VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2005

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

ENVIRONMENTAL SCIENCE

Written examination 2

Friday 18 November 2005

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	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 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 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

Mercury is particularly hazardous to human health because

A. it bioaccumulates high up the food chain.
B. as a heavy metal it can cause serious impact injury.
C. it is light and volatile and so is widely dispersed through the environment by wind.
D. as a pure metal it is very soluble in water, hence easily absorbed through drinking water.

Question 2

Which one of the following is a common source of sulfur dioxide as an airborne pollutant?

A. sparking in electric motors
B. smelting of metal sulfide ores
C. waste products from nuclear reactors
D. decomposition of sulfuric acid in landfills

Question 3

Which of the following is the best description of sulfur dioxide?

A. a gas less dense than air
B. a gas more dense than air
C. a gas insoluble in water
D. an acidic liquid at ordinary room temperature

Question 4

The **dosage** of sulfur dioxide is best described as

A. a measure of the harm sulfur dioxide does to a person.
B. the amount of sulfur dioxide a person experiences in a given time.
C. the amount of sulfur dioxide absorbed by a person in a given time.
D. the amount of sulfur dioxide entering the environment in a given time.

Question 5

The **toxicity** of mercury is best described as

A. how mercury enters the environment.
B. a measure of harm mercury does to a person.
C. the persistence of mercury in the environment.
D. how much mercury a person experiences in a given time.

Question 6

The harm to the health of people caused by prolonged exposure to high concentrations of sulfur dioxide in the air is called

A. allergies.

B. mortality.

C. persistence.

D. chronic toxicity.

Question 7

After prolonged exposure to sulfur dioxide, Gabrielle has become more sensitive to it.

At the next exposure, she is **more likely** than previously to

A. not be affected.

B. have an allergic reaction.

C. become a diffuse source herself.

D. not absorb as much sulfur dioxide.

Question 8

Which one of the following statements explains why acid rain is less of a problem in Australia than in parts of Europe and Northern America?

A. Australia has a very high rainfall.

B. Australian coal and oil have a low sulfur content.

C. There is no transport mechanism for sulfur dioxide in Australia.

D. The vast oceans in the southern hemisphere act as a major sink for sulfur dioxide.

Question 9

In some regions the combination of acid rain and smog causes damage to forests that is worse than the impact of either acid rain or smog on its own.

This is an example of

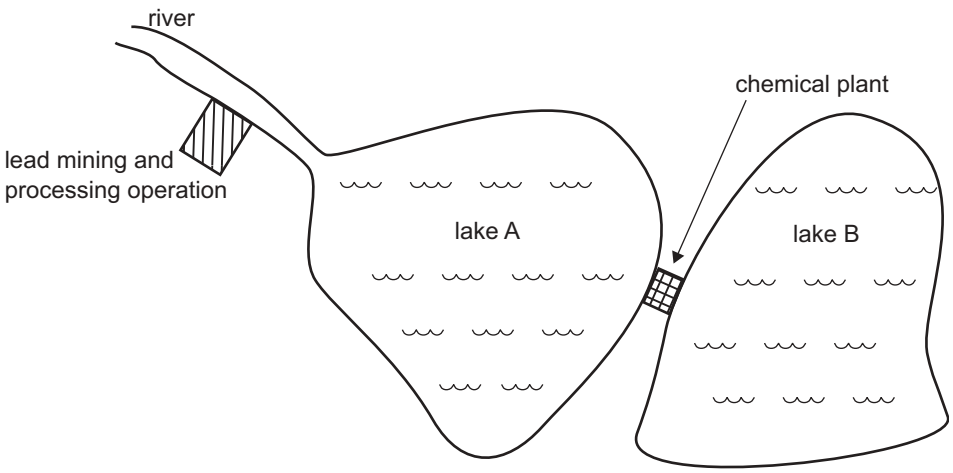
A. specificity.

B. acute toxicity.

C. chronic toxicity.

D. synergistic action.

The following information relates to Questions 10–12.



Lead, a heavy metal, has been entering an enclosed lake, A, for a number of years from a lead mining and processing operation beside a river. The processing plant has been closed for two years.

A scientist monitoring the lake today measures the lead concentrations in the water, in aquatic (underwater) plants in the lake, in aquatic insects in the lake, in large fish in the lake and in the air above the lake.

One of these measurements records a high concentration of lead.

Question 10

Where is this high concentration of lead most likely to be measured?

A. in the air above the lake

B. in aquatic plants

C. in aquatic insects

D. in large fish

Question 11

The reason for the high measured concentration of lead is **most likely** to be

A. high density of lead.

B. toxicity of lead.

C. bioaccumulation.

D. synergistic action.

A chemical plant is built on the other side of the lake as shown. Low concentrations of a chemical by-product are released into the lakes on both sides of the chemical plant. While in lake B there is no observable harmful effect on the large fish species, in lake A many large fish of the same species have died.

Question 12

The different effect on large fish is **most likely** caused by

A. synergistic action.

B. specificity.

C. mobility.

D. allergies.

The following information relates to Questions 13–16.

A company is planning the development of a mining operation, located beside a river. The ore body has sufficient material for approximately twenty years of mining. As part of its planning, the company commissions an Environmental Risk Assessment.

Question 13

The main aim of this Environmental Risk Assessment is to

A. eliminate any damage to the environment by the mine.

B. maximise the profit for the mining company and its shareholders.

C. provide information to convince the local population of the need for the mine.

D. quantify and weigh the positive gains for the community against the environmental harm of the mine.

The processing of the ore involves the use of arsenic; each day 2.0 kg of arsenic is discharged into a local river. The river has a daily flow rate of 10^{10} litres per day. (1 kg = 1000 g)

Question 14

Assuming there is no arsenic in the river upstream of the plant, the best estimate for the concentration of the arsenic in the river downstream of the mine is

A. 1.0×10^{-12} g/L

B. 2.0×10^{-7} g/L

C. 2.0×10^{-2} g/L

D. 2.0 g/L

The company studies the costs of planning, environmental assessment, setting up the mine, environmental protection measures during construction, and running the mine for twenty years, compared with the return it expects on sales of ore.

Question 15

Which one of the following has the company ignored in its analysis?

A. Life Cycle Analysis

B. Environmental Risk Assessment

C. Environmental Impact Assessment

D. environmental management planning

Question 16

Which one of the following would best contribute to waste minimisation?

A. storing the arsenic in piles on site

B. recycling the arsenic used in the ore processing

C. damming the river to reduce the river water flow

D. burying the arsenic in landfill instead of discharging it into the river

The following information relates to Questions 17–20.

Ragwort is a noxious weed. It is a major problem in Victoria's Strzelecki, Otway and Dandenong Ranges. More than 1000 dairy farms are affected by the weed.

Biological control involves introducing a living predator (plant or animal) of the species to be controlled rather than a chemical pesticide.

Researchers are examining the biological control of ragwort, using beetles and moths that will feed on the weed. This is an alternative to using chemical pesticides to kill the ragwort.

Question 17

An advantage of using biological controls compared with chemical pesticides is

A. biological control agents leave no chemical residues in the soil or water.

B. it is easy to stop the action of biological control agents.

C. biological control agents remain in the one location.

D. biological control agents feed on only one species.

Question 18

Which of the following steps would **not** form part of the Environmental Impact Assessment for introduction of biological control agents?

A. planning of monitoring procedures

B. payment of subsidies to local communities

C. determination of likely environmental changes

D. consultation with affected communities

Question 19

For biological control to contribute to environmentally sustainable development, it is essential that

A. pesticide companies maintain profits.

B. food production is high in all regions.

C. there is community support for biological control.

D. biological control does not degrade the environment for future generations.

Question 20

Researchers quantify all the environmental impacts associated with introduction of biological controls.

This process is known as

A. Life Cycle Analysis.

B. community consultation.

C. the precautionary principle.

D. establishment of regulatory frameworks.

END OF SECTION A

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SECTION B – Short-answer questions

Instructions for Section B

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

Question 1

Name a pollutant (other than sulfur dioxide or mercury) that you have studied this year.
Use this pollutant when answering **parts a.–e.**

pollutant _____

a. Describe the properties of this pollutant that make it harmful to humans or the environment.

4 marks

b. Describe a major source of this pollutant. Include whether you consider this a point or diffuse source. Explain your answer.

3 marks

c. Describe the transport mechanism for this pollutant.

2 marks

d. Describe the sink for this pollutant (that is, how it is naturally removed from the environment).

2 marks

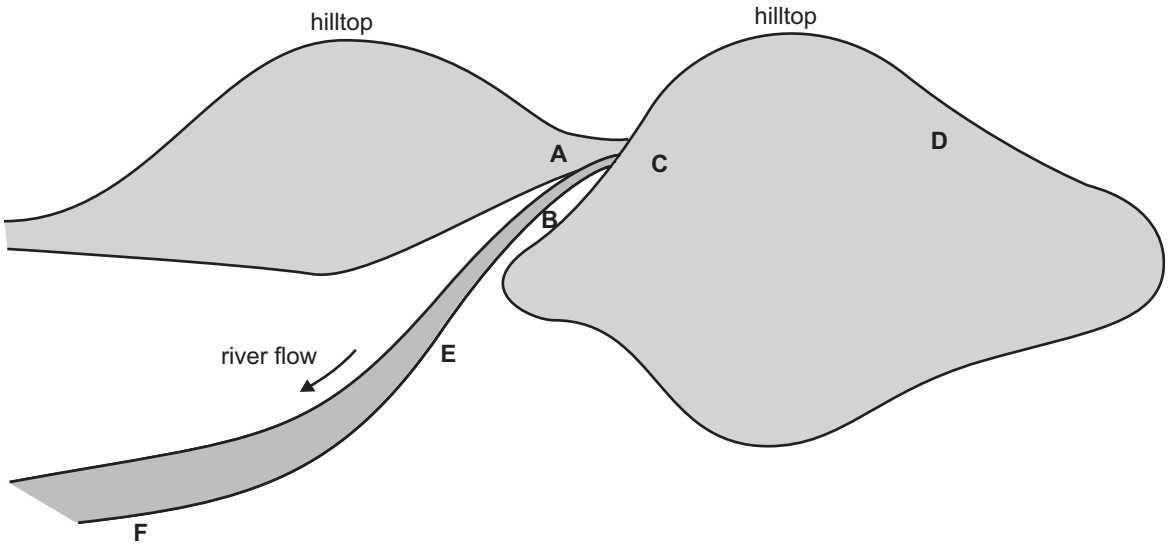
e. Describe a strategy that has been used to reduce the risk of this pollutant affecting human health or the environment. Include an evaluation, supported by some evidence, of the effectiveness of this strategy.

5 marks

Total 16 marks

Question 2

The Black Butte Mine in Oregon, USA, mined, crushed, and heated mercury sulfide to produce the element mercury from 1882 until 1969. The mine is no longer in use. As part of an environmental assessment, researchers took numerous soil samples and analysed the amount of mercury present in each sample. The map shows the location of the mine and the sampling sites.



Site A is the location of an old processing plant at the mine (established in 1882).

Site B is the location of a newer processing plant at the mine (established in 1950).

Site C is on the slope of a hill facing the mine site.

Site D is on a slope on the far side of a hill.

Sites E and **F** are near a river flowing through the mine site. Site E is closer to the mine than site F.

Results of the analyses are presented in the table below. (µg is 0.000001 g or 10^{-6} g)

	Total mercury concentration (µg/g)					
Sample number	**Site A**	**Site B**	**Site C**	**Site D**	**Site E**	**Site F**
1	1120	727	4.8	0.8	12.6	8.6
2	1850	652	9.2	1.2	15.0	4.4
3	2090	78	2.9	0.6	19.5	10.8
4	1200	41	5.0	1.0	8.7	7.8
5	1540	244	6.7	0.7	14.4	2.2

a. Why did the researchers take a number of measurements of mercury concentrations in soil samples at each site rather than relying on one sample at each location?

2 marks

b. Explain why mercury in the environment is hazardous and list some of its impacts.

4 marks

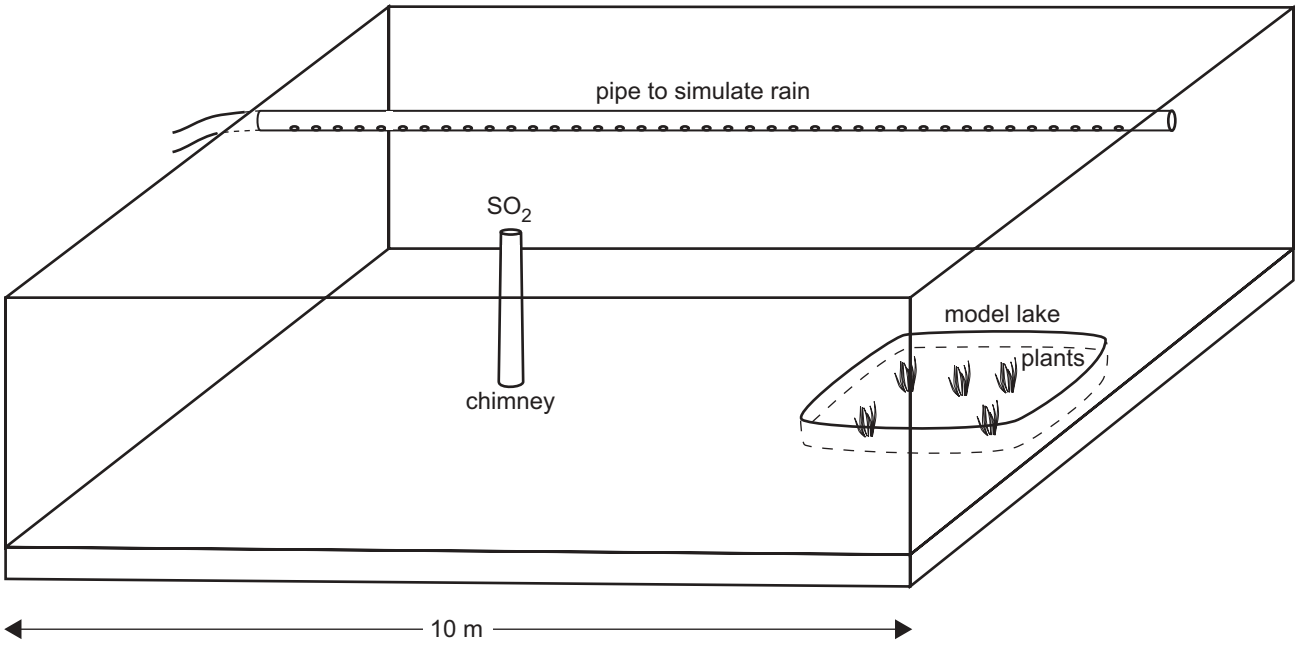
c. By examining the data in the table, describe the most likely transport mechanisms for mercury pollution in the vicinity of the mine (at C, D, E, F) and in the area affected by the mine. Explain why the data given indicates these mechanisms.

5 marks

Total 11 marks

Question 3

In planning for a large coal-burning power station, engineers make a scale model of the area around the power station in a large enclosed glass tank. To check the movement and effect of sulfur dioxide (SO_2), they blow pure SO_2 up a chimney in the middle of the model to simulate SO_2 emissions. The model includes a scale model lake, with some plants in it; a fine mist can be blown into the model to simulate rain.



a. Why might the engineers expect SO_2 in the power station exhaust chimney?

2 marks

With no simulated rain, the engineers measure the distribution of SO_2 around the model chimney.

b. Describe the distribution you would expect of SO_2. Your answer should refer to some property or properties of SO_2.

3 marks

The water mist is now switched on to simulate rain.

After a few days observation, the plants in the small lake start to die.

c. Explain this in terms of the properties and transport of SO_2.

2 marks

d. What chemical indication in the lake water would you expect to have changed?

1 mark

Total 8 marks

Question 4

a. Name and describe an environmental science project that you have studied.
Your description should include a clear account of the aims of the project, its location and time frame.

3 marks

b. Describe the **environmental** impacts and/or risks associated with the project.

3 marks

c. Describe the environmental management tools and strategies used to **either** ensure the environmental aims of the project were met **or** to guard against any environmental damage during the project.

3 marks

d. Evaluate the success of the strategies outlined in **part c.** Include any relevant data as evidence of the success or failure of the strategies.

4 marks

Total 13 marks

Question 5

a. What is ‘ecotourism’?

1 mark

b. Name and describe an ecotourism activity or business.

4 marks

c. Explain why the activity in **part b.** is described by its operators as ecotourism.

2 marks

d. Should the ecotourism activity described in **part b.** be called ‘environmentally sustainable’? Justify your answer in terms of the meaning of environmentally sustainable.

4 marks

Total 11 marks

Question 6

The Victorian Government is proposing to deepen, by dredging (removing sand), the channels through Port Phillip Bay giving shipping access to the Port of Melbourne. The Government has commissioned a detailed Environmental Impact Assessment (EIA) for the proposal. The results have been published as an Environmental Effects Statement (EES). Widespread scientific and community contributions were part of the EES.

Some points that have been made in favour of the proposal include the following.

- At the current channel depths, 30% of vessels currently entering and leaving the Port of Melbourne cannot load to full capacity. In the future this figure will increase as ships get larger and the loads that ships are expected to carry also increase. Many ships will be unable to enter the port, with great economic cost to the Victorian community.
- A smaller number of larger ships will reduce environmental impact, be more ecologically sustainable, and improve safety in the bay.
- The Port of Melbourne directly and indirectly employs about 80 000 Victorians.
- Large cruise ships will have better access, with benefit to tourism.
- Dredging has been conducted in Port Phillip Bay for over a hundred years with negligible environmental or ecological damage. During this time the biodiversity of marine life in the bay has increased.
- One of the world's best dredging companies was awarded a certificate of excellence in environmental management by the Swedish maritime organisation for its previous work in deepening channels. This company has been approached to carry out the work.
- Dredged sand can be used to build up beaches.

Some points made against the proposal include the following.

- The effect on biodiversity.
- Consequences of dumping of spill (sand etc. dug from channel) in other areas of the bay. This causes turbidity (changing water clarity) and affects currents.
- The possible effects of recirculating pollutants in dredged material, especially nearer the mouth of the Yarra River, may be greater than has been allowed for.
- The negative effect on tourism.
- The negative impact on the fishing industry, especially during dredging operations.
- One critic was reported as saying 'where is the independent umpire, you've got the Port of Melbourne Authority, who have got the most to gain from channel deepening, paying for the answers that they need to get to ensure the project goes ahead'.

a. Describe the Environmental Impact Assessment process, and what should be included in the final report of the Environmental Effects Statement (EES).

3 marks

b. Describe the appropriate role of the media **and** community groups in encouraging responsible environmentally sustainable practice in this proposal.

3 marks

c. Using only the information given, evaluate the arguments for and against the proposal.

5 marks

Total 11 marks

END OF QUESTION AND ANSWER BOOK