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VICTORIAN
ASSOCIATION FOR
ENVIRONMENTAL
EDUCATION

Victorian Certificate of Education 2010

ENVIRONMENTAL SCIENCE

Trial Written Examination 1
June 2010
Time allowed 1.5 hours [90 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	4	4	70
			Total 90

Materials
- Question and answer book of 19 pages.
- Answer sheet for multiple-choice questions.
- Writing materials.
- One approved 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

Which of the following statements is **false**?
- A. Greenhouse gases are generated by all non-renewable fuel sources
- B. Wind power originates from light energy
- C. Solar energy is used as a source of power in Victoria
- D. Biomass is a non-fossil fuel source

Use the following information to answer questions 2 and 3
Aruna uses photovoltaic solar panels connected to a rechargeable battery to power his electric front gate. The solar cells have an efficiency of around 15%, while the battery has an efficiency of 75%.

Question 2

The energy conversions involved are
- A. Light energy → Electrical energy → Chemical energy →Electrical energy → Kinetic energy
- B. Electrical energy → Light energy → Heat energy → Chemical energy → Kinetic energy
- C. Light energy → Heat energy → Electrical energy → Heat energy → Mechanical energy
- D. Heat energy → Electrical energy → Chemical energy → Electrical energy → Kinetic energy

Question 3

The overall efficiency of the gate set up is
- A. 1125%
- B. 0.20
- C. 11%
- D. 20%

Question 4

Which of the following is **least** likely to contribute to the enhanced greenhouse effect?
- A. Slashing and burning of trees
- B. Bioremediation of soils
- C. Increased population in third world countries
- D. Release of ozone from industrial plants

Question 5

Which of the following is a factor in the contribution of a gas to the greenhouse effect?
- A. Capacity of the gas to absorb visible radiation
- B. Capacity of the gas to absorb UV radiation
- C. Length of time the gas persists in the atmosphere
- D. Interaction with factors in the thermosphere

Graph 1 below is used to illustrate the idea that correlation does not necessarily show causation:

Global Average Temperature Vs. Number of Pirates

www.venganza.org
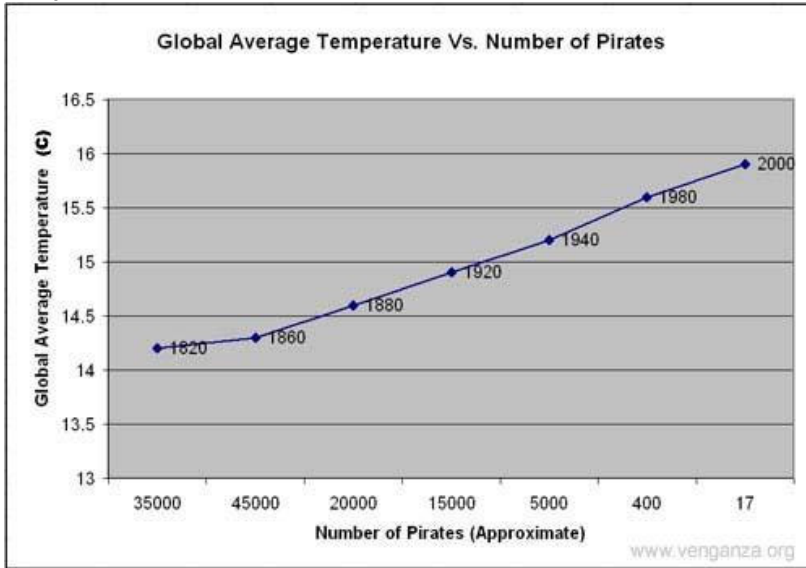
Question 6
Which of the following is a fault of the graph?
   A. The "number of pirates" data is not numerical
   B. There is correlation between number of pirates and global average temperature
   C. The title is in no way representative of the information in the graph
   D. The "number of pirates" data is continuous but is set out in discrete intervals

Question 7
The graph would show a similar relationship if, instead of "number of pirates", the *x*-axis showed
   A. Increasing concentration of nitrogen in the stratosphere
   B. Increasing absorption of infrared radiation in the thermosphere
   C. Decreasing incoming visible radiation
   D. Increasing absorption of visible radiation by the earth's surface

Question 8
The least likely variables to show a relationship are global average temperature and
   A. Concentration of nitrogen gas (N_2) in the troposphere
   B. Absorption of infrared radiation in the troposphere
   C. Amount of incoming visible radiation
   D. Absorption of heat by methane gas

Question 9
All of the following are possible detrimental consequences of the enhanced greenhouse effect, with the exception of
   A. Increased average global temperatures
   B. Rising sea levels that may submerge low lying islands
   C. Thermal expansion of seawater
   D. Degradation of ozone in the stratosphere

Table 1 shows observations from an experiment studying various chemical reactions:

Reaction	Initial temperature (°C)	Final temperature (°C)	Gas produced	Energy Change
W	23	28	H_2	Chemical → Heat
X	22	19	O_2	Light → Chemical
Y	24	27	CO_2	Chemical → Heat
Z	23	181	CO_2	Chemical → Heat

Question 10
Reaction X is
   A. Respiration
   B. Exothermic
   C. Endothermic
   D. Combustion

Question 11
The reaction most likely to be a major contributor to the enhanced greenhouse effect is
   A. W
   B. X
   C. Y
   D. Z

Question 12
The reaction responsible for removing carbon from the atmosphere is
   A. W
   B. X
   C. Y
   D. Z

Question 13
An introduced species is
   A. Always invasive to certain species
   B. Never endemic to the area in question
   C. Non-native to the area in question
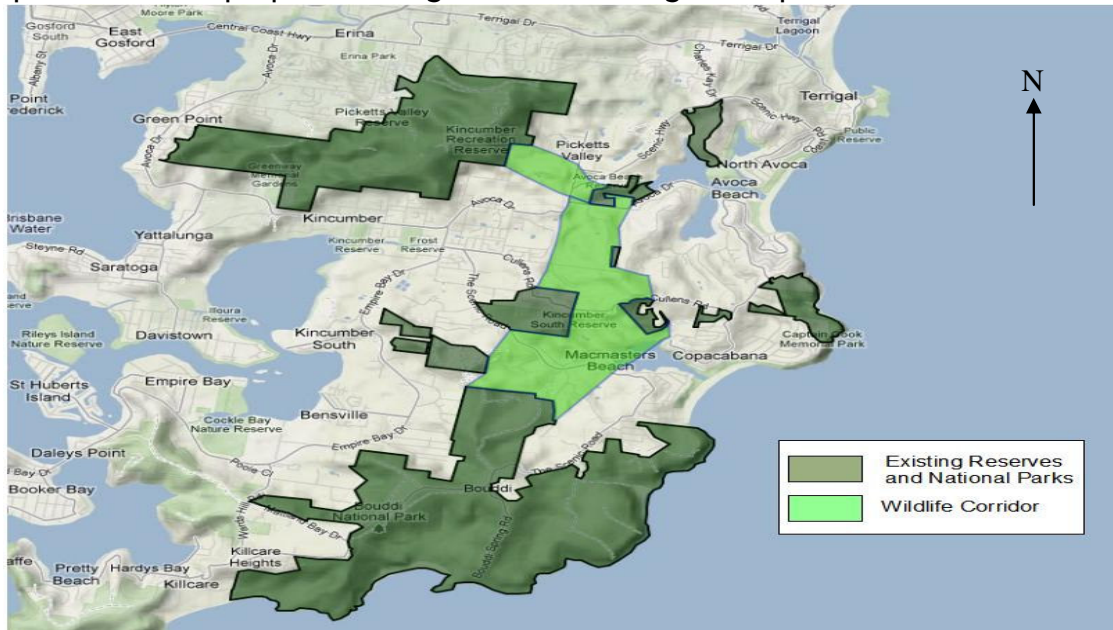   **D.** Always toxic to other species

Question 14
Captive breeding is most likely to be recommended within
   A. The CITES convention
   B. The Ramsar convention
   C. The Kyoto Protocol
   D. The Victorian Flora and Fauna Guarantee Act

The map below shows proposed changes to land management practices in New South Wales.

Source: Land for Wildlife http://newcastleonhunter.com/2009/landholders-offered-low-cost-wildlife-corridors/ February 2010.

Question 15
Which of the following is the principal aim of this proposal?
- **A.** To increase food and land availability for native species
- **B.** To decrease available resources for introduced species
- **C.** To spread seed of crop species into new areas
- **D.** To increase interaction between different species that live in different ecosystems

Question 16
A wildlife corridor is
- **A.** The release of captive plants or animals into the wild
- **B.** The reduction in quality of a habitat
- **C.** Left over small patches of vegetation
- **D.** A connection between remaining patches of vegetation

Question 17
For the purpose of the proposal, the existing reserves and national parks are categorised as
- **A.** Degraded vegetation
- **B.** Remnant vegetation
- **C.** Translocated
- **D.** Carbon sinks

Question 18
What is the most likely benefit of the proposal?
- **A.** An increase in genetic variation of previously isolated species
- **B.** An increase in genetic swamping
- **C.** The new vegetation will be a carbon source
- **D.** The area will be protected under CITES

Question 19

A species is at higher risk of extinction when:
  A. Its status is changed from endangered to vulnerable
  B. Genetic variation increases
  C. The chance of inbreeding decreases
  D. Its status changes from conservation dependent to extinct in the wild

Question 20

E.O. Wilson, a well-known biologist from Harvard University, estimates that 3 species become extinct every hour.

Which of the following has contributed most to loss of species on earth?
  A. Land degradation
  B. Habitat loss
  C. Global warming
  D. Genetic swamping

SECTION B – Short answer questions

Specific instructions for Section B

Answer all questions in the spaces provided.

Question 1
Diagram 1 below shows the movement of energy into and out of the earth's atmosphere:
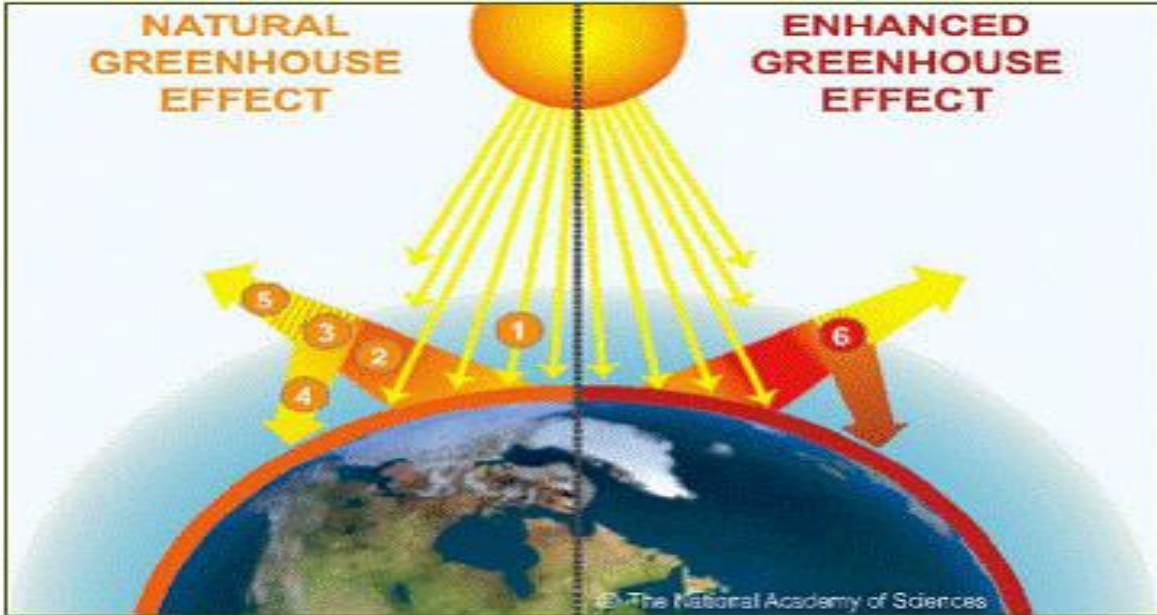
Source: Pew Center of Global Climate Change www.pewclimate.org/.../ghe.cfm March 2010.

a. Name the predominant type of incoming energy at point 1.

_____
1 mark

b. Name the predominant type of radiation at point 2.

_____
1 mark

c. Describe the process occurring at point 3.

_____

_____

_____

2 marks

d. State the process occurring at point 5.

_____
1 mark

Study diagram 2 below:
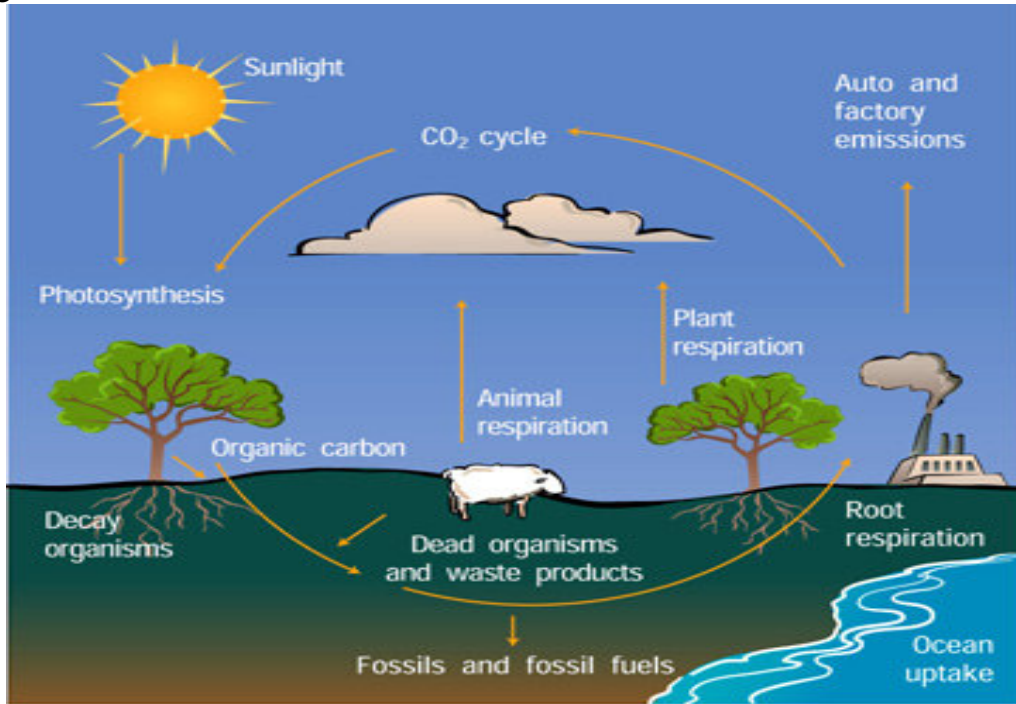
Source: "The National Center for Atmospheric Research" www.eo.ucar.edu/kids/green/cycles6.htm April 2010.

e. "Energy flows but elements cycle." State a link between diagrams 1 and 2 and explain how both diagrams illustrate this statement:

_____

_____

_____

_____

_____

_____

3 marks

f. If sufficient energy is transferred to a body of water to generate steam, the steam, so produced, can be used to drive a turbine. Draw a simple flow chart of the energy conversions in a coal-fired power station. Ensure you show the type of energy and its location in each step.

2 marks

g. State the first law of thermodynamics and use the diagram from **part f.** to explain its principles.

2 marks

h. The overall efficiency of a coal fired power station is generally between 25 –35%. Suggest two reasons as to why the overall efficiency is substantially lower than 100%:

3 marks

Total 15 marks

Question 2

Name a fossil fuel source that you have studied this year   _____

Name a non-fossil fuel source that you have studied this year _____

   a. Outline how the **fossil** fuel source came to exist in the earth's crust.

_____

_____

_____

_____

<div align="right">2 marks</div>

   b. Outline how the **non-fossil** energy source generates useable energy.

_____

_____

_____

_____

<div align="right">2 marks</div>

c. The city of Melbourne has extensive energy needs, including a high continuous base load and even higher demand at peak times. Compare the suitability of the fossil to non-fossil source for meeting the energy needs of Melbourne.

_____

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_____

6 marks

Total 10 marks

Question 3

The graph below shows the relationship between populations of the snowshoe hare and the Canadian lynx in Northern Canada. The lynx is the sole predator of the hare and the hare the sole prey for the lynx.
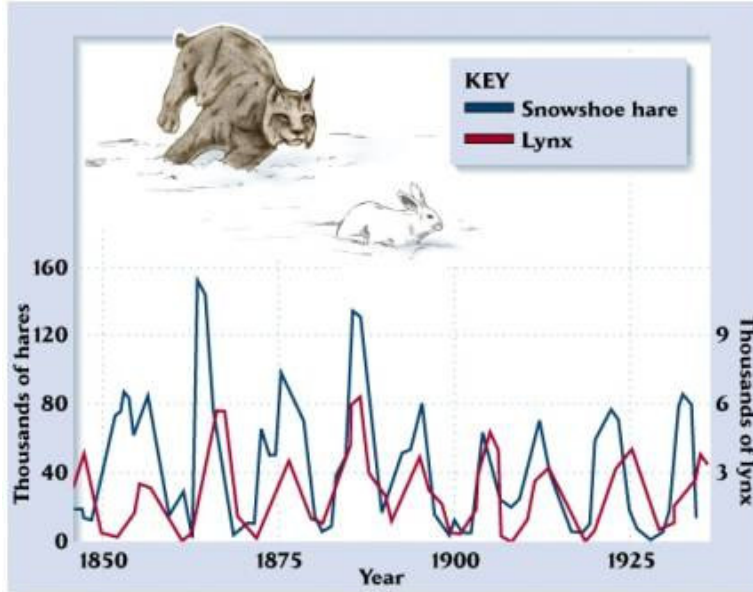
a. Compare the population size of the lynx to the hare in 1875 and explain the reason for this difference.

_____

_____

_____

_____

_____

_____

_____

3 marks

b. Calculate the percentage decrease in hare numbers between the higher peak in 1875 and the peak in 1920. Show working.

1 mark

The current IUCN status of the Canadian lynx is "endangered", but numbers are declining so this status may soon be changed.

c. Explain what the new conservation category of the lynx will be if numbers decline sufficiently.

_____

_____

_____

2 marks

Name one threatened animal you have studied this year

_____

d. Does your animal species have a greater chance of survival than the Canadian lynx? Explain.

_____

_____

_____

_____

2 marks

e. The Canadian lynx is endemic to Northern Canada. Describe 3 reasons why extinctions of local isolated populations considerably decrease the survival chances of the lynx species.

_____

_____

_____

_____

3 marks

f. In regions of localized extinction of the lynx, the hare numbers continue to fluctuate. State two reasons why this may be so.

_____

_____

_____

_____

2 marks

The population growth rate of lynx is said to be **K-selected**, that is, in favorable conditions, they experience population increase at a relatively slow rate due to their low number of offspring and the high level of care needed by their offspring before maturity. In contrast, snowshoe hare demonstrate **r-selection**, as they show rapid population increase in favorable conditions due to the large number of offspring they produce and the speed with which these offspring reach maturity.

g. Discuss, using two specific pieces of evidence, whether the endangered species studied this year is an r- or K-selected species:

_____

_____

_____

_____

_____

_____

3 marks

h. Describe the location or range as well as the habitat of the species you have studied this year and outline two conditions within the habitat that could be called "favorable" for this species:

_____

_____

_____

_____

_____

_____

_____

4 marks

i. Explain how a major threat to the chosen species reduces one or both of the favorable conditions stated in **part h**:

_____

_____

_____

_____

2 marks

j. Outline a strategy that is used to counteract the threat described in **part i.** and evaluate its effectiveness.

_____

_____

_____

_____

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_____

5 marks

Total 27 marks

Question 4

There are several wetland sites within Victoria, many of which have undergone measurable reduction in species diversity over the past 100 years.

Wetland habitat A has 15 different animal species with 100 individuals of one species and 1 individual within each of the other 14 species. Wetland habitat B also has 15 different animal species, but this one has 7 individuals within each of the 15 species.

a. Define the term "biodiversity".

_____

_____

_____

_____

<div align="right">2 marks</div>

b. Explain why it is not possible to quantify the genetic diversity of the two habitats using the information in the stem.

_____

_____

_____

_____

<div align="right">2 marks</div>

c. Determine the Simpson's index of the two wetland habitats:

HABITAT A:

Species	Number of individuals	$P = N^o$ indiv/ Total N^o	p^2
TOTAL N^o =		**TOTAL p^2 =**	

HABITAT B:

Species	Number of individuals	$p = N^o$ indiv/ Total N^o	p^2
TOTAL N^o =		**TOTAL p^2 =**	

Simpson's index habitat A =
Simpson's index habitat B =

4 marks

d. Using data and the terms "species richness" and "relative abundance", evaluate which of the two wetlands has the greater species diversity.

_____

_____

_____

_____

_____

_____

4 marks

e. Several measures can be undertaken to protect and manage the two habitats. Outline the possible advantages and disadvantages of the following strategies.
        i. Captive breeding and reintroduction.

Advantages:

_____

_____

_____

Disadvantages:

_____

_____

_____

<div align="right">3 marks</div>

        ii. Listing as a RAMSAR protected site.

Advantages:

_____

_____

_____

Disadvantages:

_____

_____

<div align="right">3 marks</div>

<div align="right">Total 18 marks</div>

- **END OF EXAM –**

VICTORIAN ASSOCIATION FOR ENVIRONMENTAL EDUCATION

| Student: | | Teacher: |

Specific instructions for Section A

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1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D