



Victorian Certificate of Education 2012

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STUDENT NUMBER

Letter

Figures

Words

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ENVIRONMENTAL SCIENCE

Written examination 2

Monday 19 November 2012

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (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 21 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 question and answer 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

A diffuse pollutant source

- A. cannot be traced to a specific point.
- B. is always a mobile (moving) source.
- C. is a waste pipe from a high-rise building.
- D. requires movement of the pollutant through air until an even concentration is reached.

Question 2

A chemical property of a pollutant is its

- A. colour.
- B. reactivity.
- C. boiling point.
- D. chemical formula.

Question 3

A pollutant that moves long distances through the environment by an airborne transport mechanism would most likely

- A. be water soluble.
- B. have a high boiling point.
- C. be a gas at room temperature.
- D. be denser than the atmosphere.

Question 4

Which one of the following is an example of chronic toxicity?

- A. food poisoning
- B. bioaccumulation of a heavy metal in a population
- C. increased sensitivity to pollen in one-year-old infants
- D. lung disease caused by repeated inhalation of sulfur dioxide

SECTION A – continued

NO WRITING ALLOWED IN THIS AREA

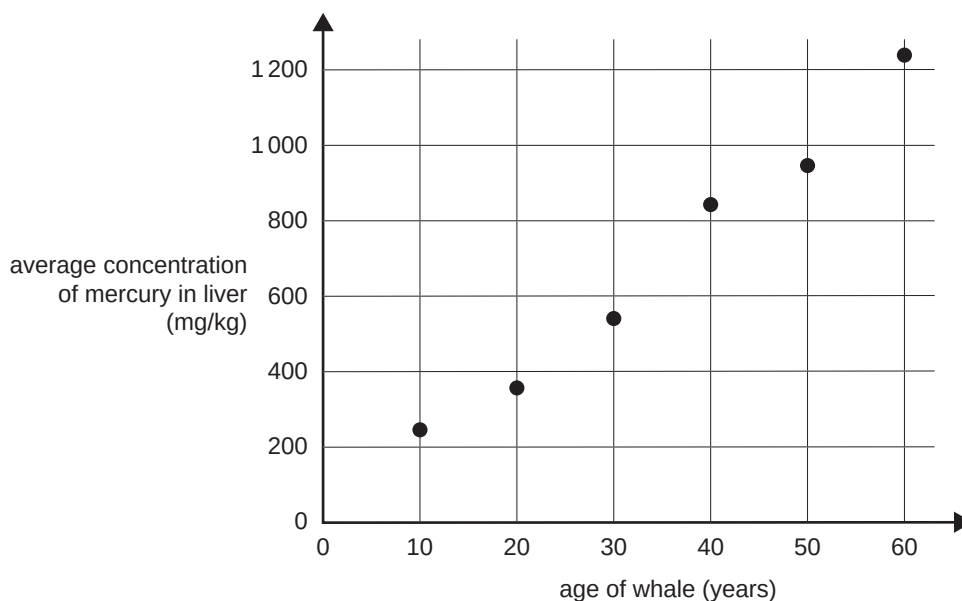
Question 5

A heightened reaction to a substance

- A. is an allergic response.
- B. relies on acute exposure.
- C. results in bioaccumulation.
- D. is dependent on a synergistic effect.

Use the following information to answer Questions 6 and 7.

In 2002, a scientist conducted a study of the mercury concentrations in the livers of 26 dead whales. The age of each whale (to the nearest 10 years) was determined and the concentration of mercury in its liver was measured in mg/kg. The data gathered is shown below.

**Question 6**

Which one of the following is the best estimate of the average annual increase of mercury concentration in the whales?

- A. 10 mg/kg
- B. 20 mg/kg
- C. 200 mg/kg
- D. 1200 mg/kg

Question 7

Which one of the following is the most likely explanation for the data?

- A. The mercury accumulated in the livers of the whales.
- B. Older whales absorb more mercury per annum than younger whales.
- C. The concentration of mercury in the water gradually increased with time.
- D. Older whales have more difficulty excreting mercury than younger whales.

SECTION A – continued
TURN OVER

Question 8

In the country in which the study was conducted, some whale meat is still eaten by people.

Which one of the following is likely to be the consequence of consuming large amounts of whale meat over a long period of time?

- A. indigestion
- B. breathing difficulties
- C. unpleasant taste of the meat
- D. mental and nervous system disorders

Question 9

The form of mercury most likely to be involved in bioaccumulation is

- A. mercury salt.
- B. mercury vapour.
- C. methyl mercury.
- D. metallic (elemental) mercury.

Question 10

Which one of the following best describes the exposure of a person to sulfur dioxide?

- A. the fact that the person has breathed in sulfur dioxide
- B. the amount of sulfur dioxide a person absorbs in a given time
- C. the maximum concentration of sulfur dioxide on a particular day
- D. the amount of sulfur dioxide a person experiences in a given time

Question 11

The dosage of sulfur dioxide for a person is the

- A. mass of sulfur dioxide inhaled by a person each day.
- B. total mass of sulfur dioxide inhaled during a person's lifetime.
- C. mass of sulfur dioxide a person absorbs per unit of body weight.
- D. maximum safe mass of sulfur dioxide that can be absorbed in a set time.

Use the following information to answer Questions 12 and 13.

A company is planning to build a processing factory on the side of a river in an urban setting.

One of the by-products of the process is a low-level pollutant chemical, X.

The maximum allowable concentration of X in water in urban areas is 20 µg/L (micrograms per litre).

1 microgram is equal to 10^{-6} grams. 1 cubic metre of water contains 1000 (10^3) L of water.

A scientist is employed to estimate the maximum allowable level of emissions of chemical X into the river. She has measured the width of the river outside the factory to be 20 m, the average depth to be 5 m and the flow rate to be 2 m/s.

Question 12

The best estimate of the volume of water flowing past the factory per second is

- A. 100 L/s.
- B. 200 L/s.
- C. 100 000 L/s.
- D. 200 000 L/s.

SECTION A – continued

NO WRITING ALLOWED IN THIS AREA

Question 13

On a day when the volume flowing past is 10 000 L/s, which of the following is the maximum amount of chemical X that could be allowed to enter the river per second to maintain the allowable concentration of X?

- A. 2.0×10^{-5} g/s
- B. 2.0×10^{-3} g/s
- C. 0.2 g/s
- D. 2.0 g/s

Question 14

Research was carried out to compare the overall costs and benefits of manufacturing, operating and disposing of cars made with different types of materials and with engine types that use a variety of energy sources.

This research could best be described as a Life Cycle Analysis because

- A. recycling is a key part of the car-manufacturing process.
- B. improvements will be made to the manufacturing and performance of all types of cars.
- C. making decisions based on the research will reduce the environmental impacts of using a petrol-driven car.
- D. the various stages of the production and disposal process have been considered, with an aim to improve efficiency and reduce waste.

Question 15

Laura conducted an Environmental Risk Assessment to evaluate the possible impacts of releasing various levels of a particular pollutant from a chemical processing plant.

An Environmental Risk Assessment should focus on

- A. an outline of the beneficial properties of the products produced by the processing plant.
- B. the legislative requirements related to the human health effects as a result of exposure to the pollutant.
- C. the quantification of potential hazards to the local environment of the processing plant releasing this pollutant.
- D. a detailed outline of the management processes required to reduce the health effects related to exposure to the pollutant.

Question 16

A company operating a manufacturing plant has developed an Environmental Management System (EMS) in order to improve its performance.

A key aspect of this EMS would include

- A. a focus on maximising returns to shareholders of the company.
- B. the development of an overall environmental policy for the company.
- C. a consideration of the costs involved in developing an environmental policy.
- D. a limited audit of some areas of the manufacturing plant's safety procedures.

SECTION A – continued
TURN OVER

Question 17

Ecologists have measured increased salt concentrations in native forests near farming areas in Victoria. High salt concentrations in soils prevent adequate uptake of water by native plants. There is, therefore, a risk of death of native plant species in these areas.

This risk is an example of

- A. bioremediation.
- B. an environmental hazard.
- C. the precautionary principle.
- D. an environmental risk assessment.

Use the following information to answer Questions 18–20.

Unwanted electronic equipment, such as old televisions, computers and mobile phones, end up as waste – known as e-waste. E-waste contains many metals and other materials that are valuable but also toxic, and these often end up in landfills.

A company decides to set up an e-waste recycling plant. Various processes are used to separate valuable metals from plastic and other waste; this includes using a high-temperature furnace to remove plastic coating from copper and silver wires.

Some local groups are opposed to the project because of concerns about emissions.

Question 18

The company requires the e-waste recycling plant to be ecologically sustainable.

Which one of the following is the **strongest** argument for considering the project to be ecologically sustainable?

- A. It avoids any environmental damage due to mining.
- B. It provides income for the local community, both present and future generations.
- C. It minimises damage to the environment by avoiding heavy (toxic) metals being added to landfills.
- D. It provides for the electronic requirements of today, while reducing the need for the mining of valuable metals in the future.

Question 19

The Environment Protection Authority has guidelines for the maximum amount of non-recyclable toxic material that may be emitted from the furnace chimneys.

These guidelines are best described as

- A. a waste minimisation scheme.
- B. part of a regulatory framework.
- C. an environmental impact assessment.
- D. an Environmental Management System.

Question 20

The hot gases from the furnace are passed over pipes to heat water, which is required for another separation process.

This is best described as an example of

- A. a Life Cycle Analysis.
- B. a waste minimisation scheme.
- C. an environmental management plan.
- D. a process that reduces the environmental risk of the project.

END OF SECTION A

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SECTION B

Instructions for Section B

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

Question 1

Name one pollutant, other than sulfur dioxide or mercury, that you have studied this year. Use this pollutant when answering **parts a.–h.**

- a.** Explain why your chosen substance can be defined as a pollutant.

3 marks

- b.** A population of humans or animals may be exposed to a pollutant by ingestion, inhalation or dermal absorption (absorption through the skin).

Describe any characteristic of your pollutant that does **or** does not allow it to enter the body by each of these methods of exposure.

ingestion

inhalation

dermal absorption

3 marks

SECTION B – Question 1 – continued
TURN OVER

- c. Outline the method that you used to collect primary data about your chosen pollutant.

2 marks

- d. What is the unit of measurement for either the exposure to **or** dosage of an individual or population to your chosen pollutant? State whether this describes dosage or exposure.

2 marks

- e. Describe the major sink for your pollutant. Explain how this meets the definition of a 'pollutant sink'.

3 marks

SECTION B – Question 1 – continued

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- f. Outline a strategy that aims to reduce the levels of emission of your pollutant.

3 marks

- g. Evaluate the success of this strategy, using data obtained before **and** after the strategy was implemented.

3 marks

- h. Should any improvements be made to this strategy? Justify your answer.

2 marks

SECTION B – continued
TURN OVER

Question 2

The metal copper has many applications. It can be used in water pipes, locks and electrical wiring.

Copper ore is mined from both open pits and underground mines. In the ground, copper is found combined with sulfur as a mineral. Copper can be separated from the sulfur by roasting the mineral at high temperatures in a process known as smelting.

The Environment Protection Authority is concerned about sulfur dioxide emissions from the proposed development of a smelter.

- a. Why is sulfur dioxide formed during the smelting of this copper mineral?

2 marks

- b. Describe **two** effects of excessive sulfur dioxide on environmental health.

3 marks

SECTION B – Question 2 – continued

- c. As part of the planning approval process, the Environment Protection Authority requires the monitoring of sulfur dioxide before the smelter is built as well as during its operation.

Explain the value of monitoring sulfur dioxide concentrations **both** before and during operation of the smelter, and also outline how this should be undertaken.

3 marks

- d. State an effective method for reducing emissions of sulfur dioxide from the smelter and explain how this method works.

2 marks

SECTION B – continued
TURN OVER

Question 3

Name an environmental project that you have studied this year. Use this project when answering **parts a.–e.**

- a.** Provide a description of this project. Include the location, the timeframe involved and the main objective(s) of the project.

3 marks

- b.** Describe the specific environmental aims of the project. These could relate to either positive outcomes of the project **or** prevention of environmental damage during the project.

3 marks

NO WRITING ALLOWED IN THIS AREA

SECTION B – Question 3 – continued

- c. i. Describe any Environmental Risk Assessment **or** environmental impact statement **or** equivalent document that was prepared before beginning this project.

- ii. Explain who prepared this document and who was consulted in its preparation. Do you consider this consultation process to have been adequate? Explain why or why not.

2 + 2 = 4 marks

- d. Describe any actions taken as part of the management plan to achieve the environmental aims of the project that you nominated in **part b**.

3 marks

SECTION B – Question 3 – continued
TURN OVER

- e. Using evidence, evaluate the success of these management actions.

3 marks

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SECTION B – continued

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SECTION B – continued
TURN OVER

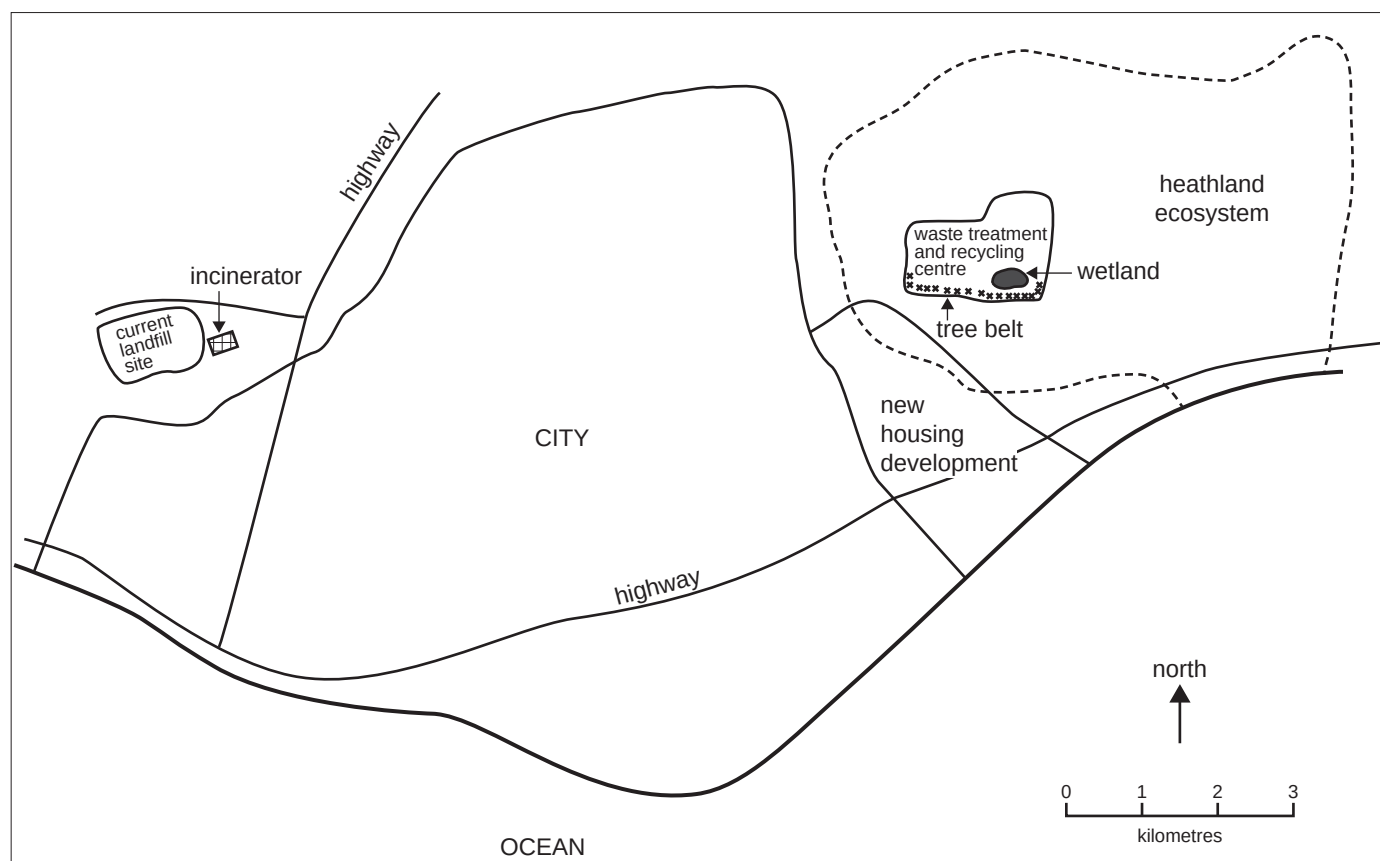
Question 4

A waste-management company has purchased land to the north-east of a coastal city, with the intention of building a major waste treatment and recycling facility. The land is currently covered by a heathland ecosystem with a small area of wetland. Most locals have little to do with the area and some complain that it is 'just a mosquito-infested swamp'. Minimal environmental investigation has been conducted at the site. However, preliminary research has identified the heathland as a possible habitat for the threatened Heath Mouse.

This new waste treatment and recycling plant will replace the current landfill system, where for the last 20 years waste has been dumped and buried in an old quarry to the west of the city. Some types of waste are also incinerated at this location. The landfill site has enough space to last for another three years. Twenty workers will lose their jobs when this site is closed down.

The construction of the proposed facility will cost approximately \$16 million and the facility will require 50–60 employees on-site when it becomes fully operational. The sale of recycled materials, such as glass, steel, paper, aluminium, other metals and organic garden compost, is predicted to result in an overall profit of \$1.3 million per year. The facility will require an upgrade of roads, water services, the sewerage system and electricity in the region. Approximately 67% of the heathland will be cleared on-site and the wetland will be drained.

The proposal includes the planting of a screening belt of non-indigenous trees, designed to hide the facility from the view of residents in the newly built housing estate. People in the housing estate have concerns about the noxious odours, dust and noise that may be produced by the new facility, and worry that vermin (such as rats) may be attracted by the waste to the area. It is planned that trucks will transport material to and from the site, 16 hours a day.



SECTION B – Question 4 – continued

- a. In the table below, summarise the major arguments for and against the proposal, identifying key social and economic factors.

	For	Against
Social factors		
Economic factors		

2 marks

- b. Before the proposal can proceed, the state government will require an Environmental Impact Assessment to be conducted.

- i. Explain why an Environmental Impact Assessment is required.

- ii. Outline what would be involved in producing this report **and** what should be included in the final report.

2 + 3 = 5 marks

SECTION B – Question 4 – continued
TURN OVER

- d.** When making the final decision regarding the approval of the proposal, the government will also need to consider the economic and social aspects of the proposal. Explain why.

2 marks

SECTION B – continued
TURN OVER

Question 5

A community environmental group, Greenyhands, has developed a plan to open a wildlife reserve, with an ecotourism focus, on land donated to the local community. The land is a significant wildlife corridor for a number of threatened species and, apart from a small clearing to the south of the property, is largely in an untouched state.

- a. In developing the site with a focus on ecotourism, identify **two** important criteria that would need to be considered by Greenyhands.

2 marks

- b. Describe how **each** of these two criteria could be incorporated into any ecotourism developments at the new wildlife reserve.

3 marks

SECTION B – Question 5 – continued

4 marks

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