VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2008

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

ENVIRONMENTAL SCIENCE

Written examination 1

Thursday 12 June 2008

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 19 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 is a non-renewable energy source?

A. natural gas
B. biomass
C. hydroelectricity
D. wind

Question 2

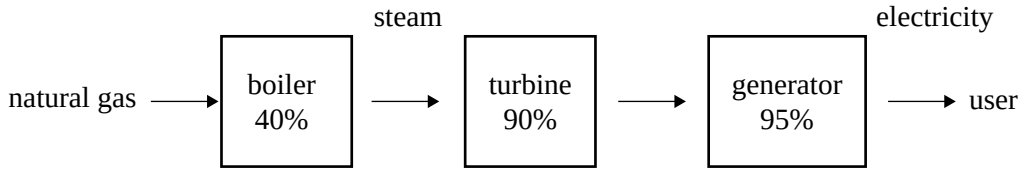
A probable consequence of the enhanced greenhouse effect is

A. an increase in the level of ultraviolet radiation reaching the Earth's surface.
B. a depletion of the ozone layer.
C. an increase in sea levels.
D. an increase in the height of the atmosphere.

The following information relates to Questions 3–4.

Natural gas is often used as the fuel (energy source) in thermal power stations. Natural gas is burned in the boiler to produce steam to drive a turbine.

The process and the efficiency of each conversion is shown below.



Question 3

The burning of natural gas in the boiler is an example of

A. a conversion of heat energy to kinetic energy.

B. an exothermic reaction.

C. an endothermic reaction.

D. a conversion of heat energy to chemical energy.

Question 4

The overall energy efficiency of the power station in converting natural gas to electricity is approximately

A. 34%

B. 40%

C. 95%

D. 225%

Question 5

Emissions trading is often suggested as a way to reduce the enhanced greenhouse effect.

Which one of the following is the best example of emissions trading?

A. A power station uses natural gas in place of coal in its boilers to reduce emission of greenhouse gases.

B. A forestry company plants trees and sells emission credits to a power station.

C. A company replaces its fleet of large petrol-powered cars with hybrid petrol electric cars.

D. An Australian company sells liquid natural gas to China.

The following information relates to Questions 6–8.

The graph in Figure 1 shows the carbon dioxide concentration in the atmosphere at a particular measuring station from 1960 to 2005.

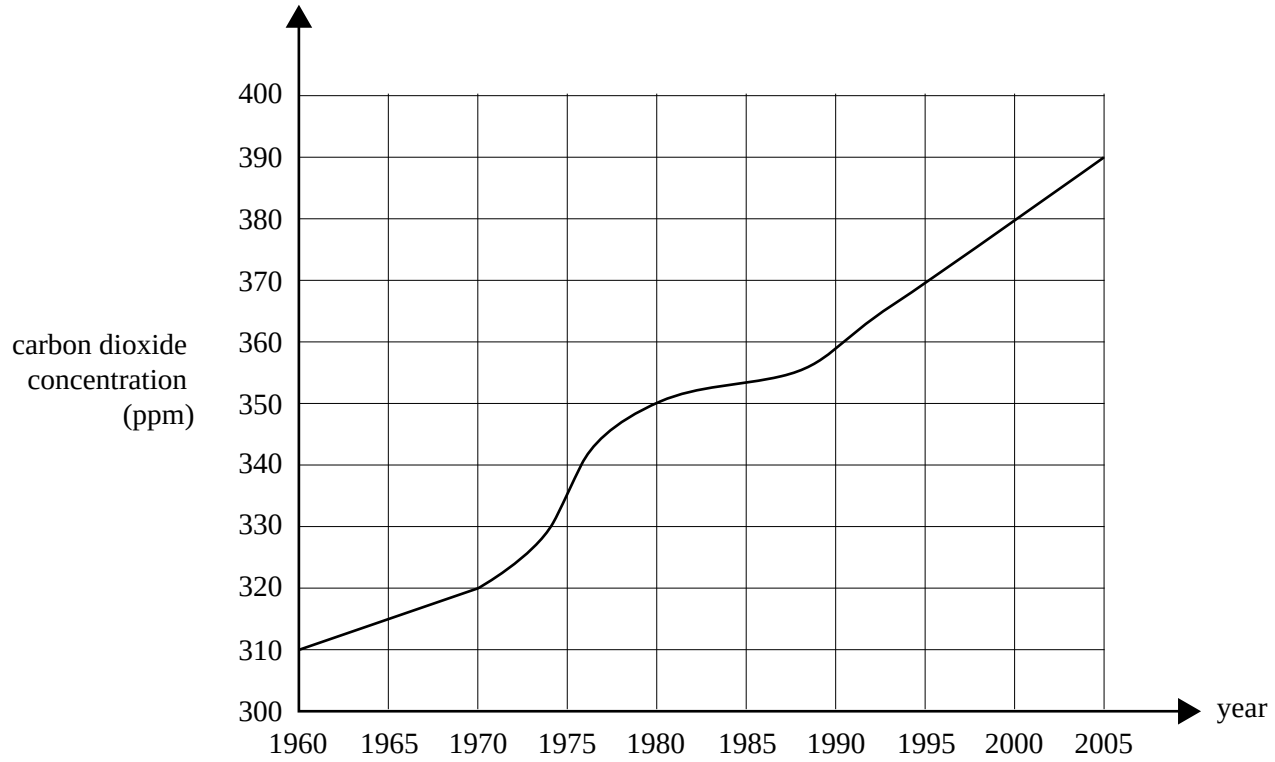


Figure 1

Question 6

Which one of the following is the best estimate of the percentage increase in carbon dioxide concentration in the atmosphere as measured at the station from 1960 to 2005?

A. 16%

B. 21%

C. 26%

D. 80%

Question 7

In which of the following decades (10-year period) was the rate of increase of carbon dioxide concentration the greatest?

A. 1960–1969

B. 1970–1979

C. 1980–1989

D. 1990–1999

Question 8

From the information in Figure 1, which one of the following is most likely to have caused the greater rate of increase in the decade identified in Question 7?

A. opening of a coal-burning power station close to the measuring station

B. clearing of a large area of forest close to the measuring station for housing development

C. a brief volcanic eruption close to the measuring station

D. unusually high rainfall in the area close to the measuring station

Question 9

The explicit aim of the Kyoto Protocol is to

A. replace nuclear energy sources with renewable energy sources for electricity generation.

B. transfer timber production from native forests to plantations.

C. change from natural gas to methane for electricity generation.

D. reduce carbon dioxide emissions.

Question 10

The Gang-gang Cockatoo is endemic to Australia.

This means the Gang-gang Cockatoo

A. is at serious risk of extinction in Australia.

B. is not indigenous (native) to Australia.

C. does not exist elsewhere in the world.

D. can only exist in conjunction with other native Australian species.

Question 11

A threatened Australian reptile species is highly valued in other countries, and so is at risk of illegal trading.

Which one of the following is intended specifically to guard against this threat?

A. *Flora and Fauna Guarantee Act 1988*

B. Kyoto Protocol

C. Ramsar Convention

D. CITES

Question 12

Ecosystem diversity of an area is best described as the variety of

A. species found in that area.

B. types of habitats and ecological processes found in that area.

C. species endemic to that area.

D. types of habitats occupied by single species in that area.

Question 13

For a threatened species, which one of the following changes in threat status represents an **increase** in the probability of extinction?

A. vulnerable to endangered

B. critical to endangered

C. exotic to vulnerable

D. endangered to vulnerable

Question 14

Two previously isolated populations of a particular species come into contact and breed with each other. One of the populations is much larger than the other.

A potential consequence for the smaller population may be

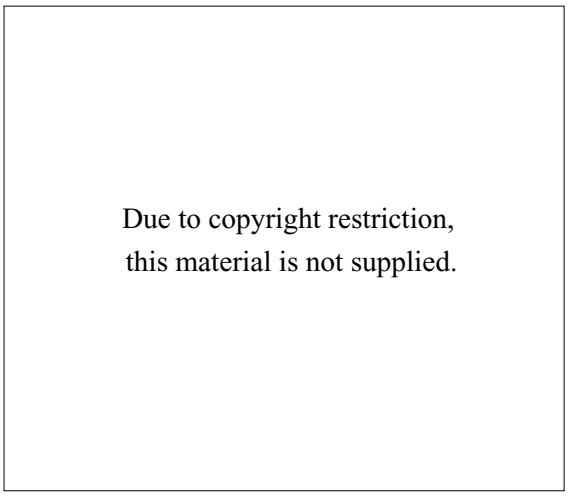
A. genetic drift.

B. genetic swamping.

C. inbreeding.

D. demographic variation.

The following information relates to Questions 15–16.



A population of a species of Australian marsupial, the Northern Quoll, is considered threatened in a particular habitat.

A scientist, Ling, takes a small number of breeding pairs from the population for a captive breeding program. The program involves the pairs breeding in a controlled environment. Their offspring are then reintroduced to the original habitat.

Question 15

The main aim of this captive breeding program is to

A. avoid genetic swamping.

B. increase the numbers in the population.

C. increase the genetic diversity.

D. increase the species diversity.

Question 16

Phil, another scientist, suggests that Ling should have taken some Quolls for her captive breeding program from a nearby, but separate, population of the same species.

Phil's suggestion would have been intended to increase the

A. numbers in the breeding program.

B. genetic diversity.

C. genetic drift.

D. demographic variation.

The following information relates to Questions 17–20.

A marsupial species is identified at two separate areas, area A and area B. Area A is approximately 9 square kilometres (3 km × 3 km); area B is smaller with a smaller population.

Question 17

Robyn determines the population of area A by sampling. She samples four random areas of 300 m × 300 m. She finds 10, 12, 8 and 10 individuals respectively in these sample areas.

Which one of the following is the best estimate of the population of area A?

A. 10

B. 100

C. 1 000

D. 10 000

Question 18

The overall probability of extinction of two independent populations is calculated by multiplying individual risks of extinction.

Robyn estimates the probability of extinction of the population of area A as 0.15, and area B as 0.45.

Which of the following gives the best overall probability of both populations becoming extinct?

A. 0.0675

B. 0.300

C. 0.600

D. 0.675

Question 19

A captive breeding program is proposed. Robyn insists that individuals come from both area A and area B. Alan argues that since area A has a much larger population and the population is at much lower risk of extinction than the population in area B, all individuals should come from area A.

Robyn's suggestion is most likely to decrease the risk of

A. demographic variation.

B. inbreeding.

C. genetic diversity.

D. endemism.

Question 20

Robyn returns to study area A annually for six years. Over each of the six years, she measures the number of individuals of the species in a sample region within area A and records the following data.

year	1995	1996	1997	1998	1999	2000
number	50	55	52	48	56	53

As the estimated number of individuals is greater in 2000 than in 1995, Robyn concludes that the probability of extinction has decreased.

Which one of the following statements can best be made about Robyn's conclusion?

A. The numbers have increased, so she is correct.

B. The difference between 1995 and 2000 is within the normal statistical variation, so her conclusion cannot be made.

C. The numbers overall are too small to draw any conclusion.

D. The probability of extinction has increased as there are more individuals in competition.

END OF SECTION A
TURN OVER

SECTION B – Short answer questions

Instructions for Section B

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

Question 1

Figure 1a shows a simplified graph of intensity of radiation from the sun reaching the outer edge of Earth's atmosphere versus wavelength.

Figure 1b shows the proportion of radiation absorbed by Earth's atmosphere.

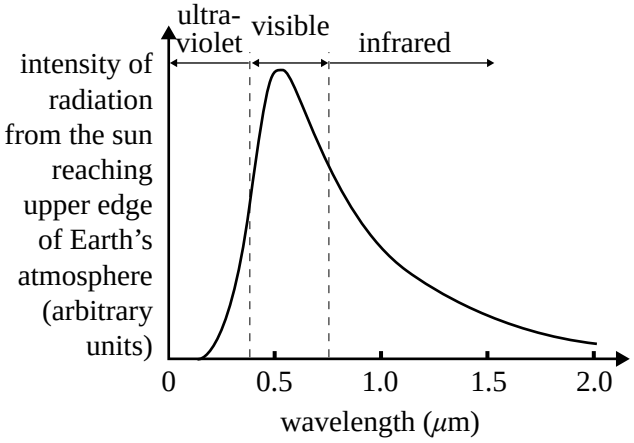


Figure 1a

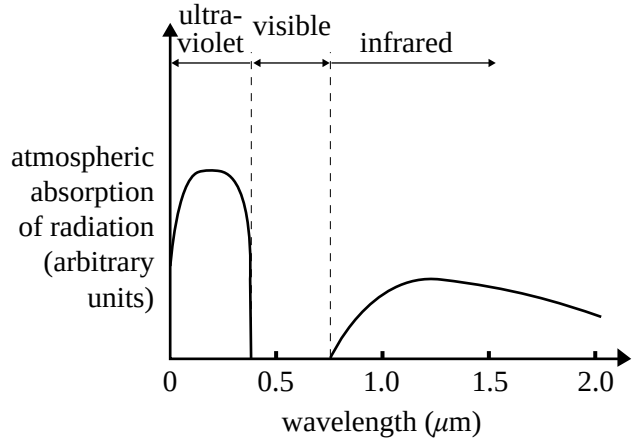


Figure 1b

The information in these graphs should be used to answer Question 1.

a. Compare the relative proportions of types of radiation reaching the outer edge of Earth's atmosphere from the sun.

3 marks

b. Explain why the incoming solar radiation actually reaching Earth's surface is different from that reaching the outer edge of the atmosphere.

3 marks

c. Describe the interaction of the incoming solar radiation energy with the Earth's surface.

3 marks

d. Referring to Figure 1b, explain the interaction of the radiation travelling from the Earth's surface with the gases in the atmosphere.

3 marks

e. Complete the following table.

	natural greenhouse effect	**enhanced greenhouse effect**
major contributing gas		
other gases contributing		

4 marks

Total 16 marks

Question 2

Name a fossil energy source you have studied this year.

_____

Name a non-fossil energy source you have studied this year.

_____

You should use these two sources in answering Question 2.

a. Give a brief outline of Melbourne's energy needs.

_____

_____

2 marks

Consider Melbourne's energy needs.

b. Explain how your fossil energy source does or could contribute to Melbourne's energy needs. Give one advantage of this source.

_____

_____

_____

_____

_____

_____

_____

_____

_____

4 marks

c. Explain how your non-fossil energy source does or could contribute to Melbourne's energy needs. Include one disadvantage.

4 marks

Total 10 marks

Question 3

Name one threatened animal species you have studied this year.

_____

Use this species in answering Question 3.

a. Describe a population of this species. Include in your answer the location and size of the population, and a description of its habitat.

4 marks

b. Outline the main threats to this species.

3 marks

c. Identify the threat category of the species.

Justify your answer by reference to

i. size and distribution of populations

ii. trends in population size

iii. risk of extinction

3 marks

d. Describe a management strategy that has been put in place or could be used to protect the population you have described in **part a.** from the threats in **part b.**

3 marks

e. Evaluate the effectiveness of this management strategy, including data to support your evaluation. If the project is not yet evaluated, outline a detailed plan that could be used.

4 marks

Total 17 marks

Question 4

The Giant Gippsland Earthworm (GGE) is considered one of the largest species of earthworm in the world. The worms can be over one metre in length.

Giant Gippsland Earthworm (*Megascolides australis*)

The GGE is endemic to a small area in south and west Gippsland, Victoria. Within this area, GGE populations can be restricted to very small areas of fragmented habitat.

The GGE is listed as 'threatened' under the Victorian *Flora and Fauna Guarantee Act 1988*.

The main threat to the GGE is habitat degradation caused by agricultural activities, such as planting and harvesting crops on private land owned by farmers.

The fact that the GGE species is endemic to this area makes it more in need of protection.

a. Explain why.

3 marks

Due to a proposed freeway construction through the area, conservation scientists intend to remove some of these GGE and relocate them to another site with suitable habitat.

b. Outline one advantage and one disadvantage of relocation as a method of protecting populations of the GGE.

Advantage

Disadvantage

3 marks

c. Describe one other possible strategy for protecting the population of the GGE.

3 marks

Total 9 marks

Question 5

The following information should be used in answering Question 5.

A scientist is studying a number of Australian marsupials in the mountain areas of Victoria, as part of a study to determine the sustainability of timber harvesting in different areas.

He identifies the conservation status and habitats for seven marsupials and completes the following table.

marsupial	conservation status	range
Common Brushtail Possum	not threatened	throughout eastern Australia and New Zealand
Leadbeater's Possum	critical	endemic to a small region in central Victoria
Common Ringtail Possum	not threatened	throughout eastern Australia
Yellow-bellied Glider	vulnerable	throughout eastern Australia
Sugar Glider	not threatened	throughout eastern Australia
Feathertail Glider	not threatened	throughout eastern Australia
Eastern Pygmy-possum	not threatened	eastern Australia and Tasmania

He studies three mountain areas and records the following data.

	number of individuals		
	area 1	**area 2**	**area 3**
Common Brushtail Possum	54	30	40
Leadbeater's Possum	0	0	12
Common Ringtail Possum	30	18	50
Yellow-bellied Glider	6	12	0
Sugar Glider	12	30	0
Feathertail Glider	6	18	0
Eastern Pygmy-possum	12	12	0

Species richness is the number of different species present in a particular region.

Species diversity takes into account the relative abundance of each species present as well as the total number of species.

a. Explain why both species richness and species diversity are important in determining the biodiversity of a habitat. Include in your answer reference to the data above.

4 marks

The scientist argues that the area to be logged should be area 3, as it has the lowest total number of individuals to be disturbed, and the lowest species richness.

b. Do you agree or disagree with him? Give reasons for your answer.

3 marks

Indices are used to provide a quantitative measure of biodiversity. Simpson's Index is one of these.
Simpson's Index (D) is defined as
$D = 1 - (p_1^2 + p_2^2 + p_3^2 + p_4^2 + p_5^2 + p_6^2 + p_7^2)$ for seven species
where

$$p_1 = \frac{\text{number of individuals of species 1 at the site}}{\text{total number of individuals at the site}}$$

and similar for each species.
A lower Simpson's Index indicates lower biodiversity.

c. Calculate Simpson's Index for areas 1 and 2 using the following workspaces.
Show working.

area 1

Species	**No. of individuals**	**$p = \frac{\text{No. individuals}}{\text{Total no.}}$**	**p^2**
Common Brushtail Possum	54		
Leadbeater's Possum	0		
Common Ringtail Possum	30		
Yellow-bellied Glider	6		
Sugar Glider	12		
Feathertail Glider	6		
Eastern Pygmy-possum	12		
	Total no. =		Total p^2 =

Simpson's Index (D) = 1 – Total p^2 =

area 2

Species	**No. of individuals**	**$p = \frac{\text{No. individuals}}{\text{Total no.}}$**	**p^2**
Common Brushtail Possum	30		
Leadbeater's Possum	0		
Common Ringtail Possum	18		
Yellow-bellied Glider	12		
Sugar Glider	30		
Feathertail Glider	18		
Eastern Pygmy-possum	12		
	Total no. =		Total p^2 =

Simpson's Index (D) = 1 – Total p^2 =

4 marks

d. Discuss the species diversity of these two areas, including reference to the meaning of the Simpson's Indices that you have calculated in **part c.**

3 marks

e. Discuss the reasons for maintaining biodiversity in our world for human health and wellbeing. Include some examples in your answer.

4 marks

Total 18 marks

END OF QUESTION AND ANSWER BOOK