



Victorian Certificate of Education 2005

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

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ENVIRONMENTAL SCIENCE

Written examination 1

Tuesday 7 June 2005

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	6	6	70
			Total 90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, an approved graphics calculator (memory cleared) and/or one 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 electronic communication 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

A fossil fuel is best described as

- A. a flammable solid or gas.
- B. a fuel that contains carbon.
- C. fossilised rock that will burn in a power station.
- D. a flammable substance formed from ancient biological material.

Question 2

An example of a non-renewable, non-fossil energy resource is

- A. oil.
- B. coal.
- C. tidal.
- D. uranium.

Question 3

Which of the following is **not** a renewable energy source?

- A. wind
- B. solar
- C. biomass
- D. natural gas

Question 4

Australia is a signatory to the Ramsar Convention.

Which of the following actions is most likely to be covered by the Ramsar Convention?

- A. replacing introduced (exotic) grass species in parks with native species
- B. deciding for or against the reintroduction of limited whaling in the Antarctic
- C. protection of large wetlands in northern Australia by excluding exotic predatory animals
- D. a decision about culling excessive numbers of koalas on Kangaroo Island, South Australia

The following information relates to Questions 5–6.

A marine scientist records all whales observed entering a bay during the three months of the breeding season. He records the following data.

Year	1998	1999	2000	2001	2002	2003	2004
Number of whales sighted	36	38	46	34	36	50	40

Question 5

The average number of whales observed is

- A. 7
- B. 20
- C. 40
- D. 60

In 2003 a commercial whale-watching operation, using three boats, commenced.

Question 6

Which of the following best describes the conclusion that the scientist can make?

- A. The whale watching has significantly reduced the whale population.
- B. The whale watching has significantly increased the whale population.
- C. The between-year variation is too great to draw any meaningful conclusion.
- D. There is an overall downward trend in the number of whales, so boats made no difference.

The following information relates to Questions 7–8.

An engineer is planning the electricity supply for an isolated city. She wants to make the system as energy efficient and environmentally friendly as possible, but her options are limited. The two options she is considering are

Option 1: Coal-burning power station on a coal field approximately 300 km from the city, with high-voltage transmission lines between them.

Option 2: Diesel power station in the city, generating power at the desired voltage (250 V AC).

In Option 1, the efficiency of the various stages in the process are as follows.

Efficiency of the generating plant (coal to electricity) 60%

Efficiency of the long-distance high-voltage transmission lines 90%

Efficiency of the transformers to convert high voltage to 250 V in the city 90%

In Option 2, the diesel power station is approximately 60% efficient (oil fuel to electricity ready to use).

Question 7

What percentage of the coal's energy reaches the city?

- A. approximately 30%
- B. approximately 50%
- C. approximately 60%
- D. approximately 90%

One kilogram of diesel-oil fuel used contains 8000 kJ of energy.

Question 8

How much of the energy contained in the diesel-oil fuel is **not** converted to electricity when burnt in the power station?

- A. 4800 kJ
- B. 3200 kJ
- C. 2400 kJ
- D. 1200 kJ

Question 9

Which of the following is **not** a threat to biodiversity?

- A. inbreeding
- B. genetic swamping
- C. scientific monitoring programs
- D. competition from exotic species

Question 10

Which of the following management strategies is likely to **increase** genetic diversity in a population of a species?

- A. wildlife corridors connecting different habitats
- B. culling some animals to allow more access to food
- C. fencing their breeding habitat to exclude predators
- D. removal of some pairs for a captive-breeding program and reintroduction to this habitat

Question 11

The conservation category of a threatened species **improves** when it changes from

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

Question 12

Species diversity of the animals in a region can best be determined by measuring

- A. how many endemic species occur in this region.
- B. the total number of animals within the region.
- C. differences in gene structure within a species.
- D. the relative abundance of the different species within the region.

Question 13

Which of the following is a greenhouse gas?

- A. helium
- B. oxygen
- C. nitrogen
- D. methane

Question 14

The enhanced greenhouse effect is due to

- A. increased trapping of infrared radiation emitted from the Earth's surface and oceans.
- B. decreased trapping of infrared radiation emitted from the Earth's surface and oceans.
- C. increased trapping of visible and ultraviolet radiation emitted from the Earth's surface and oceans.
- D. decreased trapping of visible and ultraviolet radiation emitted from the Earth's surface and oceans.

Question 15

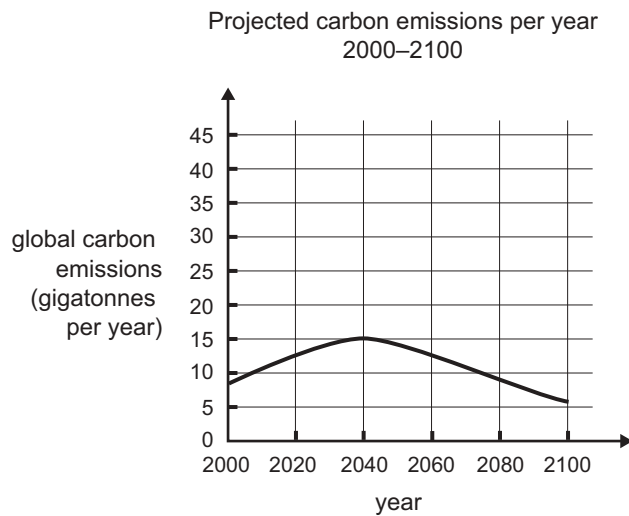
Which of the following is likely to be caused by the enhanced greenhouse effect on Earth?

- A. rising sea levels
- B. more extensive acid rain
- C. snowfalls at lower altitudes
- D. increased bioaccumulation of toxic metals by marine life

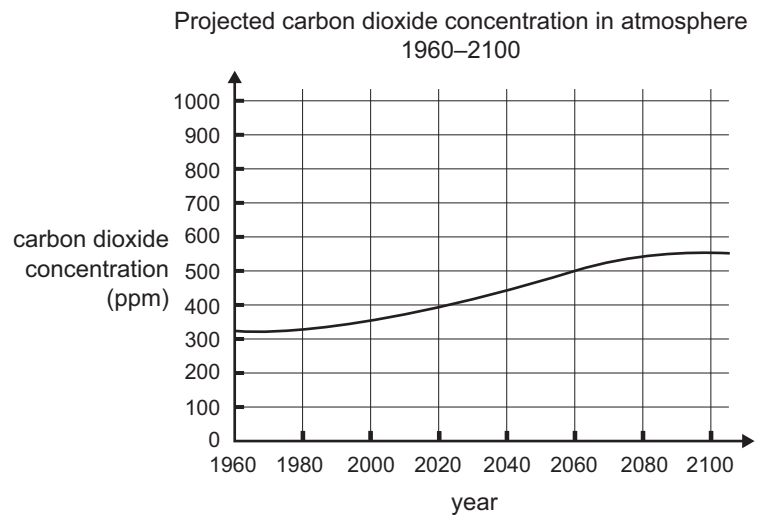
The following information relates to Questions 16–17.

The following graphs show projected atmospheric carbon emissions and carbon dioxide concentrations.

Graph 1



Graph 2



The carbon is emitted in the form of carbon dioxide gas. Carbon comprises approximately 27% of the mass of carbon dioxide.

Question 16

The mass of **carbon dioxide** in gigatonnes emitted into the atmosphere globally in the year 2000 was approximately

- A. 2
- B. 8
- C. 15
- D. 30

Question 17

The projected percentage increase in atmospheric carbon dioxide between the years 2000 and 2100 is approximately

- A. 60
- B. 100
- C. 200
- D. 550

The following information relates to Questions 18–19.

A rare species of possum, Leadbeater's Possum, is identified at two separate sites, A and B. Both populations are approximately the same size. The probability of extinction of the population in the next 10 years at site A was assessed as 0.30, and at site B as 0.50.

The probability of extinction of two or more independent populations is found by multiplying together the probability of extinction of each individual population.

Question 18

The overall probability of extinction of both populations is approximately

- A. 0.15
- B. 0.20
- C. 0.80
- D. 1.5

The habitat of population A is approximately 1000 hectares. To determine the total population, a scientist counts the number of possums in a 10 hectare block one evening, identifying 10 possums.

Question 19

From this data, assuming the sample was representative, the total population would be approximately

- A. 10
- B. 100
- C. 1000
- D. 2000

The Flora and Fauna Guarantee (FFG) Act 1988 is a key piece of legislation in Victoria for the conservation of threatened plants and animals. The FFG Act allows for individuals, organisations or government agencies to nominate a species for listing on the Threatened Species list.

Question 20

An important reason for having legislation such as the Flora and Fauna Guarantee Act is to

- A. guarantee that environmental issues are considered by politicians.
- B. ensure that actions will be taken to protect threatened species in Victoria.
- C. monitor the populations of feral animals occurring in Victoria.
- D. document extinct species of plants and animals in Australia.

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

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

Question 1

A large industrial port city is located on the coast. Nearby is a high mountain range, which receives heavy rainfall due to the strong, moist onshore wind (blowing from sea to land) that blows about half of the time. The city is well served by both sea and rail transport, so fossil fuels can be easily obtained. Public transport is provided by an extensive electric tram system.

One of the main industries in the city is an aluminium smelter, which operates 24 hours per day, 365 days per year continually, and is a large consumer of electricity.

The city council is doing long-term planning to provide for the future electricity supply needs of the city.

Name a fossil energy source and a non-fossil energy source that you have studied.

Fossil _____ Non-fossil _____

- a.** Outline the advantages of your nominated fossil energy source.

2 marks

- b.** Outline the disadvantages of your nominated fossil energy source.

2 marks

- c.** Outline the advantages of your nominated non-fossil energy source.

2 marks

- d.** Outline the disadvantages of your nominated non-fossil energy source.

2 marks

- [illegible]

SECTION B – continued
TURN OVER

Question 2

Compared with coal from most other parts of the world, an advantage of Australian coal is that it has a very low sulfur content.

When burned, sulfur forms a gas, sulfur dioxide. Sulfur dioxide absorbs infrared radiation and readily dissolves in water.

In another country, a very large power station serves a surrounding industrial complex located in a region of forests and lakes. The power station uses a high sulfur-content coal which is mined next to the power station.

- a. Name **two** emission products from the combustion of the high sulfur-content coal.

2 marks

- b. Discuss the implications of these two emissions for global warming. Your answer should include an account of the mechanism by which these contribute to the enhanced greenhouse effect.

3 marks

To comply with the Kyoto Protocol, environmentalists wish to replace the power station with a renewable energy source.

- c. Describe the Kyoto Protocol and its aims.

3 marks

Total 8 marks

Question 3

Solar cells are to provide for the following energy needs of a house by replacing the existing electricity supply from a coal-burning power station.

Light	$25 \times 100 \text{ W}$ globes
Heating	$4 \times 1000 \text{ W}$ heaters
Fridge and washing machine	500 W in total
Hot water system	$1 \times 2000 \text{ W}$ system

- a. What is the total electrical power requirement of the house when all the electrical equipment is operating?

2 marks

- b. The solar cells used are approximately 30% efficient. Explain what is meant by 30% efficient.

2 marks

- c. Explain why it is impossible to produce a solar cell that is 100% efficient.

2 marks

- d. With only some appliances working, 4000 W are used.

Calculate what area of solar cells would be required to provide power for these appliances during a period when the power from the Sun at the Earth's surface is 800 Wm^{-2} (watts per square metre). Explain each step and show your working.

4 marks

Total 10 marks

Question 4

- a. Name one endangered (threatened) animal species you have studied this year. Describe its habitat and the location and size of a known population of the species.

3 marks

- b. Scientists often assess the degree of threat to a species in terms of conservation categories. In what threat conservation category is your nominated species? Explain the meaning of this category, and why you would place the species there.

3 marks

- c. Outline the main threats to this species.

3 marks

- d. Describe **two** practical management strategies that could be used to protect a population of this species from the threats mentioned in part c.

3 marks

- e. Outline a scientific process for evaluating the threats to the species.

1 mark

- f. Describe how the effectiveness of the management strategies could be assessed.

2 marks

- g. Explain the relevance of the Flora and Fauna Guarantee Act 1988 to the protection of your selected species.

2 marks

Total 17 marks

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Question 5

There are several large national parks in the Mallee region of northwestern Victoria. This semi-arid environment supports a diverse range of plants, animals and vegetation types, which are distinctly different from those occurring in southern Victoria.

A ranger working in a national park became concerned about the number of colonies of introduced honeybees that she observed in the park. She frequently noted bees entering and leaving large hollows in River Red Gum trees along a creek.

- a. Explain why the ranger may be justified in her concern about the effects of honeybees on the conservation values of the national park.

2 marks

- b. Major Mitchell's Cockatoo, a threatened species, is known to breed in the national park. The ranger was disturbed to see several trees in the park which had been cut open to gain access to a cockatoo's nest in a tree hollow. Major Mitchell's Cockatoos are prized as an aviary species and birds smuggled overseas illegally can be sold for a high price.

Outline a management action that the ranger could take to reduce the incidence of illegal collection of Major Mitchell's Cockatoos.

2 marks

- c. The smuggling of Major Mitchell's Cockatoos to other countries contravenes an international convention to which Australia is a signatory. What is the name of this convention?

1 mark

- d. The national park is regarded as an important area for the conservation of plant and animal species because it has a high 'ecosystem diversity'. Describe what is meant by ecosystem diversity.

2 marks

- e. Each year, rangers carry out controlled burns in one or more sections of Mallee vegetation in the park to create a pattern of differently aged areas of vegetation. Is this management practice likely to increase or decrease ecosystem diversity in the park? Explain your answer.

3 marks

Total 10 marks
SECTION B – continued
TURN OVER

Question 6

One of three forest blocks, A, B, and C, is to be harvested for timber.

As part of the forest-planning process, a survey was undertaken of the flora and fauna. Tree-dwelling mammals (possums and gliders) were surveyed by carrying out spotlight observations at night along marked transects (straight line paths). In each forest block, six transects were to be surveyed. Two hours of spotlight observations were completed on each transect by a scientist. Blocks A and B were surveyed as planned but, because of bad weather, only four transects were completed in Block C.

The table below shows the total number of individuals of each species that were observed in each of the three blocks. In each block, the results from the transects undertaken have been added together.

Leadbeater's Possum is an endangered species in Australia.

Species	Block A	Block B	Block C
Mountain Brushtail Possum	18	6	8
Leadbeater's Possum		3	
Yellow-bellied Glider		2	3
Sugar Glider		2	4
Common Ringtail Possum	18	5	5
Greater Glider	12		6
Feathertail Glider			2

- a. In which block was the highest species richness recorded? Explain your choice.

2 marks

The relative abundance of tree-dwelling mammals can be expressed as the number of individuals observed per spotlight-hour of observation. This simple index can be calculated by dividing the total number of individuals observed (of all species combined) by the total number of hours of observation.

- b. What is the relative abundance of tree-dwelling mammals in each forest block? Show your working.

	Working	Relative abundance
Block A		
Block B		
Block C		

2 marks

d. Which of the three blocks available would you consider could be harvested with the **least** impact on biodiversity of the tree-dwelling mammals? Your answer should include reference to species diversity, relative abundance and endangered status.

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Total 12 marks