



Victorian Certificate of Education

2011

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

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ENVIRONMENTAL SCIENCE

Written examination 1

Wednesday 15 June 2011

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 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 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

Measurements taken during the decade 1990–2000 show that the average temperature of Earth increased.

The **major** cause for this increase is likely to have been the

- A. natural greenhouse effect.
- B. enhanced greenhouse effect.
- C. increased use of natural gas as a fuel rather than coal.
- D. increased generation of electricity from nuclear power stations.

Question 2

A major volcanic eruption in the 19th century emitted large quantities of grey ash into the atmosphere. In the year after this eruption, the average surface temperatures were 1–2 °C cooler.

This is most likely because the ash in the atmosphere

- A. trapped carbon dioxide in the lower atmosphere.
- B. caused increased rainfall, thus reducing surface temperature.
- C. reduced infrared radiation escaping from Earth's surface.
- D. reduced incoming solar radiation reaching Earth's surface.

The following information relates to Questions 3–5.

Most of the electrical energy for Melbourne is generated in coal-fired power stations in the Latrobe Valley. Coal is mined in open-cut mines next to the power station. Coal is burned in a boiler to produce steam.

Question 3

The burning of coal in the boiler is an example of

- A. a renewable reaction.
- B. an exothermic reaction.
- C. an endothermic reaction.
- D. conversion of mechanical to potential energy.

Question 4

At present coal is the fuel used in the boilers. Environmentalists suggest that natural gas should replace coal.

This is most likely because

- A. natural gas is renewable but coal is not.
- B. natural gas is more easily stored than coal.
- C. the cost of transporting the coal will be saved.
- D. natural gas produces less carbon dioxide per unit of energy released compared with coal.

SECTION A – continued

NO WRITING ALLOWED IN THIS AREA

Question 5

Environmentalists argue that the change to natural gas from coal will be in accord with the Kyoto Protocol.

This is most likely because the Kyoto Protocol

- A. aims to reduce carbon dioxide emissions.
- B. encourages the use of renewable energy sources.
- C. aims to increase sustainability by the use of more efficient energy sources.
- D. encourages the use of energy sources that will not damage the ozone layer.

Question 6

High-voltage electricity transmission lines are used to carry electricity from a power station to a city 100 km away. Power losses occur in the lines.

The power into the transmission lines system is 2800 kW and the system is 93% efficient.

The amount of energy lost from the transmission lines is approximately

- A. 200 kW
- B. 400 kW
- C. 2600 kW
- D. 2700 kW

The following information relates to Questions 7–9.

A variety of solar cells are available for use by home owners for the production of electricity. The energy output of these cells depends on a number of factors. These factors include

- the materials used for the semiconductor
- methods of cell construction
- latitude of location
- weather conditions
- cleanliness of cell surface.

Question 7

The production of energy by a solar cell is an example of

- A. kinetic energy being stored as light energy.
- B. light energy being used as chemical energy.
- C. light energy being converted into electrical energy.
- D. potential energy being converted into kinetic energy.

Question 8

The efficiency of energy conversion by a solar cell is directly related to

- A. how sunny or cloudy the day is.
- B. how expensive the solar cell is to produce and install.
- C. the size and number of cells used to collect the sunlight.
- D. how effectively the cell produces electricity from the sunlight available.

Question 9

A solar cell panel has a surface area of 3.0 m^2 and receives 980 W of light per m^2 . This energy is converted into 530 W of electricity in total.

The solar cell has an efficiency of approximately

- A. 5.5%
- B. 16%
- C. 18%
- D. 54%

Question 10

Which of the following statements is correct about the use of nuclear reactors for electricity generation in Australia?

- A. Uranium is very costly and difficult to mine.
- B. Nuclear reactors are not used because Australia has very small uranium reserves.
- C. Use of nuclear reactors has increased as the emissions of greenhouse gases from coal-burning power stations has become a major concern.
- D. Use of nuclear reactors does not currently occur because some people are concerned about the disposal of radioactive waste materials and other issues.

The following information relates to Questions 11–13.

Wildlife managers noted a large number of kangaroos were being killed by traffic on a section of highway that passed through bushland. To reduce the number of animals being killed, they considered erecting road signs to warn motorists of the danger of hitting a kangaroo.

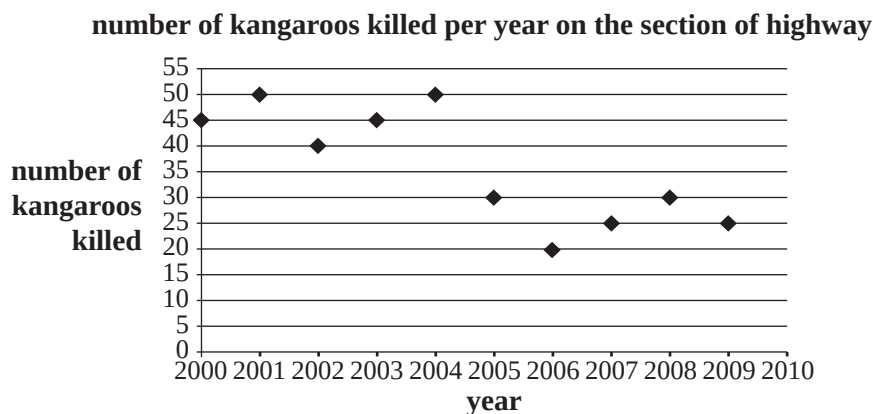
Question 11

In 2004, the managers had no evidence that the kangaroos killed on the highway actually reduced the overall population of kangaroos. However, they decided to erect road signs anyway to reduce any possible effect that these deaths might have on the kangaroo population.

This is an example of

- A. managing an exotic species.
- B. applying the precautionary principle.
- C. implementing the sustainability charter.
- D. precautionary management to reduce habitat destruction.

The figure below shows the number of kangaroos killed each year in this section of the highway before and after the warning signs were erected at the end of 2004.



Question 12

In the period after the road signs were erected, 2005–2009 inclusive, the average number of kangaroos killed per year was

- A. 25
- B. 26
- C. 27
- D. 30

Question 13

The best estimate of the percentage decrease in the number of kangaroos killed in 2009 compared with 2000 is

- A. 80%
- B. 44%
- C. 25%
- D. 20%

Question 14

A Landcare group decided that the protection of remnant vegetation along a stream should be its next priority. A management action that would directly address this priority is to

- A. plant trees along a bare section of the stream.
- B. erect signs to educate visitors about the value of the stream system.
- C. erect fences to prevent cattle from damaging natural vegetation along the stream.
- D. ensure both trees and shrub species are planted when revegetating along the stream.

Question 15

Inbreeding is a possible consequence of small population size.

Inbreeding is most likely to occur due to

- A. genetic drift in the population.
- B. genetic swamping of the population.
- C. increased demographic variation in the population.
- D. mating of closely related individuals in the population.

Question 16

A stream is used to supply water to a small town. Vegetation along the stream helps protect the water quality by filtering runoff of sediments from surrounding land.

In this regard, the vegetation can be seen as providing

- A. species diversity.
- B. a vegetation offset.
- C. a wildlife corridor.
- D. an ecosystem service.

The following information relates to Questions 17 and 18.

Dianthus deltoides L. is a flowering plant species found as a natural (wild) population in southwest Sweden. The pollination of flowers of *Dianthus* plants occurs when insects take the pollen nectar from the centre of the flower. These insects go on to take nectar from more than one flower, exchanging pollen.

Question 17

The loss of insects would affect *Dianthus deltoides* L.

This is because the relationship between insects and *Dianthus* is an example of

- A. symbiosis.
- B. endemism.
- C. competition.
- D. host-parasite.

Question 18

Pesticides used in farming areas in southwest Sweden have reduced the species diversity and abundance of important pollinator insects in the area.

The most likely effect of this reduction would be

- A. loss of *Dianthus* exotic competitors.
- B. increased genetic diversity of *Dianthus*.
- C. death of *Dianthus* from pesticide poisoning.
- D. reduced population size and range of *Dianthus*.

Question 19

Species diversity is related to

- A. richness within species.
- B. variation between species.
- C. variation within populations.
- D. the number of species and the relative abundance of each.

Question 20

A benefit of implementing wildlife corridors is to

- A. increase the amount of genetic drift in a species.
- B. prevent genetic swamping within a species.
- C. maintain or increase genetic diversity.
- D. reduce habitat destruction.

NO WRITING ALLOWED IN THIS AREA

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided. Write using black or blue pen.

Question 1

Name one fossil and one non-fossil fuel energy source you have studied.

Fossil _____

Non-fossil _____

A group of farmers grows fruit for export. These farmers wish to set up a processing plant to treat and package the fruit. The processing plant needs to be close to the farms. There is no local electricity power supply near the site, so the farmers have to provide electricity.

The processing plant requires standard voltage (240 V AC). It is necessary for the heating and refrigeration to run continuously (24 hours per day). The region has both windy and sunny days.

The site is 300 km from a port on the coast. The port can provide adequate supplies of coal, oil and natural gas. You may assume any other required materials are available at the port.

- a. Explain how one or both of your nominated energy sources could be used to provide the electric power that is necessary for the plant. Justify your choice.

3 marks

- b. Describe the infrastructure/system that is necessary to provide the electric power. Include where you would locate this infrastructure/system and any necessary transportation links.

3 marks

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- This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

d. Outline two disadvantages of your nominated non-fossil fuel energy source if it was to be used to provide the electric power for the plant.

1. _____

2. _____

SECTION B – continued

NO WRITING ALLOWED IN THIS AREA

Question 2

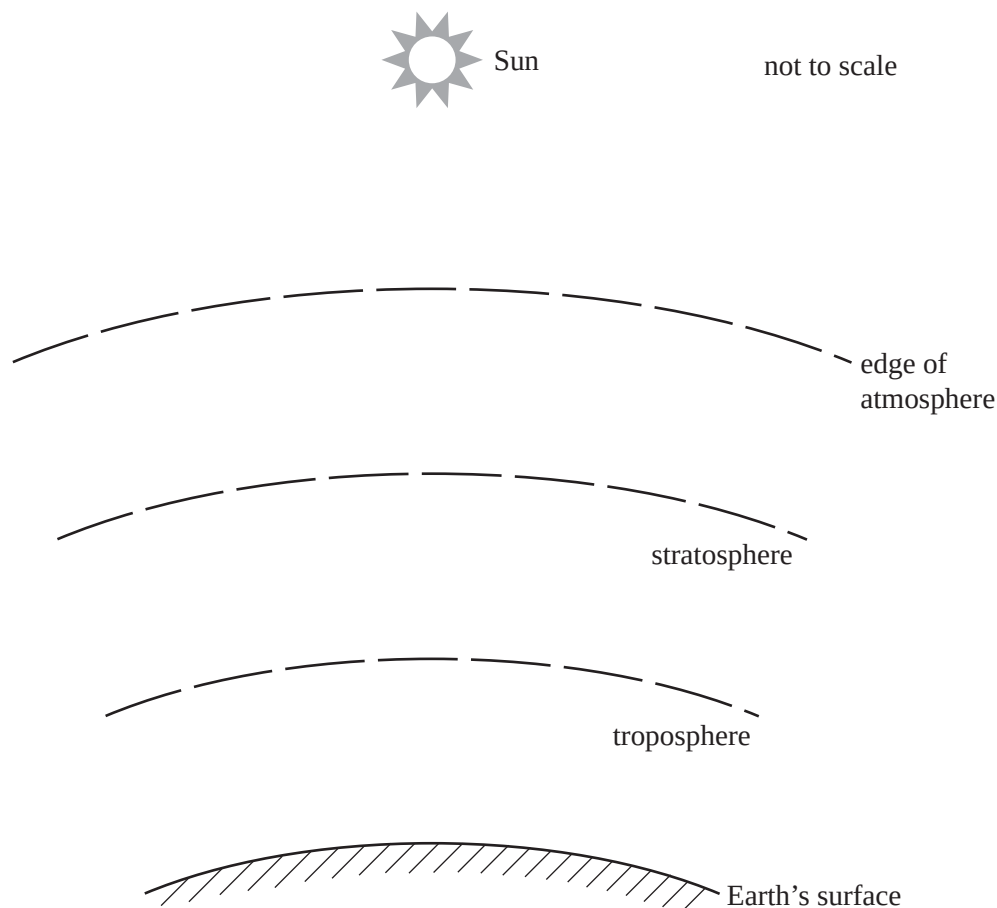
a.

Infrared radiation

Visible radiation (light) _____

Ultraviolet radiation - - - - -

Using the key above, draw on the diagram below where you would expect to find the paths of infrared (IR), visible and ultraviolet (UV) radiation.



4 marks

[illegible]

c. Name the fossil fuel energy source you used in Question 1. _____

SECTION B – continued

NO WRITING ALLOWED IN THIS AREA

Name one threatened animal species that you have studied. _____

-
- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

b. Explain the importance of this particular population in relation to the overall numbers of this species.

[illegible]

SECTION B – Question 3 – continued
TURN OVER

- c. State the organisation, piece of legislation or system that has identified the species as threatened. Identify the conservation status of your named species. State the key criteria that have led to the species being placed in this conservation category.

3 marks

- d. State the risk of extinction for the species using some numerical data to support your answer.

2 marks

- e. If this population was to become extinct, would there be any impact on ecosystem function?
Justify your answer.

2 marks

- f. Describe a management plan or strategy that has been put in place to protect this population from a specific threat.

3 marks

- g. Evaluate the effectiveness of this management plan or strategy in reducing the risk of extinction of this population. Quote specific numerical data in your answer.

4 marks

SECTION B – continued
TURN OVER

NO WRITING ALLOWED IN THIS AREA

Question 4

The Southern Bluefin Tuna (*Thunnus maccoyii*) has migratory paths throughout oceanic regions of the southern hemisphere, with spawning grounds (where fish eggs are fertilised) south of Indonesia.

The IUCN (International Union for the Conservation of Nature) has classified the tuna as 'critically endangered'.

The tuna is a very popular food.

The fishing industry is regulated, with maximum catches determined by international law. There are also fishing guidelines which aim to reduce the number of incidental deaths of other species.

Commercial bluefin tuna farms are in operation off the southern coast of Australia. Fish farming involves removing young fish from the wild and farming them until they reach an appropriate size. Artificial breeding technology is also being developed.

- a. State the threat to biodiversity that has caused the Southern Bluefin Tuna to be classified as critically endangered.

1 mark

- b. Explain whether the Southern Bluefin Tuna is a species endemic to Australia.

2 marks

- c. Explain why the tuna needs to be protected in the waters south of Indonesia.

2 marks

- d.** The maximum allowable Australian catch in 2011 is 4 015 tonnes (1 tonne = 1000 kilograms). If the average weight of the caught tuna is 20 kg, calculate how many individual fish may be caught. Show your working.

2 marks

- e.** Explain why guidelines which relate to other species are being developed for the tuna fishing industry.

3 marks

SECTION B – Question 4 – continued
TURN OVER

NO WRITING ALLOWED IN THIS AREA

The commercial bluefin tuna farms provide some advantages for the conservation of tuna and also some disadvantages.

f. Describe one possible advantage and one possible disadvantage.

Advantage _____

Disadvantage _____

4 marks

NO WRITING ALLOWED IN THIS AREA

Question 5

An ecologist, Anna, is analysing data on the waterbirds that occur at different types of wetlands. The table below shows the species recorded from surveys at five shallow wetlands and five wetlands with deep permanent water. There is an additional set of data from one other wetland. Anna does not know whether this data comes from a deep or shallow wetland.

Species	5 Shallow wetlands (A)	5 Deep wetlands (B)	Unknown wetland (C)
Pacific Black Duck	×	×	×
Grey Teal	×	×	×
Blue-billed Duck		×	×
Musk Duck		×	
Purple Swamphen	×		
Dusky Moorhen	×	×	
Eurasian Coot		×	
Brolga	×		×
White-faced Heron	×	×	×
White-necked Heron	×		×

× indicates species is present

Anna decides to use Jaccard's index to compare the unknown wetland with each of the other types. Jaccard's index provides a measure of the similarity between communities.

Communities that have high similarity have high values of the index.

Jaccard's index of similarity (S_i) between two communities is calculated as

$$S_i = \frac{\text{number of species that are common to both sites (i.e. found in both A and B)}}{\text{total number of species that occur in either A or B or both, when combined}}$$

Anna first calculates the index to compare the waterbird communities of the shallow and deep wetlands. There were four species that occurred in both wetland types and a total of ten species in these two wetland types combined. Consequently, Jaccard's index is $4/10 = 0.40$.

- a. Using Jaccard's index, calculate the similarity between the waterbird communities of the unknown wetland and each of the shallow and deep wetlands.

Unknown and shallow

Unknown and deep

4 marks

- b. Which type of wetland is the unknown data most likely to be from? Explain your reasoning.

2 marks

- c. One of the species from the shallow wetlands, the Brolga, is a threatened species in Victoria. The Brolga is listed under the *Flora and Fauna Guarantee Act 1988* and an Action Statement has been prepared. State three features that an Action Statement should include.

1.

2.

3.

3 marks

NO WRITING ALLOWED IN THIS AREA

- d.** The Brolga nests in shallow wetlands, but its eggs and chicks are at risk of predation by foxes. Anna decides it is necessary to carry out fox control to protect the Brolga at some of these wetlands.

Outline an investigation that she could use to test whether fox control is effective in reducing the risk of predation.

3 marks

- e.** Explain how you would know, from this investigation, whether the breeding success of the Brolga has increased.

2 marks