever present in New South Wales.

Question 7 C

C is correct. Quadrat sampling is the most appropriate method for sampling small plant species.

A is incorrect. Transect sampling is only appropriate for sampling zonation changes, which is not relevant to this scenario.

B is incorrect. Mark-recapture sampling is only appropriate for mammals or larger animals.

D is incorrect. The collection method would involve removing individual plants from the population; this would be inappropriate as Merran's sun orchid is listed as endangered.

Question 8 B

B is correct. Counting the orchids would not classify as a safety or ethical consideration.

A and **D** are incorrect. Wearing a hat to prevent sun damage and avoiding insect bites are safety considerations for outdoor fieldwork.

C is incorrect. Taking care not to disturb mammal species is an ethical consideration for field studies.

Question 9 D

D is correct. The key focus of the mining project is the lithosphere; the mines operate on the upper soil and rock layers of the Earth's crust.

A is incorrect. The hydrosphere specifically refers to all water on Earth.

B is incorrect. The biosphere specifically refers to all living things on Earth.

C is incorrect. The atmosphere specifically refers to all air on and surrounding Earth.

Question 10 B

B is correct. An environmental impact assessment (EIA) is based determining whether a development is compliant with environmental legislation. Stakeholder opinions about the development are not included in an EIA because they are subjective.

A, **C** and **D** are incorrect. These options contain information that would be included in an EIA.

Question 11 B

B is correct. The dependent variable is the variable that is measured in an experiment/study. In this case, the number of whales is the measurement being taken.

A and **C** are incorrect. The time of day and number of people in the area are not the variables that are being measured.

D is incorrect. The total number of whales is being counted, not just the calves.

Question 12 B

B is correct. Ecocentrism is the perspective that places intrinsic value on entire species and their natural environments (rather than individual organisms).

A is incorrect. Anthropocentric views place importance on humans over all other species.

C is incorrect. Biocentric views are the belief that biology is the central and driving science of the universe. This question is describing the ecosystem, rather than the organisms within.

D is incorrect. 'Gene-centric' is not a relevant vocabulary term.

Question 13 C

C is correct. The user pays principle refers to the idea that the price of a project or a resource should be reflected onto consumers. This could be applied to the project if tourists pay a fee to enter the surf reserve.

A, **B** and **D** are incorrect. The user pays principle refers to the consumer paying a cost for a resource after the project is complete.

Question 14 B

ending value – starting value = difference between values

$$22\,500 - 15\,000 = 7500$$

$$\frac{7500}{15\,000} = 0.5$$

$$0.5 \times 100 = 50\%$$

Question 15 D

D is correct. The development will make way for more destruction of the coastal area. Intergenerational equity considers the impacts of a development on future generations and their ability to use a resource (in this case, the natural coastline).

A is incorrect. There is no information to suggest that the project has high costs.

B is incorrect. Intragenerational equity refers to access to resources for people within the same generation. Constructing the boardwalk would benefit people within this generation.

C is incorrect. The information refers to stakeholders rejecting the proposal and, although the local coast care groups are against the proposal, there are multiple stakeholders who are in favour of the proposal (for example, the developer and the organisers of the surfing contest).

SECTION B

Question 1 (16 marks)

a.

Species recorded at site B	n_i	$n_i - 1$	$n_i(n_i - 1)$
weedy seadragon	0	**0 – 1 = –1**	**0 × –1 = 0**
chiton	30	**30 – 1 = 29**	**30 × 29 = 870**
elephant snail	12	**12 – 1 = 11**	**12 × 11 = 132**
sea hare	8	**8 – 1 = 7**	**8 × 7 = 56**
decorator crab	15	**15 – 1 = 14**	**15 × 14 = 210**
common seastar	10	**10 – 1 = 9**	**10 × 9 = 90**
Northern Pacific seastar	33	**33 – 1 = 32**	**33 × 32 = 1056**
N	**108**		$\sum\left[n_i\left(n_i - 1\right)\right] = 2414$
N (N – 1)	**108 (108 – 1) = 11 556**		

Therefore:

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

$$D = 1 - \frac{\mathbf{2414}}{\mathbf{11\,556}}$$

$$D = 1 - \mathbf{0.2089}$$

Simpson's Index (D) for site B is **0.791**.

3 marks

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

b. Site A has a Simpson's Index (D) value of 0.796, while site B has a D value of 0.791. A higher D value equates to a higher species diversity. Thus, site A, with a higher D value, has a higher species diversity than site B.

2 marks

1 mark for identifying the site with highest species diversity.
1 mark for providing a suitable explanation.
Note: Appropriate data values must be included for the second mark to be awarded.
*Award marks for responses that use an incorrect D value from **part a.** to correctly respond to **part b.***

c. *For example:*

An improvement that may increase validity would be to ensure that site samples are counted at the same time on each day of the study. This will help to ensure that the day/night cycle is not affecting the results.

2 marks

1 mark for identifying relevant method for improving validity.
1 mark for providing a supporting statement about how the improvement may increase validity.

d. An endemic species is one that is found in only one specific geographical location. In this case, the weedy seadragon is endemic to Victoria.

The presence of an endemic species implies that the health and biodiversity of a site is high, as these particular species can be found nowhere else outside of this region.

2 marks

1 mark for defining 'endemic species'.
1 mark for linking the presence of an endemic species with good ecosystem health and high biodiversity.
Note: Responses are not required to use an example/identify the weedy seadragon to receive full marks.

e. Both site A and site B are within 10 kilometres of housing developments. Housing developments require roads and buildings to be constructed. In order for this to happen, land must be cleared in the area. These changes can negatively impact species in both site A and site B.

For example, any one of the following potential impacts:

- Clearing of land close to the marine ecosystems can lead to an increase in soil runoff into the marine regions, increasing turbidity in the ecosystem and affecting photosynthesis.
- Land and road runoff can increase chemical pollutants in the ecosystem.
- Increased nutrients from home gardens can lead to nitrogen and phosphorus entering the marine ecosystem.

2 marks

1 mark for identifying the potential cause for the decline in species.
1 mark for stating a potential impact.

f. Site A has 7 different species, while site B has 6. Therefore, site A has a higher species richness than site B. Site A has 25 individuals of the introduced species Northern Pacific seastar, while site B has 33. Site A has two individuals of the endemic species weedy seadragon, while site B has 0. Due to the presence of an endemic species and fewer individuals of the introduced species, it can be concluded that site A has a greater ecological integrity than site B.

3 marks

1 mark for using data in table to compare site A and site B species richness and noting that site A has a higher species richness.
1 mark for using data in the table to make some note of introduced species and/or endemic species.
1 mark for giving a comparative statement on site A and site B's ecological integrity.

f. *For example, any one of:*

- Northern Pacific seastars could be physically removed by volunteer groups. This would help reduce numbers of individuals in a particular area.
- Ballast water exchange could be mandatory for ships or vessels arriving from Japan and/or the North Pacific.
  This would help control the amount of Northern Pacific seastar larvae entering Victorian waters.

2 marks

1 mark for identifying a valid management strategy.
1 mark for providing a supporting statement about how the strategy may help control the spread of the Northern Pacific seastar.

Question 2 (13 marks)

a. $\left(\frac{16\ 200}{66\ 500}\right) \times 100 = 24\%$

1 mark

Note: Award 1 mark for the correct final answer; responses are not required to show working.

b. A primary forest is an old-growth forest OR a forest that has not previously been cleared. 1 mark

c. The swift parrot nests in the hollows of both living and dead messmate stringybark and Tasmanian blue gum trees. 1 mark

Hollows are only formed in old-growth trees, which are removed during logging. 1 mark

Even though trees will be replanted, they may not be the same species. They will be young and could take up to 100 years to form hollows that are appropriate for nesting. This will leave no habitats for the swift parrot. 1 mark

d. **i.** A seed bank is a type of gene bank. It is a place to store the DNA of threatened species. 1 mark

ii. The swift parrot relies on the Tasmanian blue gum as its only food source. 1 mark

The addition of Tasmanian blue gum seeds to a seed bank ensures that the genetic diversity of the Tasmanian blue gum survives, which means the swift parrot will always have its food source. 1 mark

iii. *For example, any one of:*

- One potential conservation strategy is protecting the forest from logging by declaring it nature reserve or national park. This would conserve and protect the habitat of the swift parrot.
- One potential conservation strategy is introducing a captive breeding program. This would protect the genetic diversity of the swift parrot.
- One potential conservation strategy is translocating swift parrot individuals from a captive breeding program into a protected area. This will increase the number of the swift parrots in the wild.

2 marks

1 mark for identifying a valid conservation strategy,
1 mark for providing a supporting statement about how the strategy may help conserve the biodiversity of the swift parrot.

e. **i.** *For example:*

It is predicted that, as temperature increases, the number of seeds that germinate will increase until 20°C. This is because as temperature increases, biochemical reactions increase. At 30°C, the proteins in the seeds may be affected by high temperature, causing reduced germination.

2 marks

1 mark for providing a valid hypothesis.
1 mark for providing a supporting statement outlining the reason for the statement of prediction.
Note: Accept any relevant reasoning and hypothesises that may link seed germination to temperature. Responses are not required to refer to biochemical reactions.

ii. temperature of seed environment (°C) 1 mark

Question 3 (16 marks)

a. *For example:*

This project does not meet the principle of intergenerational equity, but it does meet the principle of intragenerational equity.

Intergenerational equity considers the impact that a project has on future generations. As part of this, environmental, social and economic impacts must be considered. This project promotes the use of fossil fuels and non-renewable resources to power Australia; once the gas is located, it will be drilled, piped and put into the gas bank for distribution in Australia. Use of fossil fuels does not meet the principle of intergenerational equity as combustion leads to an enhanced greenhouse effect and subsequent global warming. This project may also be severely harmful on the animal species in the area, including potentially driving large mammals away, meaning that future generations may not have the ability to view the animals in their natural habitat. Finally, the fishing industry may be affected by this project, which would have a negative impact on the economy.

Intragenerational equity refers to access to resources among the same generation. This project may lead to the discovery of new natural gas reserves. Should the testing be successful, the current generation of Australians would have access to cheaper natural gas as an energy resource for a longer period.

4 marks

1 mark for identifying if the project meets the principles of intergenerational equity and intragenerational equity.
1 mark for a discussion of why the project does/does not meet the principle of intergenerational equity.
1 mark for a discussion of why the project does/does not meet the principle of intragenerational equity.
1 mark for presenting a clear understanding of both principles in a cohesive response.

b. *For example:*

Marine mammals may be frightened away or disturbed by the blasts. This may impact their migration or breeding patterns.

2 marks

1 mark for identifying a negative impact on the biosphere.
1 mark for providing further information on how the stated impact affects living organisms.
Note: A range of responses are acceptable.

c. A challenge to sustainability is energy. 1 mark

If successful, this project will result in new natural gas reserves being located. 1 mark
The natural gas will be used to provide energy to Australians for heating, electricity and manufacturing. 1 mark

Note: Accept other challenges to sustainability only if an appropriate explanation is given. No marks are awarded to responses that identify a challenge other than energy without a relevant explanation.

d. *For example:*

The precautionary principle states that we should not proceed with any project unless there is full scientific certainty that biological resources or ecosystems will not be harmed in the process. 1 mark

This tool should be used in the decision-making of this project when looking at the likelihood of the various species of whales being present in the area, as well as the chances of the giant crabs and rock lobsters being negatively impacted by the blasting. 1 mark

Because there is no scientific certainty that these species will not be harmed by the project, using the precautionary principle would mean that the project is rejected. 1 mark

Note: A range of responses are acceptable. Responses may also refer to the use of preventative measures (for example, investigating appropriate times to perform the seismic testing so that whale populations are not affected).

e. *For example, any one of:*

- Local environmentalist groups are stakeholders in this project. This group would have interest in the project due to the many environmental risks that the project would pose on the biosphere and biodiversity of the area.
- Local media outlets are stakeholders in this project. This group would play a role in informing the public about the project.
- Local employment agencies and communities are stakeholders in this project. These groups would have interest in the project due to the future employment and training opportunities provided by the project.
- Australian energy companies are stakeholders in this project. Energy companies purchase the gas to sell on to consumers. These companies need the resources to ensure they can keep costs low for consumers.

2 marks

1 mark for identifying a relevant stakeholder.
1 mark for outlining the given stakeholder's interest in the project.

f. *For example, any one of the following safety considerations:*

- Take precautions against sun damage (including wearing hats, sunscreen and long sleeves).
- Take precautions against dangerous animals that may be present in the sample area.
- Ensure that all students can swim.
- Take care when on the boat (including wearing a life jacket and following boat safety rules).

1 mark

For example, any one of the following ethical considerations:

- Take care when handling and identifying marine species.
- Do not keep the rock lobsters out of the water for too long if handling them.
- Take care not to disturb other animal species in the area.
- Take care not to damage reef or algae species with the boat's propellors.

1 mark

Note: A range of responses are acceptable. Accept other safety and ethical considerations only if they are valid and relevant to the scenario (for example, do not accept 'lab coat and safety glasses' as a safety consideration).