

VCE Environmental Science Unit 3

Suggested Solutions

2024 Trial Examination

Section A – Multiple-choice questions

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|----|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| 1 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input checked="" type="checkbox"/> C | <input type="checkbox"/> D |
| 2 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input checked="" type="checkbox"/> D |
| 3 | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 4 | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 5 | <input type="checkbox"/> A | <input checked="" type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 6 | <input type="checkbox"/> A | <input checked="" type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 7 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input checked="" type="checkbox"/> D |
| 8 | <input type="checkbox"/> A | <input checked="" type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 9 | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 10 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input checked="" type="checkbox"/> C | <input type="checkbox"/> D |
| 11 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input checked="" type="checkbox"/> C | <input type="checkbox"/> D |
| 12 | <input type="checkbox"/> A | <input checked="" type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 13 | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input type="checkbox"/> D |
| 14 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C | <input checked="" type="checkbox"/> D |
| 15 | <input type="checkbox"/> A | <input type="checkbox"/> B | <input checked="" type="checkbox"/> C | <input type="checkbox"/> D |

Question 1 C

C is correct. For a region to be declared a biodiversity hotspot, it must contain at least 1500 endemic plant species and have 30% or less of its original vegetation remaining. The Southwest Australia Ecoregion has $8000 \times 0.75 = 6000$ endemic plant species and 30% of its original vegetation, so it meets both criteria.

A is incorrect. Land coverage is not relevant to a region being classified as a biodiversity hotspot.

B is incorrect. Although isolation may impact the number of endemic species found in a region, this is not a direct reason for a region to be classified as a biodiversity hotspot.

D is incorrect. Although regions must be threatened to be classified as biodiversity hotspots, the threat of agriculture is not a specific criteria.

Question 2 D

D is correct and **A** is incorrect. Although introduced crops can outcompete native plants, mass amounts of land must first be cleared for new agricultural land to be cultivated. Land clearing leads to loss of native species and the habitats that they create, causing biodiversity loss and threatening ecosystems.

B is incorrect. Methane released from cattle does not disrupt photosynthesis cycles.

C is incorrect. Dichlorodiphenyltrichloroethane (DDT) is banned in Australia.

Question 3 A

A is correct. Supporting services are those that are necessary for the production of a healthy ecosystem; examples include soil formation and photosynthesis.

B is incorrect. Provisioning services are tangible products that humans can obtain from a healthy ecosystem; examples include food and fuel.

C is incorrect. Regulating services regulate and control Earth's spheres; examples include pollination and water purification.

D is incorrect. Cultural services are those that humans obtain through recreational or spiritual experience; examples include aesthetic values and sense of place.

Question 4 A

A is correct. When there is a mass extinction event, ecological niches that were once occupied become free. This leads to speciation due to populations being able to occupy those empty niches, resulting in mass diversification.

B is incorrect. Although mass extinction does lead to a change in predator–prey relationships, this does not directly impact the mass diversification that occurs after a mass extinction.

C is incorrect. Increased gene flow would reduce the chances of speciation and therefore does not lead to mass diversification.

D is incorrect. Photosynthesis is the process of converting solar energy to chemical energy in the form of glucose. A reduction in photosynthesis does not lead to mass diversification because they are not directly related processes.

Question 5 B

B is correct. High genetic diversity means that a population has a variety of alleles, allowing the population to adapt and become resistant to environmental disruption and changes.

A is incorrect. Populations with low genetic diversity are susceptible to inbreeding.

C is incorrect. There is no evidence to suggest that genetic diversity is linked to interspecies breeding.

D is incorrect. Mutations can still occur in populations with high genetic diversity.

Question 6 B

In 1970, global wildlife populations were at 100%. In 2018, global wildlife population were at 30%. Therefore, the percentage decrease in global wildlife populations from 1970 to 2018 was 70%.

Question 7 D

D is correct and **C** is incorrect. The graph shows average values and so does not provide specific data about specific species or populations. Therefore, any uncertainties are accounted for by presenting a range of estimates.

A is incorrect. The data in the graph is numerical; therefore, it is based on quantitative values.

B is incorrect. Systematic errors may have occurred during data collection, however, this is not the reason why the data is presented as a range of estimates.

Question 8 B

B is correct. A Critically Endangered species is at an extremely high risk of extinction in the near future. Although the number of orange-bellied parrots in the wild has increased, the risk of extinction remains extreme due to existing threats and a low population.

A is incorrect. The population estimates are likely to be accurate, as the orange-bellied parrot is heavily protected by regulatory frameworks.

C is incorrect. The question does not refer to the introduction of another population; therefore, genetic swamping is not relevant.

D is incorrect. Stakeholder values do not determine conservation categories.

Question 9 A

A is correct, and **B** and **C** are incorrect. The orange-bellied parrot migrates between Victoria and Tasmania, making it endemic to both states and thus endemic to south-eastern Australia.

D is incorrect. Migratory behaviour does not determine the degree of endemism.

Question 10 C

C is correct. An anthropocentric value system is one in which the benefit to humans is foremost. In this case, attracting tourists can bring financial gain and thus benefit the residents of the region.

A is incorrect. Sociocultural is not a type of stakeholder value system.

B is incorrect. Ecocentrism is a stakeholder value system, not a dimension of sustainable development.

D is incorrect. Attracting snorkelers to a region is not linked to circular economy thinking.

Question 11 C

C is correct. Intragenerational equity refers to equity among people of the current generation. This project will provide snorkeling opportunities for people of the current generation to enjoy marine life.

A, B and D are incorrect. These options refer to future generations and so relate to intergenerational equity.

Question 12 B

B is correct. Ongoing monitoring of biodiversity data is essential for tracking the impact of environmental projects.

A is incorrect. Stakeholder support may be investigated at the beginning of some projects but would not be a long-term priority after a project has been implemented.

C is incorrect. Long-term management is a requirement for a project's Environmental Management System (EMS).

D is incorrect. The dimensions of sustainability require that projects provide long-term economic, ecological and socio-cultural benefits. Thus, the economic benefits do not outweigh the ecological benefits in the long-term management of the project.

Question 13 A

A is correct. Sustainability is a long-term goal for Earth, while sustainable development is the mechanism by which sustainability can be achieved as the world's population increases.

B is incorrect. Sustainable development is not a value system.

C is incorrect. Although the sociocultural dimension of sustainable development relates to human wellbeing, it does not ensure equal access to food security.

D is incorrect. The implementation of sustainable development does not guarantee long-term water security.

Question 14 D

D is correct. The hydrosphere refers to all water on Earth. Given that the project aimed to monitor the health of the river, it mainly focused on the hydrosphere.

A is incorrect. The lithosphere refers to Earth's crust and upper mantle. Although the river is fed from an underground aquifer, this project focused on the hydrosphere as it aimed to monitor the health of the river.

B is incorrect. The atmosphere refers to all the gases surrounding Earth, which is not relevant to the project.

C is incorrect. The biosphere refers to all living things on Earth, which is not relevant to the project.

Question 15 C

C is correct. Systematic errors result in readings that differ from the true value by a consistent amount; this affects accuracy. An uncalibrated probe would consistently measure inaccurate pH values.

A, B and D are incorrect. These are examples of random errors.

Section B

Question 1 (13 marks)

- a. *Any one of:*
- Hooded plovers nest in open areas, which means that their nests are exposed and chicks are more susceptible to being eaten by predators, leading to low chick numbers. 1 mark
1 mark
1 mark
 - Hooded plovers nest in open areas, which means that chicks are exposed to harsh summer weather, leading to low chick numbers. 1 mark
1 mark
1 mark
- b. Rising sea levels will cause higher tides, which will lead to a loss of nesting areas for the hooded plover. 1 mark
- c. Limited beach use leads to fewer people disturbing the nests, resulting in more chicks hatching and, therefore, increases in populations. 1 mark
1 mark
- d. *For example:*
- The hooded plover encourages more bird watching, which can improve the general wellbeing of humans or their sense of place. 1 mark
1 mark
- e. The hooded plover is legally protected from harm in Victoria. 1 mark
- f. *For example, any one of:*
- An inability to truly mimic a natural habitat may result in birds not laying eggs. 1 mark
1 mark
 - Problems with introducing breeding pairs in captivity due to low numbers in the wild may lead to birds not mating. 1 mark
1 mark
 - Problems with reintroduction, may mean that birds cannot survive outside of captivity. 1 mark
1 mark
- g. *For example, any one of:*
- Volunteers are not professionals and may misidentify birds, leading to inaccurate data. 1 mark
1 mark
 - Volunteers may miscount, leading to inaccurate data. 1 mark
1 mark

Question 2 (14 marks)

- a.** Simpson's Index of Diversity (SID) measures species diversity, with a higher SID indicating greater species diversity. 1 mark
Site 1 has a SID of 0.83, site 2 has a SID of 0.54 and site 3 has a SID of 0.86, 1 mark
meaning that site 2 has the lowest species diversity, followed by site 1 and 1 mark
then site 3.
- b.** SID is a calculation of species richness, species abundance, and relative 1 mark
abundance.
Site 2 has a lower SID than sites 1 and 3 due to lower species richness 1 mark
and an uneven relative abundance resulting from the high number of black
garden ants.
- c.** Site 2 has a high abundance of introduced black garden ants and low species 1 mark
richness, which suggests low ecological integrity
compared to sites 1 and 3. Both sites 1 and 3 have the endangered Angahook 1 mark
pink fingers orchid, and site 1 also has the rare coast bush-pea. This means that
they have a higher ecological integrity.
- d.** This process would be unsuccessful because pesticides kill all insects, not just 1 mark
black garden ants.
Therefore, the diversity of both native and introduced insects would decrease. 1 mark
- e.** Initial data can act as baseline data, 1 mark
offering a long-term comparison for the life of the study. 1 mark
- f.** A valid study is one that measures what it sets out to measure, as stated in the aim. 1 mark
A study of three sites provides a limited amount of data; therefore, the overall
biodiversity and ecological integrity of the heathland is unlikely to be truly 1 mark
represented in the data,
leading to an invalid study. Therefore, the suggestion is correct. 1 mark

Question 3 (18 marks)**a.** *For example:*

This project does meet the sustainability principle of intergenerational equity. It provides for future generations by promoting the use of renewable energy sources, reducing carbon emissions and mitigating the impacts of the enhanced greenhouse effect.

1 mark

The project provides for current generations by building infrastructure that enables them to charge electric vehicles.

1 mark

b. *For example:*

Circular economy thinking is driven by the idea that environmental impacts can be reduced by reusing the outputs (or waste) of one process as inputs for another process.

1 mark

To demonstrate circular economy thinking, this project could use resources that are already available at the chosen site or previously reclaimed resources to construct the charging station.

1 mark

This may include the use of timber from trees located on the site or the use of reclaimed or recycled timber, which would reduce the environmental impact of using newly felled logs for timber.

1 mark

c. *For example:*

Sustainable development is development that meets the needs of the current generation without impacting the ability of future generations to meet their own needs. Site B would be the better option because it better meets the three dimensions of sustainable development than site A.

1 mark

In terms of the ecological dimension, site B is already clear of native vegetation, negating the need for any land clearing.

1 mark

Site A is a known habitat of an Endangered species; therefore, the use of this site would not successfully meet the ecological dimension of sustainable development, as it would threaten ecological integrity.

1 mark

In terms of the sociocultural dimension, site B requires the construction of an exit ramp, which would provide employment for local residents and potentially improve their standards of living. However, the construction of the ramp for site B may impact local residents by creating noise pollution, which should also be considered.

1 mark

Site A would not offer the same improvements to standards of living but would not contribute as much noise pollution.

1 mark

Both sites may meet the economic dimension of sustainable development by improving the economic outcomes for local towns and residents through income generated by the sale of goods and services at the charging station and any surrounding businesses.

1 mark

Note: Responses may argue that site A or site B is the better option but must provide a clear evaluation based on the three dimensions of sustainable development.

d. *For example:*

A qualitative risk analysis is a tool that can be used to analyse the risks, hazards and likely occurrence of environmental impacts of a project. 1 mark

It could be implemented in this project by investigating risks such as the impacts on the health of local residents during construction, or the impacts on local biodiversity from the extra traffic in the area. 1 mark

e. Technocentric value systems are centred on the use of technology to protect the environment. 1 mark

In this case, the use of electric vehicles and their charging needs are both examples of new technology being implemented to meet the needs of environmental protection. 1 mark

f. i. The precautionary principle states that a project should not proceed without sufficient evidence that the environment will not be harmed. 1 mark

ii. The precautionary principle may be triggered if site A is selected. Given that biodiversity surveys have noted that an Endangered species inhabits the site, further population sampling should be conducted to determine the species' abundance before the project proceeds. 1 mark