

STUDENT NAME



**Victorian Certificate of Education
2011**

ENVIRONMENTAL SCIENCE

**Trial Written Examination 1
May 2011**

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	5	5	70
			Total: 90

Materials

- Question and answer book of 21 pages.
- Answer sheet for multiple choice questions.
- At least one pencil and eraser.
- One scientific calculator.
- A Graphics Calculator is not allowed

Instructions

- Write your **student name** and **class** in the space provided on this book
- Write your student name and class in the space provided on your answer sheet for multiple-choice.
- All written responses must be in English.
- Time allowed: 15 minutes reading time, 90 minutes writing time

At the end of the examination

- Place the answer sheet for multiple choice questions inside the front cover of this question and answer book.

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Please note this is a practice exam only and its degree of hardship and content is different to the end of Unit 3 exam. VAEE takes no responsibility for your success in completing the actual VCE Environmental Science Unit 3 exam.

SECTION A—Multiple-choice questions

Specific instructions for Section A

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.

Question 1

Which of the following energy sources is renewable and **does** generate greenhouse gas emissions when converting it into a useful form?

- a) Solar
- b) Geothermal
- c) Uranium
- d) Biomass

Answer: D Biomass

Question 2

Which of the following energy sources emits the lowest concentration of carbon dioxide per unit of energy released?

- a) Coal
- b) Natural Gas
- c) Biomass
- d) Nuclear

Answer: D Nuclear (*Nuclear does not produce any CO₂ emissions*)

Question 3

The natural greenhouse effect is caused mainly by the:

- a) increase in the greenhouse gases due to human activity
- b) trapping by the atmosphere of radiation re-emitted by the earth's surface
- c) direct trapping of visible light and ultra-violet radiation by the ozone layer
- d) trapping by the atmosphere of infra-red radiation re-emitted by the earth's surface

Answer: d) trapping by the atmosphere of infra-red radiation re-emitted by the earth's surface

Question 4

Which of the following greenhouse gases has the greatest capacity to absorb infra-red radiation in the atmosphere?

- a) Carbon dioxide
- b) Methane
- c) Water vapour
- d) Ozone

Answer: B Methane

The following information relates to questions 5-8

1 tonne = 1000 kg

kilo (k) = 10^3

mega (M) = 10^6

The East-West Treatment Plant harnesses methane produced from the breakdown of waste during the treatment of sewerage and uses it as an electrical power source. It uses highly efficient electrical generators that can run on the methane gas produced during sewage.

Each kilogram of methane produces 50MJ of energy.

Question 5

The combustion of methane is an important step in the production of electricity. This process is best described as:

- a) An exothermic reaction
- b) An endothermic reaction
- c) Conversion of potential energy to chemical energy
- d) Conversion of chemical energy to potential energy

Answer: A an Exothermic reaction

Question 6

The plant burns approximately 15 tonnes of methane per hour.

Which of the following is the best estimate of the methane energy used per hour?

a) 7.5×10^5 MJ

b) 3.2×10^5 MJ

c) 7.5×10^3 MJ

d) 3.2×10^3 MJ

Answer: A ($50 \times 1000 \times 15 = 750000$)

Question 7

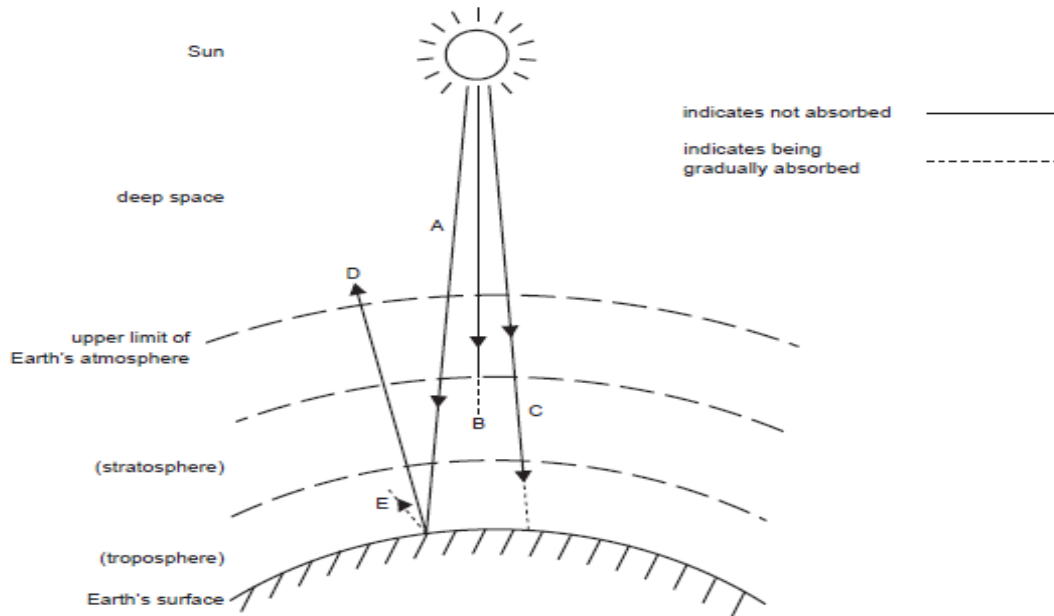
When burning 15 tonnes of methane per hour, the output of the electricity generator is 4800MJ per minute. The percentage efficiency of the entire operation is closest to:

- a) 3.8%
- b) 10%
- c) 38%
- d) 0.38%

Answer: C $(4800\text{MJ} \times 60/750000) \times 100$

The following information relates to questions 8-11

The diagram below (not to scale) shows the Sun, Earth and parts of the Earth's atmosphere. The lines/arrows A–E can indicate ultraviolet (UV), visible or infrared radiation (IR).



Source: VCAA 2009 Unit 3 Exam

Question 8

Which of the following options best identifies ultra-violet radiation being absorbed in the atmosphere?

- a) A
- b) B
- c) C
- d) E

Answer: B

Question 9

The option indicated by E is associated with which type of incoming/outgoing solar radiation:

- a) IR
- b) Visible Light
- c) UV
- d) None of the above

Answer: A (IR)

Question 10

Which of the following man made greenhouse gases only occurs in the enhanced greenhouse effect?

- a) Water vapour
- b) Nitrous Oxide
- c) Chlorofluorocarbons
- d) Methane

Answer: C Chlorofluorocarbons

Question 11

Under the Kyoto Protocol, it is proposed that countries are allowed to take into account the removal of carbon dioxide from the atmosphere by sinks.

Which of the following **does not** represent a carbon sink?

- a) Woody biomass
- b) Geosequestration
- c) Newly cleared land for agriculture
- d) Oceans

Answer: C Newly cleared land for agriculture

The following information relates to Questions 12-18

A study was completed by a group of scientists researching the impact of logging on the biodiversity in a region in East Gippsland. Scientists recorded their data before and after logging had occurred. They examined the impact on 5 different species in a range of locations in the region, these locations were all linked by vegetation prior to logging however, became fragmented after logging. These results are represented in the tables below.

Table 1: Represents the number of individuals found prior to logging

	Species 1	Species 2	Species 3	Species 4	Species 5	Total No. of Individuals
Location 1	25	14	8	21	23	91
Location 2	21	12	10	24	18	85
Location 3	24	14	9	25	20	92
Location 4	22	17	6	22	16	83

Table 2: Represents the number of individuals found after logging

	Species 1	Species 2	Species 3	Species 4	Species 5	Total No. of Individuals
Location 1	14	9	0	9	8	40
Location 2	15	5	4	12	6	41
Location 3	11	9	5	11	4	40
Location 4	13	10	2	9	3	37

Question 12

The **species richness** of the region **prior** to logging would be best represented as:

- a) 5
- b) 351
- c) 10
- d) 160

Answer: (A) 5 species richness refers to the number of species present in a particular region.

Question 13

The **species abundance** of the region **prior** to logging would be best represented as:

- a) 5
- b) 351
- c) 10
- d) 160

Answer: (B) 351 species abundance takes into account the number of species and the total number of individuals found in each

Question 14

In which **locations** has a **decrease** in species richness occurred after logging?

- a) Location 1 & 3
- b) Location 2 & 4
- c) Location 1
- d) All locations

Answer: C

Question 15

Scientists calculate the probability of extinction for **species 5** over the next 2 years. They estimate the probability for the population found in **Location 1** to be 0.8 while the probability for the population found in **Location 4** to be 0.9.

Which of the following best gives the combined probability of extinction for populations at locations 1 and 4 in the next 2 years?

- a) 0.72
- b) 1.7
- c) 0.1
- d) 0.54

Answer: A

Question 16

Based on these findings scientists suggest **Species 5** should have its threatened status upgraded from **Vulnerable** to **Critically Endangered** under the *Victorian Flora and Fauna Guarantee Act 1998*.

This means Scientists believe **species 5** are:

- a) Facing no risk of extinction in the wild
- b) Facing **extremely** high risk of extinction in the wild in the **immediate** future
- c) Facing **very** high risk of extinction in the wild in the **near** future
- d) Facing **very** high risk of extinction in the wild in the **medium-term** future

Answer: B

Question 17

Scientists now propose that these locations which have become fragmented by logging need to be connected by vegetation. Connecting these remnant patches with wildlife corridors will:

- a) reduce the risk of extinction for all species
- b) increase the genetic diversity of all species
- c) reduce the risk of predation to species
- d) All of the above

Answer: D

Question 18

Scientists fear that without action the genetic diversity within these species will decrease over time as they are small in numbers and isolated from other populations. As a consequence, scientists fear these populations could be at risk of:

- a) Genetic drift
- b) Inbreeding
- c) Demographic variation
- d) All of the above

Answer: D (*All of these processes are possible in small populations*).

Question 19

Which of the following is **not** considered an ecosystem service?

- a) the culling of endemic species
- b) the pollination of crops
- c) the formation of soil
- d) the nitrogen cycle

Answer: A

Question 20

The agreement that aims to halt the illegal trading, poaching and smuggling of endangered animals is known as:

- a) Ramsar
- b) JAMBA
- c) CITES
- d) IUCN

Answer: C

SECTION B—Short-answer questions

Specific instructions for Section B

Answer all questions in the spaces provided.

Question 1

Name a **fossil** fuel energy source that you have studied this semester _____

Name a **non-fossil** fuel energy source that you have studied this semester _____

You should use these fuels for question 1a-d

Question 1

- a.) Identify and discuss whether your nominated **fossil** fuel is considered renewable or non-renewable by using the steps required to extract and use this fuel as an energy source in homes. In your response, illustrate at least two energy conversions.

Answer:

1mark – Correctly identifying fuel as non-renewable

1mark – Linking response to method of extraction &/or use to non-renewable

1mark- Correctly illustrating two energy conversions

1 mark for correctly applying the fuel source to an energy form used in the home

*Possible response: **Coal** (other possible include natural gas or oil)*

- *Coal is a fossil fuel that is non-renewable (1m).*
- *Coal is extracted from the earth at a rate quicker than it can be replenished by natural processes(1m)*
- *To use: extraction of coal (chemical energy) → Steam (kinetic energy) → Movement of turbine (mechanical energy) (1m)*
- *Turbine connected to electrical generator and electricity transmitted to homes to power electrical appliances (1m)*

(4marks)

- b.) Identify and discuss whether your nominated **non-fossil** fuel is considered renewable or non-renewable by using the steps required to extract and use this fuel as an energy source in homes. In your response, illustrate at least two energy conversions.

Answer:

1mark – Correctly identifying fuel as renewable or non-renewable

1mark – Linking response to method of extraction

1mark- Correctly illustrating two energy conversions

1 mark - for correctly applying the fuel source to an energy form used in the home

*Possible response: **Wind***

- *Wind is considered a renewable resource (1m).*
- *Wind is considered renewable as at a large scale it can be replenished by natural processes at a faster rate than it is harvested (1m)*
- *To use: harness wind (kinetic energy) → Movement of turbine (mechanical kinetic energy) → Generation of electricity (electrical energy) (1m)*

- *Electricity transmitted to homes to power electrical appliances. (1m)*

(4marks)

- c.) For each of your chosen energy sources state and explain two advantages and two disadvantages in their use.

Answer:

2marks – Advantages

2marks – Disadvantages

Possible response:

Coal

Advantage: *Can be used to run electrical power stations at anytime 24/7. (1m)*

Disadvantage: *Creates large amounts of GHGs when combusted (1m)*

Wind

Advantage: *Produces no GHGs when converted into a useful form (1m)*

Disadvantage: *Relies on the availability/constant wind (1m)*

(4marks)

- d.) You are working for a major energy provider in Victoria. The company is required to increase its “Green Energy” significantly or completely for residents of Melbourne by constructing a new electrical energy plant. You have been asked to recommend an implementation strategy for the company using your selected non-fossil fuel. Justify your strategy by considering patterns of electrical demand in Melbourne, the best location of the power plant, and viability of your selected strategy in meeting all of the electrical power needs of Melbourne.

Answer:

1mark- Description of implementation strategy including location

2marks- Justification for suggested implantation strategy and location for power plant using valid figures (available energy; efficiency of conversions and likely electrical output) and terms associated with non-fossil fuel.

2marks- Viability of strategy to meet patterns of electrical energy demands of Melbourne significantly or completely (clear stance needed for full marks).

Possible response:

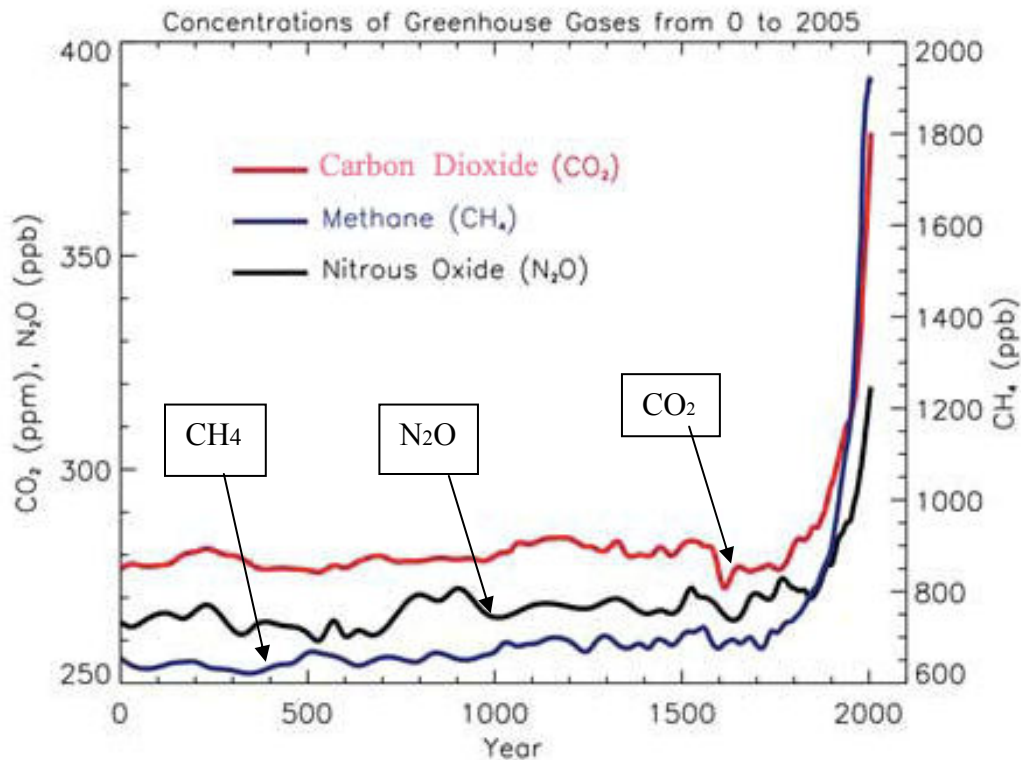
- *Melbourne is a large city with demanding peak and base energy loads that must cater for both industry and residential clients (1mark). Or Melbourne is a large city that must be able to support a high demand for energy use (such as heating, lighting, industry and transport needs).*
- *It is not viable to be completely reliant on wind energy as it relies on a constant supply of wind (1m)*
- *Therefore it is possible for the company to increase its green power significantly but not completely (1m)*
- *The best location for the new plant would be along the coast where wind is more constant (1m) as close to Melbourne as possible to reduce energy lost*

during transport along power lines (1m).

(5marks)

Use the graph below to answer questions 2a- e.

ppb – parts per billion
ppm – parts per million



(New Zealand National Institute of Water and Atmospheric Research. 2010)

Question 2

a.) In which century did greenhouse gases begin to increase significantly?

Answer:

1mark - 18 century

(1mark)

b.) What human –induced event(s) can be attributed to causing the dramatic increase in the production of methane and/or carbon dioxide?

Answer:

Could except any of the following for 1mark:

- The industrial revolution, using fossil fuel combustion as an energy source
- Age of steam using fossil fuel combustion as an energy source

- Rapid development of agriculture – flood irrigation and increased stock numbers, to supply food to rapidly growing human population
- Deforestation
Etc

(1mark)

- c.) Identify which of these gases has had the most significant increase. Using information from the graph justify your reasoning.

Answer:

- Carbon Dioxide (1mark)
- Because this unit of measurement is represented in parts per million whilst the other two gases are represented in parts per billion. (1mark)

(2marks)

- d.) Discuss the role these gases play in the (natural) greenhouse effect by describing the characteristics that enable them to be named greenhouse gases.

Answer:

- GHGs have the ability to absorb and retain heat (or infrared radiation) in the atmosphere (1mark).
- GHGs are important factors in the greenhouse effect as they ensure the earth's temperature remains at about 15 degrees C (30 degrees warmer than without them) (1mark)

(2marks)

- e.) Using your understanding of both the natural and enhanced greenhouse effect, explain how your selected fossil fuel energy source from Question 1, has contributed to this phenomenon. In your response, discuss the main features that distinguish the natural and enhanced greenhouse effect.

Possible Answer:

- 1. The natural greenhouse effect is integral in maintaining a relatively constant temperature, to support all life on Earth /Or Without the natural greenhouse effect the Earth's temperature would be too cold to support life on Earth as we know it, approximately -15C). (1m)*
- 2. Since the industrial revolution the burning of fossil fuels such as Coal has increased significantly/Or due to human activity the burning of fossil fuels such as coal has increased significantly (1m)*
- 3. The generation of electricity through the use of coal produce large amounts of GHG emissions (1m)*
- 4. Increased GHGs in the atmosphere has increased the amount of heat (infrared radiation) being absorbed and retained in the atmosphere (1m)*
- 5. The enhanced greenhouse effect has led to significant increases in the Earth's temperature (1m)*

(5marks)

Question 3

Name one endangered species you have studied this year. _____

- a.) State the conservation category for this species and give a definition of this classification.

Answer:

1mark – Threat classification

1mark – Definition of classification

Possible response:

1. The Southern Brown Bandicoot (SBB) is listed as Vulnerable in the Victorian Flora & Fauna Guarantee Act 1988 (1m).

2. This means that the SBB faces a very high risk of extinction in the mid-term future (1m).

(2marks)

- a.) For your selected species chose one specific population and describe its geographic location, range and size. Comment on how important this population is for the survival of the species as a whole.

Answer:

1mark – Description of geographic location

1mark – Approximate range

1 mark - Size of this population

1mark – Statement on how important this population is to the species

Possible response:

1. The SBB is found in the Pines Flora and Fauna reserve in Frankston - an hour South East of Melbourne (1m).

2. The SBB ranges across the whole reserve which is 238 hectares in size, with the population estimated to be less than 12 individuals (2m).

4. Each population of the SBB is very important for the long term survivability of the SBB. The greater the number of populations that exist the higher the level of genetic diversity that can occur (1m).

(4marks)

- b.) Outline two main threats affecting the survival of this population.

Answer:

1mark for each threat listed

Possible response:

1. Introduced predators such as the fox

2. Road kill due to location of reserve close to freeway

(2marks)

- c.) Describe two management strategies that have been suggested and/or implemented to reduce the threats facing your population. In your response, quote any scientific data that was used to develop these strategies and the important role scientific evidence has played in evaluating the effectiveness of your chosen strategies.

Answer:

2marks – for described management strategies

2 marks – For identifying & quoting scientific data used to develop each strategy

1marks – Discussing how scientific evidence was used to evaluate strategies

Possible response:

- 1. Secured Perimeter fence to reduce introduced predator entry (1m)*
- 2. Increased planting of indigenous flora for habitat (1m)*
- 3. Scientific data collection is an integral step needed in developing management strategies and evaluating their effectiveness (1m)*
- 4. Research has found the preferred habitat of the SBB is heathland, after a vegetation structure survey was completed (1m)*
- 5. It was found the reserve lacked sufficient plant structure to effectively support the continued survival of the SBB resulting in increased planting of indigenous shrubs and grasses /OR After planting it was found through scat data and increase in scats found after planting had occurred (1m)*

(5marks)

- d.) Using the information from question 3d predict the survival probability in the future for this particular population. Justify your prediction by referring to evidence of threats and quoting scientific data.

Answer:

1mark – Statement on survival probability

1mark – Evidence of threats to support predictive statement

1mark – Scientific evidence linked to prediction

Possible response:

- 1. The SBB population continues to fall and it is predicted that the SBB will face probable extinction in this reserve in the near future (1m)*
- 2. This is due to increasing urban development/encroachment surrounding this reserve (1m)*
- 3. Scientific evidence has not indicated a significant increase in the numbers of SBB since management strategies were implemented (1m)*

(3marks)

Use the following information to answer questions 4a-e



The Kangaroo Island Dunnart is a small marsupial that is on the IUCN's critically endangered list.

Kangaroo Island Dunnarts prefer to eat insects including spiders, ants, beetles, and scorpions. Males and females appear to eat the same foods. Most of the information on the feeding habits of the Kangaroo Island Dunnart have been observed through careful analysis of scats and from captured specimens. It competes for the same resources with other animals such as birds, small reptiles and other marsupials and faces predation from feral cats and dogs.

The home range of movement of the species is poorly known. Radio tracking of a few individuals has indicated that range lengths are in the order of 200-300 m. The dispersal patterns of juveniles from their natural range are also not known. The capture (and release) of Dunnarts over a period of 11 years at one site suggests that some areas provide core habitat, and Dunnarts continually occupy such areas for relatively long periods of time.

Figure 1 below provides locations of previous documented sightings and a historical reference back to 1974. The red "boxed" area is the most recent sites of collected data. Note the shaded areas along the south and east coasts of the island represent National or State Parks, under strict governmental regulation. Other land use is primary agricultural grazing with areas set aside for eco-tourism. There is no bridge to the South Australian mainland.

Management practices for this Dunnart have been in place since 1971, but population data has not been reliable since 2008. (Refer to the table below)

Figure 1: Historical data for sightings of the Kangaroo Island Dunnart

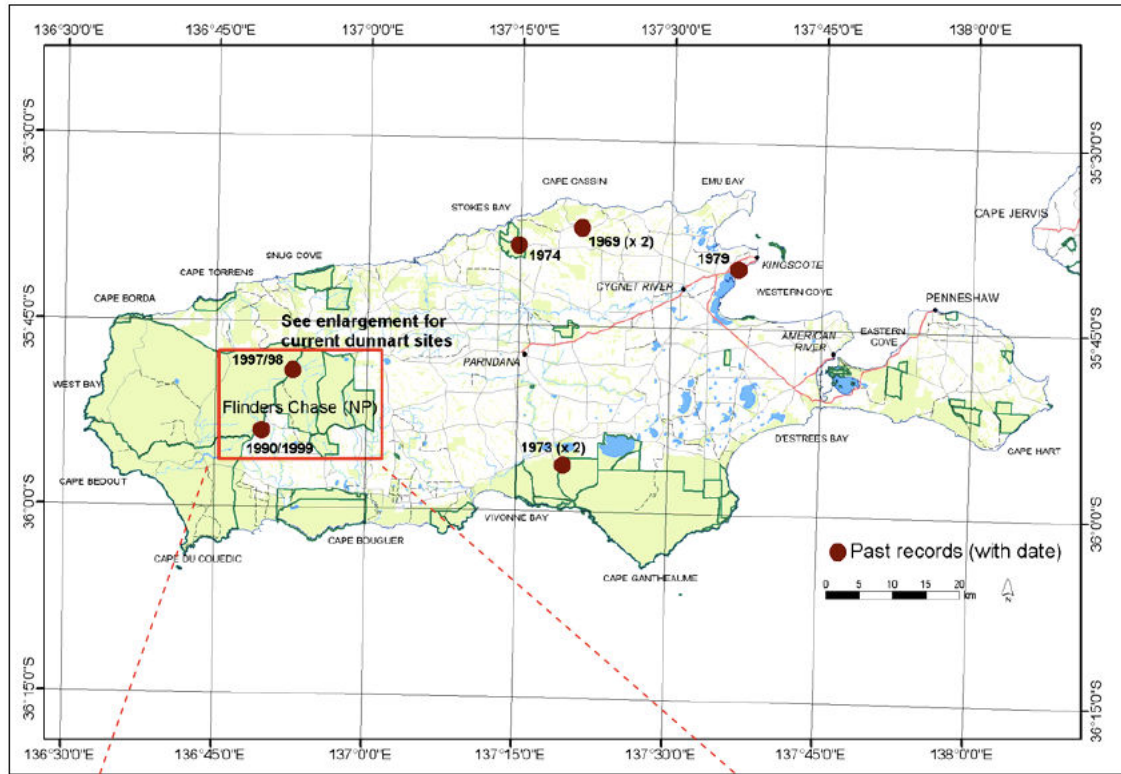


Figure 1: Location of Kangaroo Island, South Australia

Table 1: Population statistics of the Kangaroo Island Dunnart

Drop pit capture release Program (11,600 traps set for the years 2008-11)

Year	2008	2009	2010	2011
Number of individuals	29	32	35	34

Question 4

- a.) From the information given, what do you think the long-term prospect for the survival of the Kangaroo Island Dunnart? Explain your reasoning.

Answer:

*- It is likely the Kangaroo Island Dunnart (KID) is critically endangered (1m)
- This is based on the current IUCN's definition that the animal has an extremely high risk of extinction in the wild in the immediate future. (1m)
- The KID is critically endangered because its population and range have been dramatically reduced – its habitat now apparently restricted to an area in the red box of approx 15Km sq. And its population to less than 30(1m)*

(3marks)

- b.) Describe TWO major threatening processes that have led to a reduction in population for the Kangaroo Island Dunnart. Explain the impact that these threats will have on the population inferred from the data above.

Answer:

*2marks for: identification of two human impacts – loss of habitat, habitat fragmentation, competition for resources, habitat degradation etc.
1marks – what impact these will have on the species*

Possible response:

*- Due to habitat fragmentation from human activity such as agriculture (1m)
- In addition, the KID faces competition for resources from other species which can result in a decline in the population (1m)
- These factors can reduce the reproduction rates of the species resulting in a reduction of genetic diversity (1m)*

(3marks)

- c.) Outline TWO possible management strategies that are different from those you addressed in question 3d that could support the survival of this Dunnart population.

Answer:

2marks – for correctly outlining two of the following: creating wildlife corridors, captive breeding program and reintroduction, predator fencing or baiting, creation of habitat shelters, national parks etc.

(2marks)

- d.) Compare the degree of threat and management issues of Kangaroo Island Dunnart with your chosen threatened species used in Question 3.

Answer:

*1mark – Comparing the degree of threat for both
3marks – Comparing the similarities and differences in management issues*

Possible response:

*- The SBB faces a high risk of extinction in the mid-term future
- compared to that of the KID which faces an extreme risk of extinction in the*

immediate future and is therefore rated as being at a higher risk of extinction. (1m)
- There are similarities between the impacts affecting both populations such as loss of habitat due to human activity and (1m)
- and risk of predation from introduced species (1m) Differences(1m)

(4marks)

- e.) From the data, evaluate the effectiveness of present management practices. In your response, discuss the reliability of the data provided.

Answer:

- There has been some apparent improvement in the population numbers of the KID suggesting that the management strategies may have been effective(2m)
- Despite this, the population is too small and data collection has been unreliable to make any conclusive statements about the effectiveness of the management strategies in place (1m)

(3marks)

Use the following information to answer question 5a-d

Wilson Diversity Index is one of many tools that can be used to indicate the relative quality of ecosystems. The following calculation can be used to determine Wilsons Index:

$$\text{Wilson's Diversity Index} = \frac{\text{number of individual species}}{\text{total number of individuals}}$$

Students have been studying a particular part of a local creek. Site 1 is a location at point in a small wooded catchment prior to the creek passing through the township. Site 2 is at a location after the creek has passed through the township.

Species	Site 1	Site 2
Mayfly	6	0
Caddis fly	11	0
Freshwater snail	9	2
Water boatman	54	32
Mosquito fish	21	41
Gudgeon fish	15	2
Fresh water mussel	12	0
Blood worm	3	186
Freshwater shrimp	28	27
Daphnia	51	0
TOTAL		

Question 5

- a.) Calculate the total **species abundance** found at each site and write the total in the table. (1marks)

Answer:

1mark – site 1 = 210

1mark – site 2 = 290

- b.) Using the formula given above calculate **Wilson's Diversity Index** for each site. Show all calculations.

Answer:

1mark – Site 1 0.05

1mark – Site 2 0.02

(2marks)

- c.) Identify which site has the greatest species diversity as indicated by Wilson's index. Justify your selection.

Answer:

1mark – Correctly identifying site with highest species diversity

1mark – Use of data to support response

1mark – Explanation to support why this site has a great diversity

Possible response:

- *Site 1 has a higher species diversity than site 2 (1m)*
- *This is clear as Site 1 has an index of 0.05 compared to Site 2 with an index of 0.02. (1m)*
- *The closer the index is to one the higher the species diversity (1m)*

(3marks)

d.) Some scientists argue that Wilson's Diversity index is not an accurate measure of species diversity. Outline two limitations of Wilson's index of species diversity.

Answer:

- *The Simpsons diversity index is not always an accurate measurement of species diversity (1m)*
- *This is because it gives relatively little weight to rare species and more weight to more common species (1m).*

(2marks)

e.) Discuss what may be a contributing factor/s between the two sites that has brought about this change. Use the data to justify your answer.

Answer:

1 mark – Identification of possible cause for reduction

1 mark – expansion of link between possible cause and reduction

1 mark – Use of data to support the link

Possible response:

- *It is clear a reduction in species diversity has occurred in the creek after it began to pass through the township. (1m)*
- *This is seen with a species diversity index of 0.05 before the creek passed through the town to a figure of 0.02 after the creek passed through the town (1m)*
- *Human impact is the most likely cause to have affected the species diversity within the creek/OR Based on the data alone a conclusive cause to this reduction in diversity cannot be determined (1m)*

(3marks)

END OF EXAMINATION PAPER



ENVIRONMENTAL SCIENCE
Trial Written Examination June 2011
Section A answer sheet

Student:

Teacher:

Specific instructions for Section A

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.

	A	B	C	D
1				x
2				x
3				x
4		x		
5	x			
6	x			
7			x	
8		x		
9	x			
10			x	
11			x	
12	x			
13		x		
14			x	
15	x			
16		x		
17				x
18				x
19	x			
20			x	