STUDENT NAME	

Victorian Certificate of Education
2006

ENVIRONMENTAL SCIENCE

Trial Written Examination 1
June 2006

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	7	7	70
			Total 90

Materials

- Question and answer book of 17 pages.
- Answer sheet for multiple-choice questions.
- At least one pencil and eraser.
- One approved graphics calculator (memory cleared) and/or one scientific calculator

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

SECTION A – Multiple-choice questions

Specific instructions for Section A

Answer all questions.
All questions should be answered on the answer sheet for multiple-choice questions, in pencil.
Choose the response that is **correct** or **best answers** the question, and shade the square on the multiple-choice answer sheet according to the instructions given on that sheet. A correct answer is worth 1 mark; an incorrect answer is worth no marks. No marks will be given if more than one answer is shown for any question. Marks will not be deducted for incorrect answers

Question 1
A school purchased an 1800 watt solar voltaic cell system to power a computer laboratory but noticed, even under idea conditions, that it never produced more than 1200 joules per second. The reason for this is because:

A. the system hasn't been wired properly
B. solar electricity is unreliable
C. changing energy from one form to another results in some energy being degraded
D. light energy striking the solar cells will depend on the solar output of the sun at any given moment

Question 2
The variation in DNA between individuals within a population is best described as:

A. the mutation rate
B. species diversity
C. phenotypic variation within a population
D. genetic diversity

Question 3
Biogas collected at the Western Treatment Plant is sold to a power generation company that burns the gas to drive a steam turbine which powers an electric generator. The electricity is then sold back to the treatment plant to power large mixing machines that aerate the raw sewerage:

- The power station is 65% efficient
- The power distribution lines are 95% efficient
- The mixing machines are 60% efficient

The best estimate of the over all efficiency of this system is:

A. 40%
B. 20%
C. 60%
D. 75%

Question 4
Maintaining biodiversity is important because:

- **A.** it reduces the evolutionary rate in animals and plants
- **B.** it reduces the impact from the "hole" in the Ozone layer
- **C.** is a major sink for carbon and hence is critical in reducing the impact of the enhanced greenhouse effect
- **D.** it makes ecosystems more robust and resilient to change

Question 5
Water flowing into a hydroelectric power station from a reservoir situated above it could best be described as:

- **A.** potential energy being converted into kinetic energy
- **B.** chemical energy being converted into electrical energy
- **C.** a non-fossil, non-renewable form of energy
- **D.** a form of energy production that has no impact on the environment

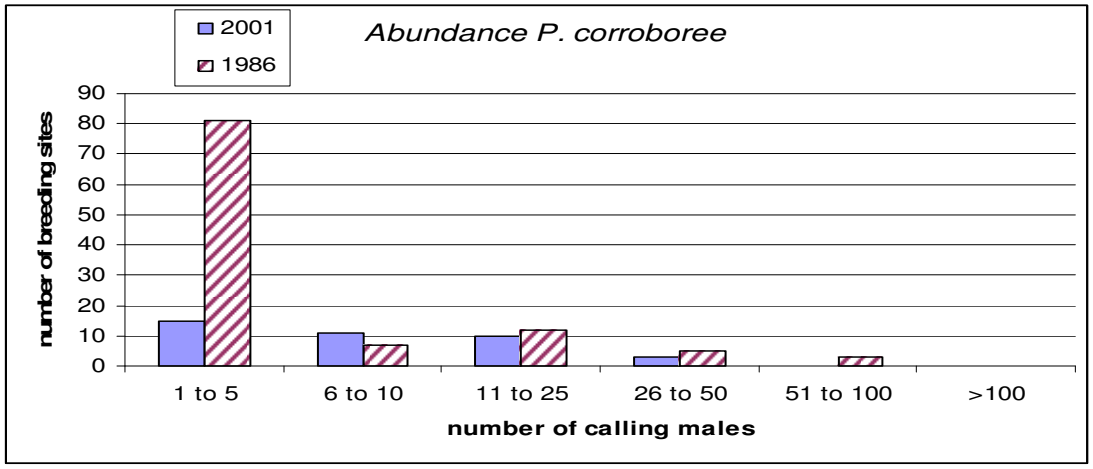
Question 6
The Southern Broodfrog, *Pseudophryne semimarmorata*, is currently not listed under the **Victorian Fauna and Flora Guarantee Act 1988** (FFG Act). Many field biologists in Victoria believe this species has been in decline for some time and there are currently attempts to get this species listed. The main purpose of listing a species is to:

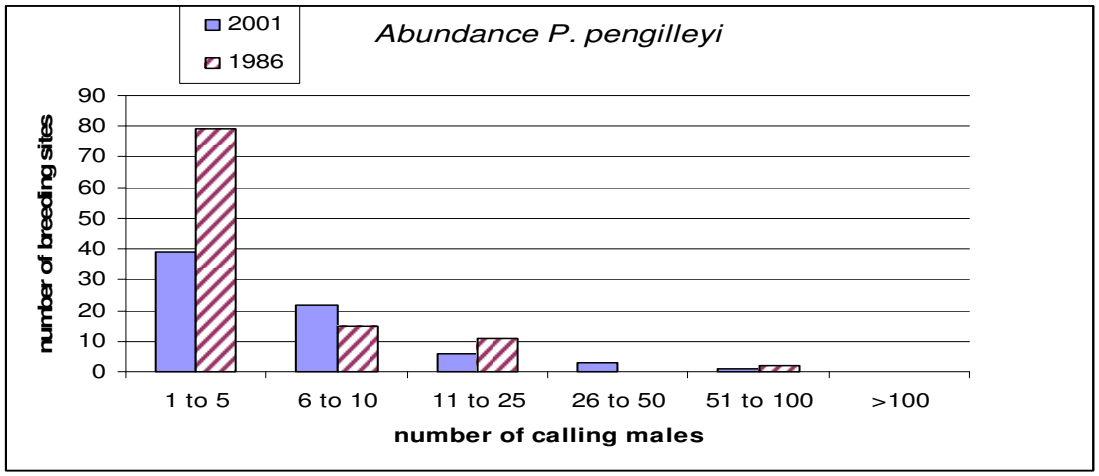
- **A.** let people know about the them
- **B.** provide some regulatory frameworks for their protection
- **C.** make it illegal to hunt and kill them
- **D.** collect as many specimens for captive breeding as possible before they go extinct

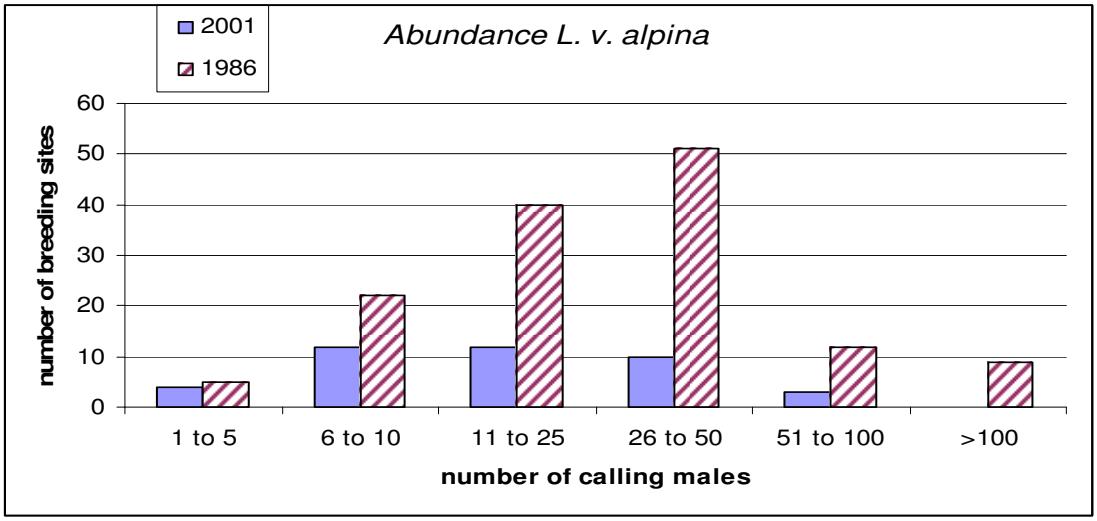
Question 7
Which of the following is a non-renewable; non-fossil fuel?

- **A.** geothermal power
- **B.** nuclear power stations
- **C.** coal
- **D.** uranium

Question 8
Pseudophryne corroboree and *P. pengilleyi* are two closely related species of frog endemic to the Snowy Mountain region. *Litoria verreauxi alpine* is another non-related species that is also found in this area. All three species have suffered large declines in distribution and abundance and one is now listed as endangered under the **Environment Protection and Biodiversity Conservation Act 1999** (EPBC Act) while the other two are considered vulnerable.







Based on the information above the most likely species to be listed as endangered is:

A. *P. corroboree*
B. *P. pengilleyi*

C. *Litoria verreauxi alpine*
D. *All of the above*

Question 9
The process by which petrol in a car is ignited to produce energy is best known as:

A. an endothermic reaction
B. nuclear fission
C. a participation reaction
D. a combustion reaction

Question 10
Ecologists have devised several numerical methods for comparing the species diversity between two different samples or communities.
Jaccard's Index, the simplest of these comparisons, is calculated by dividing the number of species found in both of the two samples (*j*) by the number found in only one sample or the other (*r*) (total number of species) and then multiplying by 100. This gives a percentage of species similarity:

Jaccard's Index = 100(j/r)

Sample 1	Sample 2
Southern Brown Tree frog	Southern Brown Tree Frog
Common Froglet	Common Froglet
Spotted Marsh Frog	Spotted Marsh Frog
Pobblebonk Frog	Stripped Marsh Frog
Growling Grass Frog	

Jaccard's Index for sample 1 & 2 is approximately:

A. 20% similarity
B. 50% similarity
C. 70% similarity
D. 90% similarity

Question 11
The process of burning coal to heat water to drive stream turbines is a chemical reaction that is best described as:

A. poikilothermic
B. homeothermic
C. exothermic
D. endothermic

Question 12
Which of the following **would not** be considered a general threat to biodiversity?

A. habitat fragmentation

B. revegetation
C. inbreeding
D. genetic swamping

Question 13
Which of the following is not considered a fossil fuel?

A. brown coal
B. oil
C. natural gas
D. biogas

Question 14
The South Eastern Freeway Extension passes through a section of the Mullum Mullum Valley that contains a small population of the increasingly rare Southern Broodfrog, *Pseudophryne semimarmorata*. The impact of the tunnel on this population is unknown and no formal study has been undertaken. However local conservationists have urged the construction company to create a buffer zone of 25m around this site. This recommendation is an example of:

A. a Population Viability Analysis
B. the Precautionary Principle
C. an Environmental Impact Statement
D. the Victorian Fauna and Flora Guarantee Act 1988 (FFG Act)

Question 15
The leaders of Tuvalu—a tiny island country in the Pacific Ocean midway between Hawaii and Australia—have conceded defeat in their battle with the rising sea, announcing that they will abandon their homeland. This rise in sea level has been blamed on the effects of the enhanced greenhouse effect which has caused the sea level to rise predominantly by the:

A. thermal expansion of the sea water
B. melting of the polar ice caps
C. increased rainfall
D. subsidence of the major landmasses

Question 16
The international convention which aims to halt the worldwide loss of wetlands and in doing so help protect many species, including migrating birds is best known as the:

A. Convention on International Trade of Endangered Species (CITES)
B. Victorian Fauna and Flora Guarantee Act 1988 (FFG Act)
C. World Heritage Commission
D. Ramsar Convention

Question 17
The enhanced greenhouse effect is primarily caused by:

A. the “hole” in the Ozone layer
B. increased strength of the sun’s radiation
C. the use of fuel fossils as an energy source
D. the removal of native vegetation

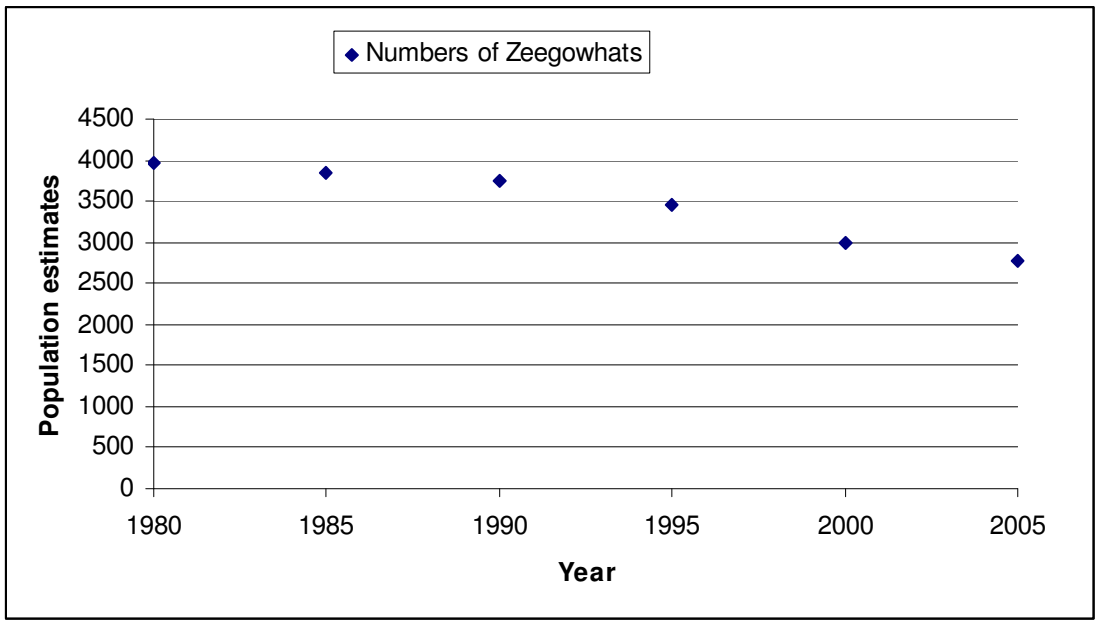
Question 18
A developer wishes to construct a series of wind turbines along the Victorian coastline in an area of Gippsland that could also contain some of the very rare Orange-bellied Parrots. Before getting approval for the construction of the wind farm the project operators would need to carry out:

A. an Environmental Impact Assessment
B. a capture and translocation program for any of the rare birds in the area
C. a fund raising project within the local community
D. a Population Viability Analysis on the Orange-bellied Parrot

Question 19
One of the main properties of a greenhouse gas is that it is:

A. an anthropogenic gas
B. transparent to visible wavelengths of light
C. able to absorb UV radiation from the sun
D. occurs in the upper atmosphere

Question 20
The number of Zeegowhats occurring in central Victoria has been regularly surveyed since 1980 and in recent years field biologists have been concerned about the decline in numbers.



Based on the data above what has been the approximate percentage decline in the population of Zeegowhats between 1980 and 2000?

A. 25%
B. 50%
C. 75%
D. 5%

SECTION B – Short answer questions

Specific instructions for Section B
Answer all questions in the spaces provided.

Question 1
A large metropolitan college in Melbourne uses on average 10000 kWh of electricity per month and as a consequence is responsible for the emission of around 160 tonnes of greenhouse gas.

a) Where would most of these greenhouse gases be released?

_____.

_____.

(1 mark)

b) What is the process taking place to generate most of this electricity?

_____.

_____.

(1 mark)

c) Is this form of energy considered renewable? Explain.

_____.

_____.

_____.

_____.

(2 marks)

d) Victorians produce more tonnes of climate change pollution each year per person than the average American, making us one of the worst climate change polluters on the planet. Suggest two reasons why Victorians are such high greenhouse gas polluters.

_____.

_____.

_____.

_____.

(2 marks)

e) Describe the difference between the enhanced greenhouse effect and the natural greenhouse effect and its relationship to climate.

(4 marks)

f) Suggest **two** possible impacts of global warming and how the enhanced greenhouse effect may have caused these impacts.

(4 marks)

g) Describe a place in the world that is currently or may be affected by each impact listed in part **f)**.

(2 marks)

Question 2

'Far from being a blot on the landscape, wind farms are an asset, especially when you look at the alternatives.' David Suzuki (*New Scientist,* 16 April 2005).

A critic has said Suzuki has missed the point that wind power will never contribute significantly to controlling atmospheric carbon dioxide, and that most people are not in favour of compromising their lifestyle to cut their demand on resources.

In a discussion of different renewable and non-renewable energy resources and their impacts on the environment, to what extent do you agree with Suzuki?

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

(5 marks)

Question 3

A botanist was investigating species diversity in dry eucalypt forest on the east coast of Tasmania. The forest consisted of two main *Eucalyptus* species with an understorey of *Acacia* species, *Banksia* sp, *Hakea* sp and some members of the Asteraceae family. The ground cover consisted mainly of epacrids and grasses. On two sides of a gully, A and B, he found the following differences:

		Area A	**Area B**
	Stratum of forest	**Number of plants**	**Number of plants**
Canopy	Species A	7	11
	Species B	3	2
	Species C	2	0
Understorey	Species D	15	0
	Species E	2	6
	Species F	3	0
Ground Cover	Species G	9	1
	Species H	5	7
	Species I	2	0

a) Which forest area has the greater plant species richness? Explain.

_____.

_____.

_____.

(2 marks)

b) Which forest area is more likely to have the greater resistance to change if all other factors are kept the same? Explain.

_____.

_____.

_____.

(2 marks)

Species diversity is measured using a variety of statistical calculations. These indices are expressed as a number. One of these is Simpson's index (D) which is defined as $D = 1 - (p_1^2 + p_2^2 + p_3^2 + p_4^2 \ldots\ldots)$

where p_1 = number of individuals of species A at the site / total number of individuals at the site
p_2 = number of individuals of species B at the site / total number of individuals at the site
p_3 = number of individuals of species C at the site / total number of individuals at the site
etc.

A lower Simpson's index indicates a lower biodiversity.

c) Calculate the Simpson's index for both sites by completing the table below.

(4 marks)

Area A			
Species	**Number**	**p value**	**p2 value**
A			
B			
C			
D			
E			
F			
G			
H			
I			
Total number			

D = 1 – Total p^2 =

Area B			
Species	**Number**	**p value**	**p2 value**
A			

B			
C			
D			
E			
F			
G			
H			
I			
Total number			

D = 1 – Total p^2 =

d) Explain what these results from part **c)** tell us about the species diversity of the two sites.

_____.

_____.

_____.

_____.

(2 marks)

Question 4

An isolated population of an endangered species of bird contains 100 birds. Two strategies are suggested for managing the population:
Translocation (the transfer of some birds to a new habitat) or;
Reintroduction (the removal of a small number of birds for a captive breeding program and reintroducing the captive birds and their offspring into the original population).

a) Describe **one** advantage and **one** disadvantage of each of these strategies.

(i) Translocation
Advantage

_____.

_____.

(1 mark)

Disadvantage

_____.

_____.

(1 mark)

(ii) Reintroduction
Advantage

_____.

_____.

(1 mark)

Disadvantage

_____.

_____.

(1 mark)

b) State **one** other possible management option to protect the population.

_____.

_____.

_____.

_____.

_____.

(2 marks)

Question 5

Australia's energy consumption per capita is boosted by large coal exports. These are also factored into Australia's carbon dioxide emissions which need to be at 108 per cent of 1990 levels over the period 2008-2012 for the agreed Kyoto Protocol target.
Although Australia has signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC), like the USA it has not done so for the Kyoto Protocol, which is intended to strengthen the UNFCCC by limiting carbon dioxide emissions for certain developed countries. Some countries are asked to reduce carbon dioxide emissions below 1990 levels, but Australia was allowed an increase.
Over 125 countries, including the European Union, Japan, Canada and more recently Russia have ratified the Protocol, the total emissions of ratifying countries now exceeds 55% and has allowed the treaty to have legal force.

a) What are the strengths and weaknesses of the Kyoto Protocol?

_____.

_____.

_____.

_____.

_____.

_____.

(2 marks)

b) Explain a strategy which could limit Australia's dependence on coal exports so that the Government might consider ratifying the Kyoto Protocol.

_____.

_____.

_____.

_____.

(2 marks)

c) Some countries are investing in Australian forest plantations as a way of reducing their carbon debt. Explain.

_____.

_____.

_____.

_____.

_____.

_____.

(2 marks)

Question 6

a) Name **one** fossil energy source that you have studied this year and describe **two** of the adverse impacts associated with its use.

_____.

_____.

_____.

_____.

_____.

_____.

(3 marks)

b) Name **one** non-fossil energy source that you have studied this year and describe **two** of the adverse impacts associated with its use.

_____.

_____.

_____.

_____.

(3 marks)

c) Is this non-fossil energy source described in part **b)** a renewable form of energy? Explain.

(2 marks)

d) Evaluate the differences between the extraction and use of the fossil and non-fossil energy sources outline in part **a)** and **b)**.

(3 marks)

Question 7

a) Nominate a threatened species you have studied this year, and describe changes that have occurred to its distribution and population size over time.

(2 marks)

b) What conservation category is assigned to the threatened species you studied and by which conservation agency / legislation – IUCN, EA, DSE? Justify its ranking under this category.

_____.

_____.

_____.

_____.

_____.

(2 marks)

c) Describe **two** major threats to this species and suggest reasons why they are considered to be major threats to this species.

_____.

_____.

_____.

_____.

_____.

_____.

(3 marks)

d) Describe **two** mitigation strategies that have been used, or could be used, to protect this species.

_____.

_____.

_____.

_____.

_____.

_____.

(3 marks)

Question 8

The locally native, or indigenous, biodiversity of a place, together with landforms, is what gives every place its unique character. The majority of Australian species are unlike any other plants and animals. 84% of Australian terrestrial mammals, 85% of our flowering plants, 89% of our reptiles, 93% of our frogs and 85% of our in-shore temperate zone fish are uniquely Australian and do not occur naturally anywhere else in the world.

a) What term is applied to species that have their distribution restricted to particular area or region?

_____.

(1 mark)

Over 200 years of non-indigenous human settlement in the 8800km^2 area of land that we call metropolitan Melbourne has reduced its indigenous biodiversity to scattered remnants.

b) Suggest **two** reasons why fragmentation of habitat can cause localised extinctions of species.

_____.

_____.

_____.

_____.

(2 marks)

c) Suggest **three** reasons why the conservation of biodiversity is important to human survival and illustrate each reason with a specific example.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

(3 marks)

END