



Victorian Certificate of Education 2006

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

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ENVIRONMENTAL SCIENCE

Written examination 1

Tuesday 6 June 2006

Reading time: 2.45 pm to 3.00 pm (15 minutes)

Writing time: 3.00 pm to 4.30 pm (1 hour 30 minutes)

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

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and a scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question and answer book of 17 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

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

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions**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 one of the following gases is entirely made by humans?

- A. methane
- B. nitrous oxide
- C. carbon dioxide
- D. chlorofluorocarbon

The following information relates to Questions 2–3.

A Queensland energy company operates an electricity generating station. They change to burning macadamia nut shells in place of coal.

Question 2

Macadamia nut shells represent a source of

- A. fossil energy.
- B. renewable energy.
- C. hydroelectric energy.
- D. an endothermic reaction.

Question 3

Which one of the following best describes the environmental advantage of biomass over coal as an energy source?

- A. Biomass produces no waste products when burned.
- B. Biomass produces no greenhouse gases when burned.
- C. Coal is a renewable energy source.
- D. As it grows, biomass absorbs greenhouse gases from the air.

Question 4

The largest overall contribution to the enhanced greenhouse effect on earth is made by

- A. methane.
- B. nitrous oxide.
- C. carbon dioxide.
- D. chlorofluorocarbons.

Question 5

Gas	Atmospheric concentration before the year 1750	Current atmospheric concentration
carbon dioxide	280 parts per million	375 parts per million
methane	750 parts per billion	1800 parts per billion
nitrous oxide	270 parts per billion	320 parts per billion

Since 1750, carbon dioxide, methane and nitrous oxide have all increased in the atmosphere.

The order of percentage increase, from the smallest increase to the biggest, is

- A. carbon dioxide, methane, nitrous oxide.
- B. nitrous oxide, carbon dioxide, methane.
- C. nitrous oxide, methane, carbon dioxide.
- D. methane, carbon dioxide, nitrous oxide.

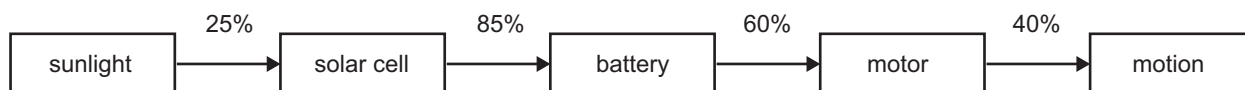
Question 6

Cows and sheep, rice paddies and landfills are major sources of increases in atmospheric concentrations of

- A. methane.
- B. nitrous oxide.
- C. carbon dioxide.
- D. chlorofluorocarbon.

The following information relates to Questions 7–8.

Students at Hampton Secondary College have built a solar car. The lightweight vehicle obtains its energy from a solar panel on the roof. The energy is stored in a lead acid battery. Electricity from the battery provides power to the car engine. The energy conversions and their efficiencies are shown in the following diagram.

**Question 7**

The main energy conversion taking place between the battery and the motor is

- A. heat to kinetic.
- B. kinetic to mechanical.
- C. chemical to mechanical.
- D. chemical to endothermic.

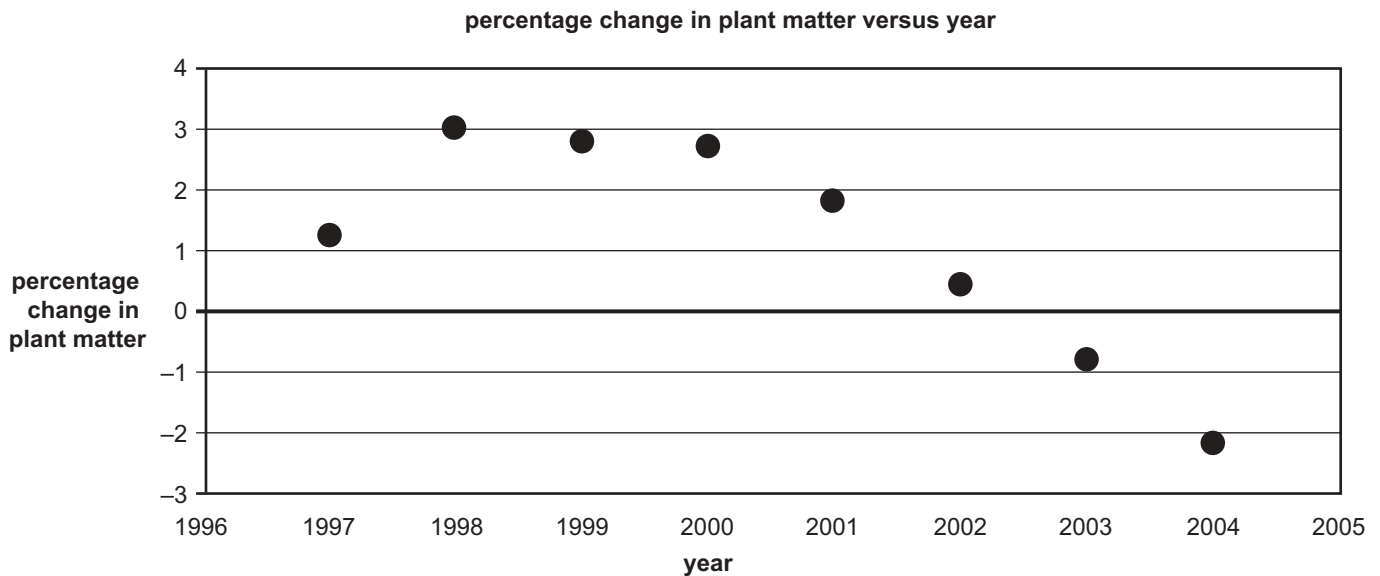
Question 8

Taking into account all the energy conversion efficiencies shown in the diagram, what percentage of sunlight is converted into motion?

- A. 0.05%
- B. 5%
- C. 40%
- D. 50%

Question 9

The graph below shows year-by-year percentage changes in the amount of above-ground plant matter in trees in a forest in Victoria. The trees have been affected by drought from 2001 onwards.



Which statement best describes the changes to the forest in 2003 and 2004 compared to the previous years?

- A. In 2003 and 2004, the forest was a vegetation sink.
- B. The forest has changed from an overall carbon sink to a carbon source.
- C. The forest has less than a quarter of the plant matter than in the past.
- D. The forest is absorbing more carbon dioxide from the air than in the past.

Question 10

Species diversity in a habitat is best measured by counting

- A. the total number of species.
- B. the total number of individuals.
- C. the number of species and the relative abundance of each.
- D. the number of different ecosystems available in the habitat.

Question 11

Genetic diversity is best assessed by determining

- A. small variations within a species.
- B. the risk of extinction of the species.
- C. the relative abundance of the species.
- D. the number of different species in the environment.

Question 12

Which one of the following categories indicates that a species is most at risk of extinction?

- A. exotic
- B. critical
- C. vulnerable
- D. endangered

Question 13

In moist tropical forests many tree trunks are covered with mosses and small ferns. These small plants gain from living on the tree trunk; for example, by increasing their access to rainwater and light. The trees do not receive a direct gain but are generally not disadvantaged by being a host for the mosses and ferns.

This close relationship between trees, mosses and ferns can be described as

- A. symbiosis.
- B. inbreeding.
- C. predator-prey.
- D. energy depletion.

Question 14

Which one of the following treaties is specifically designed to protect wetlands?

- A. CITES
- B. Kyoto Protocol
- C. Ramsar Convention
- D. *Flora and Fauna Guarantee Act 1988*

The following information relates to Questions 15–16.

A scientist monitors a population of possums for six years. The average number of possums recorded for each of the six years is given in the table below.

Year	2000	2001	2002	2003	2004	2005
Population	44	42	45	40	43	44

Question 15

The average population size over the six years is

- A. 40
- B. 43
- C. 44
- D. 45

Question 16

Which conclusion is best supported by the data above?

- A. The population is stable.
- B. The population is steadily decreasing.
- C. An exotic competitor was removed in 2002.
- D. A predator was introduced into the habitat in 2003.

The following information relates to Questions 17–18.

A farmer in western Victoria purchased a property which had several small patches of remnant bushland. When a wildlife biologist carried out a fauna survey, she discovered small populations of a threatened marsupial, the Long-nosed Potoroo, in two of the isolated remnants.

Question 17

The wildlife biologist was concerned about the conservation status of the two small populations.

The reason for this concern could be because

- A. it would be difficult to collect specimens for a museum.
- B. one of the isolated populations may experience genetic swamping from the other.
- C. small isolated populations are particularly vulnerable to demographic variation and inbreeding.
- D. it would not be possible to capture enough animals to develop a reliable model of population sizes.

Question 18

The biologist recommended that the farmer revegetate a wildlife corridor between the two remnants in which potoroos were still present. She suggested that a broad corridor of native vegetation may assist potoroos to move between the two remnant patches.

The most likely conservation benefits of such movements are that

- A. they assist the potoroos to inhabit the farmland.
- B. they allow the potoroos to avoid predators more effectively.
- C. they reduce the risk of each individual population becoming locally extinct.
- D. scientists will be better able to estimate the distance that potoroos move within their home range.

Question 19

Many land managers attempt to protect or restore native vegetation along streams. Streamside vegetation helps reduce runoff of fine particles and chemicals into the stream from adjacent land.

The role of streamside vegetation in protecting water quality in this way is an example of

- A. nutrient overload.
- B. ecosystem diversity.
- C. waterway pollution.
- D. an ecosystem service.

Question 20

The genetic composition of small populations can change in several ways. For example, there can be random loss of genetic variation in a population, as a long-term consequence of the random pairing of breeding individuals.

This loss in genetic variation is known as

- A. genetic drift.
- B. population decay.
- C. genetic swamping.
- D. population turnover.

SECTION B – Short-answer questions**Instructions for Section B**

Answer **all** questions in the spaces provided.

Question 1

Listed below are three different methods of producing electrical energy.

- a.** Briefly describe how each of these methods generates electricity and state whether it represents a renewable or non-renewable energy source.

- i.** A wind-powered turbine

- ii.** A hydroelectric plant

- iii.** A brown coal-fired power plant

2 + 2 + 2 = 6 marks

*The following information related to electrical energy demand in Victoria may be used in answering parts **b.** and **c.***

Base load demand is the amount of electrical energy needed throughout the 24 hours.

Peak load demand is the maximum amount of electrical energy required at any time during the day – that is, at peak periods.

Figure 1 gives a qualitative indication of daily peak and base load demand on a typical day.

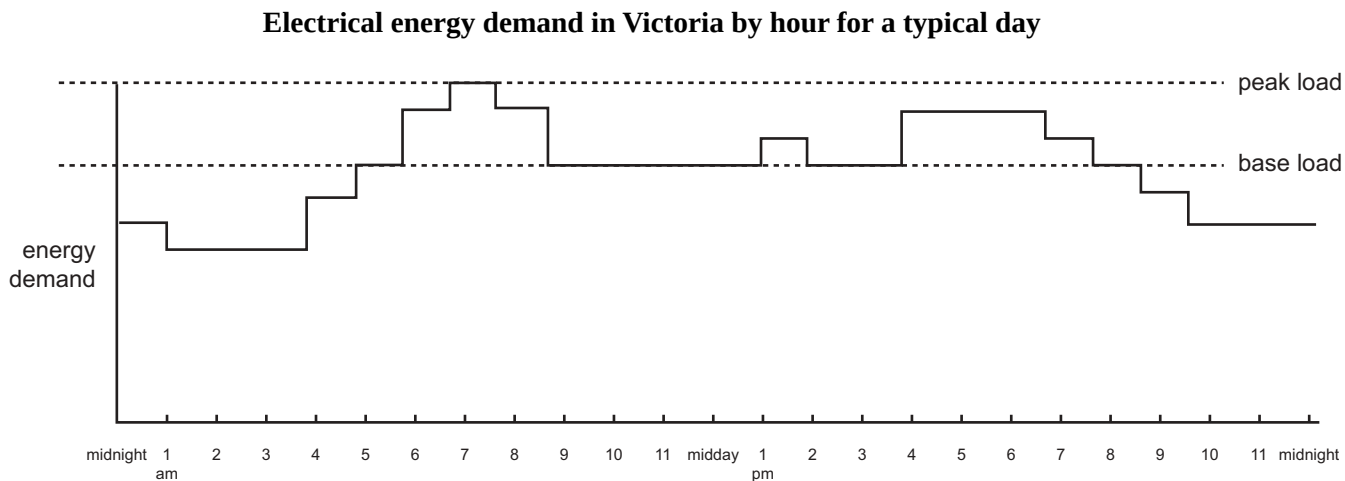


Figure 1

- b.** Discuss the possible use, including advantages and disadvantages, of one fossil and one non-fossil energy source you have studied this year for meeting Victoria's electrical energy requirements.

Name fossil energy source _____

Discussion _____

Name non-fossil energy source _____

Discussion _____

4 marks

- brown coal-fired thermal power stations (these provide almost all the base load)
- hydroelectric power stations
- natural gas power stations
- oil (diesel) power stations
- other renewables, including wind power.

Sources of electrical energy for Victoria for a particular year

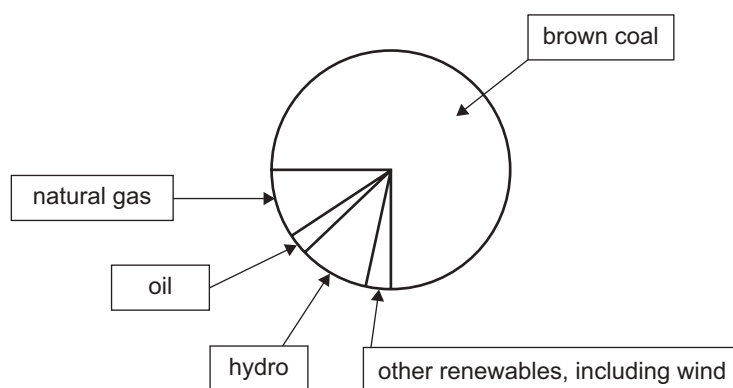


Figure 2

- c. Assume you are designing the whole Victorian electrical energy production system from the beginning. Taking into account economics, availability and environmental issues, recommend an appropriate balance of energy sources to meet Victoria's electrical energy requirements. Briefly justify your recommendation. You may use the fossil and non-fossil energy sources nominated in part **b.** in your answer.

[illegible]

Total 15 marks

Question 2

- a.** The temperature of the earth's atmosphere is determined by the greenhouse effect.

Explain the mechanism of the earth's greenhouse effect, including the role of ultraviolet, visible and infrared radiation.

You should include a clearly labelled diagram.

Your answer should include reference to

- types of incoming solar radiation
- atmospheric absorption
- types of re-emitted radiation.

6 marks

- b. Explain the difference between the natural and enhanced greenhouse effects, including the implications of each for human life.

4 marks

- c. Describe **one** strategy for reducing the enhanced greenhouse effect.

2 marks

- d. Discuss the impact of one fossil and one non-fossil energy source on global warming.

fossil energy source _____

non-fossil energy source _____

4 marks

Total 16 marks

SECTION B – continued
TURN OVER

Question 3

Name **one** endangered (threatened) animal species you have studied.

- a. Explain why this species is considered threatened. Include the degree of threat and reference to the main threats.

3 marks

- b. Describe **one** known population of this species, including reference to the population size, the long-term survivability of this population, and a description of a geographic location of a population of the species.

4 marks

- c. Comment on how important this population is to the survival of the species as a whole.

2 marks

-
- This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

Total 14 marks

Question 4

An environmental scientist doing a wildlife survey in coastal heathland discovered a small population of the New Holland Mouse, an endangered native mammal in Victoria. Despite carrying out extensive surveys it was found only at one site in the heathland. The scientist estimated the total population size to be less than 20 individuals, and expressed concern about the future survival of the species in that area.

- a. Explain why the scientist may be justified in expressing concern about the survival of the New Holland Mouse in this heathland area.

2 marks

Like many other threatened species, the New Holland Mouse is listed under the *Flora and Fauna Guarantee Act 1988*, and an **Action Statement** has been prepared.

- b. What is the purpose of an Action Statement for a threatened species under the Flora and Fauna Guarantee Act?

3 marks

In the following summer the heathland was burned in a bushfire. The scientist returned and carried out further surveys to assess the impact of the fire on the New Holland Mouse. No animals were found in the area in that year or in the following five years. The scientist concluded that the population was locally extinct. A reintroduction program was planned to release captive-bred animals back into this area.

- c. What step could be taken in the reintroduction program to enhance the genetic diversity of the new population? Explain how this step would enhance genetic diversity.

4 marks

Total 9 marks

SECTION B – continued

Question 5

Woodland ecosystems in southern Australia have been extensively cleared for agriculture and in many places they occur as remnants, isolated by cleared farmland. There is concern about the long-term conservation of biodiversity in such woodland remnants.

The following table presents data from a monitoring program for birds in three woodland remnants, A, B and C. In each remnant, a 10 ha (hectare) study plot was surveyed in 1990 and again in 2000. The Red-capped Robin and the Hooded Robin are included among a group of woodland birds regarded as experiencing regional population decline in southern Australia.

The numbers in the table refer to the number of individuals of each species recorded in the remnant study plots A, B and C in each year.

Species	Woodland remnant	Year of survey	
		1990	2000
Red-capped Robin	A	25	26
	B	15	8
	C	20	20
Hooded Robin	A	10	5
	B	8	1
	C	6	3

- a. Calculate the average population density (number of individuals per hectare) for each of these two species in each of the two years of the survey for all three woodland remnant sites taken together.

Species	1990	2000
Red-capped Robin		
Hooded Robin		

4 marks

The scientist who carried out the surveys concluded that both species had declined between 1990 and 2000.

- b.** Evaluate the evidence for decline for each species. Explain whether there is sufficient evidence to reliably conclude whether overall population decline has occurred.

Red-capped Robin

Hooded Robin

4 marks

The scientist noted during the survey in 2000 that a colony of the Noisy Miner was present in a nearby woodland remnant, remnant D. The Noisy Miner is a native bird that is aggressive to some other bird species, especially small insect-feeding birds. The scientist carried out a survey in remnant D in 2000 and returned in 2002 and carried out a similar survey, but this time the Noisy Miner was not present. The following table lists the scientist's observations of the number of individuals of each species in each year.

Species	Year of survey	
	2000	2002
Galah	10	5
Eastern Rosella	10	8
Australian Magpie	6	0
Willie Wagtail	10	8
Red-capped Robin	0	5
Hooded Robin	0	2
Rufous Whistler	0	5
Grey Shrike-thrush	5	6
Striated Thornbill	0	15
Noisy Miner	20	0
Brown-headed Honeyeater	0	10
Black-chinned Honeyeater	0	3
Striated Pardalote	15	20
Spotted Pardalote	0	5
Grey Fantail	0	2

- c. Species richness refers to the number of different species in a community. What was the species richness of birds recorded in remnant D in 2000 and in 2002?

2000	2002

2 marks

The scientist concluded that the Noisy Miner has a significant effect on bird communities in woodland remnants.

- d. i. Discuss **one** reason why the validity of the scientist's conclusion might be limited.

- ii. Outline a study that could be carried out to provide a stronger test of the hypothesis that the Noisy Miner has a significant negative effect on bird communities.

2 + 4 = 6 marks

Total 16 marks