VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2010

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

ENVIRONMENTAL SCIENCE

Written examination 2

Tuesday 16 November 2010

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

The combustion of coal with a high sulfur content can produce sulfur dioxide. This form of coal is used in a town's electricity generation station.

The station can be regarded as a

A. sink for sulfur dioxide.

B. point source of sulfur dioxide.

C. diffuse source of sulfur dioxide.

D. mobile emission source of sulfur dioxide.

Question 2

A particular individual who has been exposed to sulfur dioxide over a period of time becomes sensitised to the pollutant. When exposed to levels over 0.4 mg/m^3 this person experiences serious respiratory problems. Most other people do not experience this level of breathing difficulty, even when exposed to double this amount of sulfur dioxide.

This is an example of

A. persistence.

B. allergic action.

C. synergistic action.

D. pollutant specificity.

Question 3

Sulfur dioxide does not bioaccumulate towards the top of the food chain.

This is due to its

A. gaseous state.

B. insolubility in fatty tissue.

C. persistence in the environment.

D. chronic toxicity in the atmosphere.

The following information relates to Questions 4–6.

Bioethanol is a renewable liquid fuel made from crops such as corn and sugar cane.

It can be added to standard unleaded petrol at low concentrations.

Bioethanol is considered by some people to be 100% carbon neutral – this means that all the carbon that is emitted while using it as fuel can eventually be recycled back into the next plant crop as it grows.

Other people argue that bioethanol can never be completely carbon neutral if the life-cycle costs of the fuel are considered.

Question 4

As it relates to bioethanol production, a Life Cycle Analysis attempts to

A. assess the impact of producing bioethanol on the breeding patterns of animals and humans.

B. measure all the adverse effects on human and environmental health of producing bioethanol.

C. quantify all environmental impacts of the supply and use of raw materials and wastes in producing bioethanol.

D. describe the risks associated with producing bioethanol, including pollution and environmental degradation.

Question 5

The burning of bioethanol produces high quantities of aldehyde chemicals, which contribute to photochemical smog. In spring, when both photochemical smog and pollen are present, the occurrence of asthma can be much higher.

This is an example of

A. persistence.

B. bioaccumulation.

C. chronic exposure.

D. synergistic action.

Question 6

The arguments for and against the use of bioethanol as an additive to unleaded petrol are being debated in the media.

The major role of community and environmental interest groups in this debate is to

A. produce a Life Cycle Analysis.

B. maintain the profitability of petrol companies.

C. encourage responsible environmental practices.

D. assess the consequences of regulatory frameworks.

The following information relates to Questions 7 and 8.

A large mobile phone manufacturing company has undertaken an investigation of its production techniques, including the extraction of the raw materials and an evaluation of the energy required to produce, transport and use its products.

Question 7

This investigation could best be described as

A. a regulatory framework.

B. an Environmental Impact Assessment.

C. an Environmental Management System.

D. an ecologically sustainable development.

Question 8

The company also developed a mobile phone recycling plan which included a study of the potential risks of disposal methods, the possible impacts on the environment and the effects pollutants could have on human health. The plan included actions to stop discarded phones ending up in landfill, where toxic heavy metals can leach into the soil.

This plan could best be described as

A. an ecologically sustainable development.

B. a waste minimisation scheme.

C. a regulatory framework.

D. a Life Cycle Analysis.

The following information relates to Questions 9 and 10.

The mobile phone manufacturing company decides to build a large-scale manufacturing and recycling plant. Before it can start with the construction it must gain approval from various government authorities including the Environmental Protection Authority (EPA). The EPA sets guidelines on the amount and types of gases that can be emitted from the factory. These guidelines include potential fines that are a consequence of exceeding set pollutant limits.

Question 9

These potential fines are part of

A. a Life Cycle Analysis.

B. a regulatory framework.

C. a waste minimisation scheme.

D. an Environmental Risk Assessment.

Question 10

As part of the approval process the company may be required to complete an Environmental Impact Assessment.

The Environmental Impact Assessment would **not** include

A. input from the local community regarding their concerns.

B. recommendations regarding future monitoring procedures.

C. a description of the potential environmental changes due to the factory's construction.

D. the government minister's decision on whether the project will be allowed to proceed.

The following information relates to Questions 11–16.

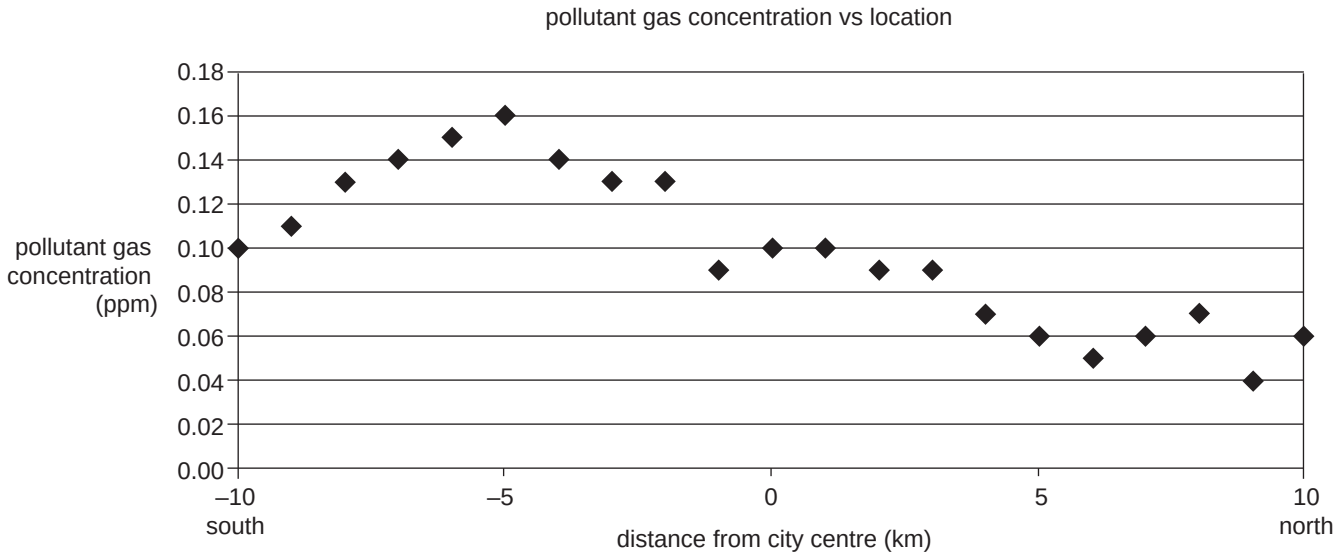
Raised levels of a particular pollutant gas increase the likelihood of respiratory problems: inflaming the lining of the lungs, reducing immunity to lung infections and causing wheezing, coughing, colds, flu and bronchitis.

About 1% of this pollutant gas in city air is formed naturally by lightning and from plants, soil and water. The major source of this pollutant gas is the burning of fossil fuels: coal, oil and natural gas. Most of this pollutant gas in cities comes from motor vehicle exhaust.

The government wants to restrict concentrations of this particular pollutant to less than 0.12 ppm (parts per million).

For a research project, Angie measures pollutant gas concentrations in the air on 1 July. She takes her first measurement at a location 10 kilometres south of a city. She then travels north, recording a measurement every kilometre, taking her final measurement 10 kilometres north of the city.

The following graph shows the measurements that Angie made at each of the 21 locations. The locations south of the city are shown as negative numbers, with the locations to the north shown as positive numbers. The measurement that she took in the centre of the city is labelled as 0 km on the graph.



Question 11

At which location was the measured concentration of the pollutant gas the lowest?

A. 1 km south

B. 9 km south

C. 6 km north

D. 9 km north

Question 12

What percentage of the measurements were within the government's target concentration for the pollutant gas?

A. 14%

B. 33%

C. 67%

D. 100%

Question 13

Which of the following is the most likely cause of the observed distribution of the pollutant gas?

A. The pollutant gas is being produced in the city.

B. There is a major point source of the pollutant gas south of the city.

C. There is a major pollutant sink for the pollutant gas south of the city.

D. Wind blowing from north to south is acting as a transport mechanism for the pollutant gas.

Question 14

Angie concludes that people living 5 km south of the city are exposed to more of the pollutant gas throughout the year than any other residents.

Her conclusion is **incorrect** because

A. she has too little data.

B. few people live south of the city.

C. some people are allergic to many pollutants.

D. she has not used a control in her measurements.

Question 15

Angie spent different periods at each location making her measurements.

Which of the following represents her greatest exposure to the pollutant gas?

A. 2 minutes at 6 km south

B. 3 minutes at 1 km south

C. 4 minutes at 1 km north

D. 5 minutes at 8 km north

Question 16

Angie spent 4 minutes at the point 1 km north of the city.

The dosage of the gas Angie received while she was at this location is best described as the

A. amount of the gas present per litre of air.

B. harm done to Angie by exposure to the gas.

C. amount of the gas Angie was exposed to per hour.

D. amount of the gas absorbed by Angie while she was there.

The following information relates to Questions 17 and 18.

The Murray-Darling Basin is the prime agricultural and food source area for Australia.

The Murray-Darling Basin Authority was established in 1985 to manage the Murray and Darling rivers and their tributaries.

The authority obtained the data on the annual amounts of water given in the following table.

Water data for the Murray-Darling Basin, in gigalitres per year

	Natural	**Current**
Runoff (from rain)	23 850	23 850
Inter river transfer	0	1 200
Diverted (used)	0	11 580
Wetlands	10 960	6 970
Outflow to sea	12 890	5 000

- 'Runoff' is the total amount of water entering the Murray-Darling system from rain, averaged over twenty years.
- 'Inter river transfer' is water artificially diverted from other river systems into the Murray-Darling system (as, for example, is done through the Snowy Mountains hydroelectric scheme).
- 'Diverted' water is the amount taken out of the river for domestic use and irrigation.
- 'Wetlands' indicates the amount of river water diverted and retained in wetlands.
- 'Outflow to sea' is the amount exiting the mouth of the Murray into the ocean.

The first column of numbers gives the figures without any human intervention (natural). The second column of numbers gives the current figures.

Question 17

The percentage decrease in water entering the wetlands due to human intervention is closest to

A. 20%

B. 36%

C. 41%

D. 64%

Question 18

Which of the following statements is most accurate regarding the current usage of water in the Murray-Darling Basin?

A. It is ecologically sustainable, as the runoff from rainwater into the system is unchanged.

B. It is not ecologically sustainable, as the fresh water flowing into the ocean has decreased.

C. It is not ecologically sustainable, as the decreased water flow into the wetlands has had negative effects.

D. It is not ecologically sustainable, as the water available is insufficient to meet domestic and irrigation demands.

The following information relates to Questions 19 and 20.

The Murray-Darling Basin Authority is developing a plan for a project to increase the water flow in the Murray. This is done by transfer of water from another river that currently flows directly into the ocean, as is done in the current Snowy Mountains Scheme.

Question 19

The Murray-Darling Basin Authority requests an Environmental Risk Assessment of the project.

The main aim of this Environmental Risk Assessment should be to

A. minimise the cost of the project.

B. eliminate all damage to the environment.

C. assess the risk of demonstrations disrupting the project.

D. balance the environmental and social advantages against the disadvantages.

Question 20

Which of the following would be the most important in ensuring the environmental sustainability of this project?

A. ensuring that all relevant people in the current generation are consulted

B. maintaining sufficient water for hydroelectricity generation for future generations

C. ensuring that the river from which the water is transferred still has adequate water flow

D. increasing the domestic water supply to provide for population growth in future generations in the towns along the Murray River

END OF SECTION A

SECTION B

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. You should use this pollutant in answering **parts a.–g.**

_____

a. Explain why the substance that you have named is considered a pollutant.

2 marks

b. Outline a method by which the concentration of this pollutant is measured. State the units in which the concentration is expressed.

3 marks

c. Describe a specific situation or location in which the pollutant occurs.

2 marks

d. Describe the main characteristics or properties of the pollutant which contribute to how it functions in the environment.

3 marks

e. State one major **direct** and one major **indirect** way the pollutant significantly affects the health of humans or the environment. Describe the effect on humans or other species.

4 marks

f. Describe a specific strategy that has reduced the risk of the pollutant affecting human health and the environment.

2 marks

g. Evaluate how effective this risk reduction strategy has been. Describe one way this risk reduction strategy could be improved.

3 marks

Question 2

Mercury is a pollutant that is toxic in all three of its environmental forms. These are

- elemental mercury vapour
- inorganic mercury salts
- organic methyl mercury.

Compact fluorescent lamp globes contain small quantities of elemental mercury vapour, which is released into the environment if the lamp globes are disposed of at landfill sites. Inhalation of elemental mercury vapour is a common way in which humans are exposed to mercury.

a. Identify the source of mercury from the lamp globes at landfill sites as either point or diffuse and give a reason for your identification.

2 marks

b. Outline a likely mechanism of transport from pollutant source to pollutant sink for elemental mercury when it is released into the environment from discarded lamp globes. You should include in your answer a description of a major environmental pollutant sink and refer to some of the physical and/or chemical characteristics of elemental mercury.

4 marks

According to the National Occupational Health and Safety Commission (NOHSC), the maximum 8-hour exposure limits for two of the forms of mercury are given in the following table.

Form of mercury	Maximum 8-hour exposure limit
inorganic mercury salts	0.01 mg/m^3 of air
organic methyl mercury	0.1 mg/m^3 of air

c. Referring to the data above, what can you conclude about the relative toxicities of these two forms of mercury in air over an 8-hour period?

2 marks

The quantity of methyl mercury in an 85 kg person was found to increase by 0.34 mg after the person has worked for an 8-hour period.

d. Calculate the dosage of methyl mercury received by this person in the 8-hour period. Include a unit in your answer.

2 marks

The half-life of methyl mercury in the body is approximately 50 days. This means that it takes 50 days for half of the methyl mercury present in the body to be eliminated.

e. Another person is found to have 0.80 mg of methyl mercury in their body.

Determine the mass of methyl mercury remaining in this individual after 150 days without further exposure.

2 marks

Australia sets strong regulatory guidelines for maximum allowable chronic exposure to all forms of mercury from air, water and food; rather than from the maximum allowable acute exposure.

f. Suggest one advantage of setting maximum levels based on chronic exposure rather than acute exposure. Your answer should clearly distinguish between the terms chronic exposure and acute exposure.

3 marks

Question 3

Name an environmental project that you have studied this year.

a. Describe the project, including general goals of the project, its location, time frame and the major outcome.

4 marks

b. Describe the specific environmental aims of the project and the key stakeholders responsible for implementing actions to achieve these aims.

3 marks

c. Outline the key environmental management process that was necessary to determine the potential environmental impacts of the project.

3 marks

d. Name the relevant regulatory groups and outline their roles in setting guidelines and in evaluating and monitoring the environmental impacts of the project.

3 marks

e. Evaluate how effectively the project has met the environmental aims described in **part b.** You should include evidence to support your evaluation.

4 marks

Question 4

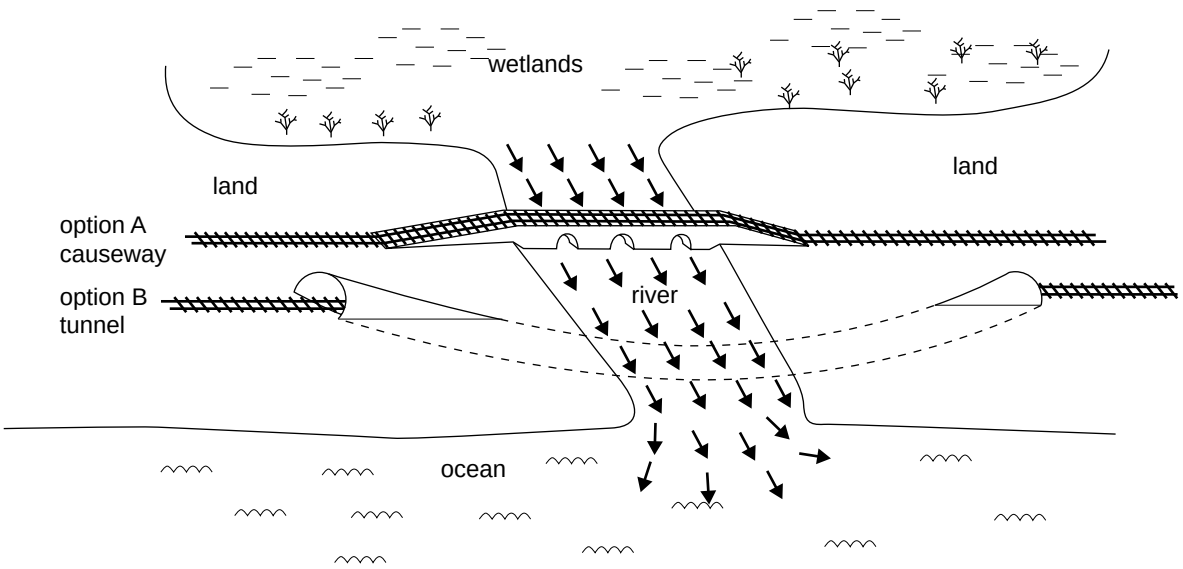
A new residential development with the potential to house approximately 100 000 people is being developed on a coastal strip of land approximately 10 kilometres from the edge of a major city. To provide transport to this new development, engineers are planning a rail link.

The planned route for this link is relatively simple, except for a wide river mouth (estuary) about midway along the route. This river mouth is about half a kilometre wide. Upstream from the proposed river crossing is a large wetland area, with significant water bird habitat. The engineers consider two possibilities for crossing this estuary.

Option A – A half kilometre long causeway or built-up embankment, with a number of openings to allow the river to flow through.

Option B – A one kilometre tunnel to allow the railway to pass under the river.

The two potential crossings are shown below.



The total cost of the railway without the river crossings is approximately $20 million. Option A is costed at approximately $4 million. Option B is costed at approximately $50 million.

Jenny argues for the tunnel

- The causeway would lead to great change in the flow of the river. The tide would no longer flush the wetlands, and hence it may become stagnant.
- At times of low flow the wetlands could become very salty, affecting the wildlife in them.
- The causeway would spoil the view of the ocean from the inland side of the railway.

Richard argues

- The railway is essential to provide an environmentally sustainable transport mode.
- If cars were the only available means of transport, the pollution would affect animal, bird and aquatic life in the area.
- The tunnel is too expensive an option and, if the causeway was not allowed, the railway is unlikely to be constructed, which would have environmental consequences.
- While agreeing with Jenny that the wetland area would be changed by the causeway, the wildlife (especially the migratory water birds) would quickly adjust.
- It is necessary to balance conflicting environmental issues, and the causeway is much better environmentally than the tunnel.

In each of the following questions you should make explicit reference to the scenario and information on page 17.

a. The local government requires an Environmental Impact Assessment of the project to be carried out. Outline the necessary steps in this process and describe what should be included in the final report.

3 marks

b. Outline **three** key stakeholder groups that should be consulted and describe a suitable process for consultation.

3 marks

c. Summarise the key points of Jenny's and Richard's arguments. Analyse these arguments and give an overall evaluation in terms of possible environmental, economic and social factors.

5 marks

TURN OVER

Question 5

A large private wildlife sanctuary is located on an island off the coast of southeastern Australia. The sanctuary has provided habitat and protection for a number of threatened species for over thirty years. Each year a small number of visitors pay a fee to come and work with the scientists involved in the conservation programs of these species for one to two weeks. These visitors are accommodated in special environmental lodges – built with recycled materials. The lodges have water tanks, composting toilets and use solar energy to provide electricity. Currently the sanctuary has a problem with a rapid increase in the size of its long-tailed bettong population, and the damage these extra numbers are having on the indigenous grassland. The long-tailed bettong is threatened in its mainland habitat. The sanctuary managers have made the decision to cull the population (that is, kill off selected individuals, in this case approximately 20% of the population) in order to reduce the population size and protect the native grassland habitat.

a. Is the proposed sanctuary plan to manage the population by culling focused on ecological sustainability? Explain.

2 marks

b. Evaluate the environmental impact of the proposed culling. Suggest a more suitable strategy.

3 marks

c. Describe **two** criteria that would lead to activities at the wildlife sanctuary being labelled as ecotourism.

3 marks

END OF QUESTION AND ANSWER BOOK