STUDENT NAME	

Victorian Certificate of Education 2009

ENVIRONMENTAL SCIENCE

Trial Written Examination 2
October 2009
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	5	5	70
			Total 90

Materials

- Question and answer book of 20 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

Please note this is a practice exam only and its degree of difficulty and content is different to the end of year Unit 4 exam. VAEE takes no responsibility for your success in completing the actual VCE Environmental Science Unit 4 exam.

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.

The following information relates to Questions 1 and 2

Asbestos and cigarette smoke are airborne pollutants that act by a synergistic mechanism to cause cancers of the lungs, abdomen and heart.

Question 1

These substances are defined as pollutants because:

- **A.** they are involved in sick building syndrome and they pollute the air above cities
- **B.** they cause harm to the environment and are manufactured by humans
- **C.** they cause deleterious health effects and are released by human action
- **D.** they cause environmental harm when they are released into natural ecosystems

Question 2

The best description of the toxic mechanism of these pollutants is:

- **A.** they are ingested and their toxic effect is equal to the sum of their effects alone
- **B.** they are inhaled and they have very similar toxic effects
- **C.** they are ingested and they work together to cause very harmful effects
- **D.** they are inhaled and their combined effect is greater that the sum of their individual effects

The following information relates to Questions 3 to 5

Organochlorine insecticides are bioaccumulating toxins that are resistant to decomposition, removal or degradation in the environment. They are able to be handled by humans using appropriate safety methods.

Question 3

These insecticides

- **A.** have low mobility
- **B.** have high volatility
- **C.** readily dissolve in water
- **D.** are acutely toxic to humans

Question 4

The benefit of the resistance of these insecticides to decomposition or degradation in the environment is

- **A.** it reduces their persistence
- **B.** it increases the likelihood of insects undergoing chronic exposure
- **C.** it prevents them from causing allergy
- **D.** it allows safe handling of the insecticides

Question 5

It is most likely that

- **A.** the LD50 of an organochlorine insecticide is higher for insects than humans
- **B.** the LD50 of an organochlorine insecticide is the same for insects and humans
- **C.** the LD50 of an organochlorine insecticide is lower for insects than humans
- **D.** organochlorine insecticides would not cause any harm to humans at any dosage

The following information relates to Questions 6 to 8

Nickel is found in the earth's crust in the form of nickel sulfides. An initial reaction in the smelting process involves roasting the nickel sulfide with atmospheric oxygen according to the following equation:

$$2NiS + 3O_2 \rightarrow 2NiO + 2SO_2$$

Question 6

The smelting plant is most likely

- **A.** a diffuse source of nickel oxide
- **B.** a point source of sulfur dioxide
- **C.** a point source of nickel sulfide
- **D.** a diffuse source of sulfur trioxide

Question 7

If 2×10^{24} particles of nickel sulfide were used up in the reaction, how many particles of nickel oxide would be produced?

- **A.** 4×10^{24} particles of NiO
- **B.** 2×10^{48} particles of NiO
- **C.** 2×10^{24} particles of NiO
- **D.** No particles as NiO is a gas

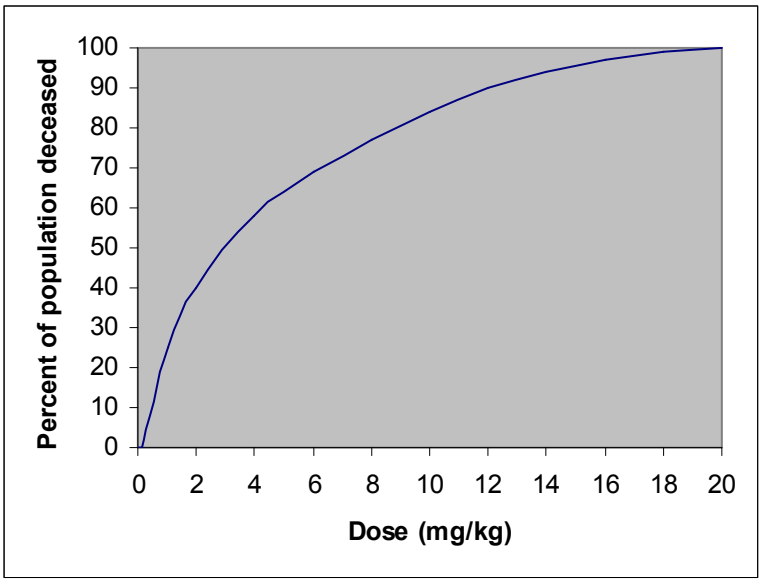
Question 8

If 195g of nickel is produced, and nickel is 79% of the mass of nickel oxide, what mass of nickel oxide is produced?

- **A.** 0.154kg
- **B.** 2.47kg
- **C.** No mass as nickel oxide is a gas
- **D.** 0.247kg

The following information relates to Questions 9 to 11

The hypothetical dose-response curve for nicotine is shown below:



Question 9

The LD40 for nicotine is

A. 50%
B. 19.5 mg/kg
C. 1.9.0%
D. 2.0 mg/kg

Question 10

The threshold for nicotine is closest to

A. 3mg/kg
B. 0.1mg/kg
C. There is no exposure data available, so the threshold can not be determined
D. 10mg/kg

Question 11

The human LD50 for arsenic oxide is 10mg/kg. The U.S. EPA recommended maximum concentration of this pollutant in water is 50mg/L. The volume of 50mg/L arsenic oxide contaminated water a 60kg man would need to ingest to reach the LD50 is

A. 12L
B. 600kg
C. 300L
D. .012kg

The following information relates to Questions 12 to 15

In the past few decades, there has been an increasing trend in developing countries to undertake the "four R's": reduce; reuse; recycle; and recover.

Question 12

The "four R's" help to achieve

A. risk analysis
B. waste minimisation
C. specificity of manufacturing products
D. soil remediation

Question 13

Arguments for reusing products incorporate the benefit that new raw materials will not be used up, allowing them to be used in the future. This supports the principle of

A. sustainability
B. precaution
C. synergistic action
D. profitability

Question 14

Debate as to whether recycling is a worthwhile process continues, with the argument that the labour, energy and pollution costs associated with collecting materials, sorting them and transporting them back to facilities where they can be reused may be too great to justify the benefits. An environmental cost-benefit analysis of the recycling process would best include

A. consultation with media groups
B. consultation of endangered species' action plans
C. an environmental effects statement
D. life-cycle analysis of the recycled products

Question 15

Local governments in Victoria have introduced legislation to ensure that recycling projects meet acceptable standards. This is an example of

A. ecological sustainability
B. a regulatory framework
C. community consultation
D. the precautionary principle

Question 16

Which of the following could best be described as "ecotourism"?

A. a tour of a pine tree plantation
B. a jet ski trip around part of Port Phillip Bay that involves swimming with dolphins
C. a bushwalk in a national park along designated paths with interpretative signs every 10m
D. snorkelling from a charter boat in the Great Barrier Reef

The following information relates to Questions 17 to 20

An environmental management plan for sulfur and nitrogen oxides was recently introduced in the Gippsland area. One monitoring process involved measuring the acid contamination of natural waters in the Gippsland lakes. Testing was conducted every 3 months in several locations for a period of 10 years. The hypothetical results over a 1 year period are shown in the table below:

Sample area	pH			
	January	April	July	October
1	5.1	5.4	5.9	5.9
2	5.2	5.4	6.4	5.7
3	5.0	5.5	6.1	5.7
4	5.1	5.3	6.4	5.6
5	5.2	5.3	6.5	5.8

Question 17

In which month was the highest average acid concentration recorded?

A. January
B. April
C. July
D. October

Question 18

In addition to the monitoring process, the management plan would have likely incorporated

A. a cost-benefit analysis of the monitoring measures
B. identification and evaluation of risks of nitrogen and sulfur emissions
C. identification of all the environmental impacts of monitoring procedures
D. mitigation strategies and evaluation methods

Question 19

What was the purpose of taking samples every 3 months?

A. to account for seasonal weather variation
B. so that multiple samples could be taken, reducing the effect of random errors
C. to prevent human error in the testing process
D. so that all samples could be combined and then tested

Question 20

The data shows

A. significant seasonal variation
B. significant variation between sample sites
C. no significant variation
D. that the Gippsland Lakes are contaminated with alkaline substances

SECTION B – Short answer questions

Specific instructions for Section B

Answer all questions in the spaces provided.

Question 1 (Total 13 marks)
Name a substance, other than sulfur dioxide and mercury, you have studied this year.

a. Describe the chemical or physical properties of the pollutant that contribute to its i. source and ii. transport mechanism.

i.

ii.

2 marks

b. State a location where the pollutant has or could effect human health or the health of the environment and describe these detrimental effects.

2 marks

c. Describe the chemical or physical properties that contribute to the persistence of the pollutant in this location.

2 marks

d. Describe a strategy that has been introduced to minimise the impact of this pollutant, ensuring you refer to the sink of the pollutant in your answer.

3 marks

e. Joel Hirschom proposes that *"Not all pollution can be eliminated… What is absolutely crucial, however, is to recognise that pollution prevention should be the first choice and the option against which all other options are judged*[1]*"*. Discuss this statement in an evaluation of the pollutant management strategy outlined in part **d**, and support your evaluation by quoting quantitative data.

4 marks

[1] Joel Hirschorn, in G. Tyler Miller, Jr. *Living in the Environment,* 8th Ed. 1994 Belmont, California: International Thomson Publishing

Question 2 (Total 16 marks)

a. State the properties of elemental mercury and sulfur dioxide in the table below:

Property	**Mercury (Hg)**	**Sulfur dioxide (SO_2)**
State at room temperature		
Colour		
Specificity		
Symptoms of toxicity		
Transport mechanism		
Density in comparison to atmospheric gases		
Source – diffuse or point?		
Natural sink		

8 marks

b. Compare the negative environmental consequences of elemental mercury and sulfur dioxide if each were released in medium concentration into a small lake.

4 marks

c. A manufacturing plant releases elemental mercury vapour and sulfur dioxide at a very high temperature from a 40m high chimney stack on a calm, dry day. Predict the relative concentration of each pollutant at the following locations, considering the properties of each:

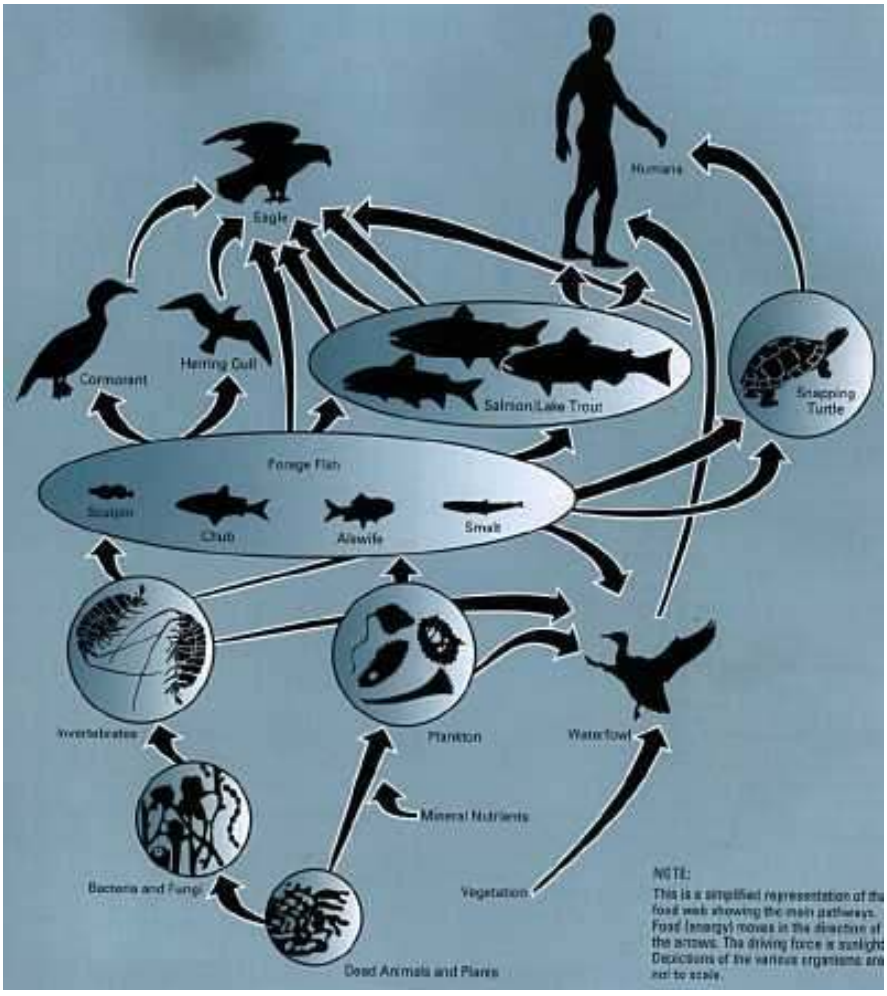
i) 30cm from the chimney stack, at 40m height, 2 minutes after release:

2 marks

ii) 30cm from the chimney stack, at ground level, 10 minutes after release:

2 marks

Question 3 (Total 14 marks)
The figure below shows a simplified food web for the Great Lakes of Ontario, which are contaminated with the biomagnifying pesticide "DDT".[2]

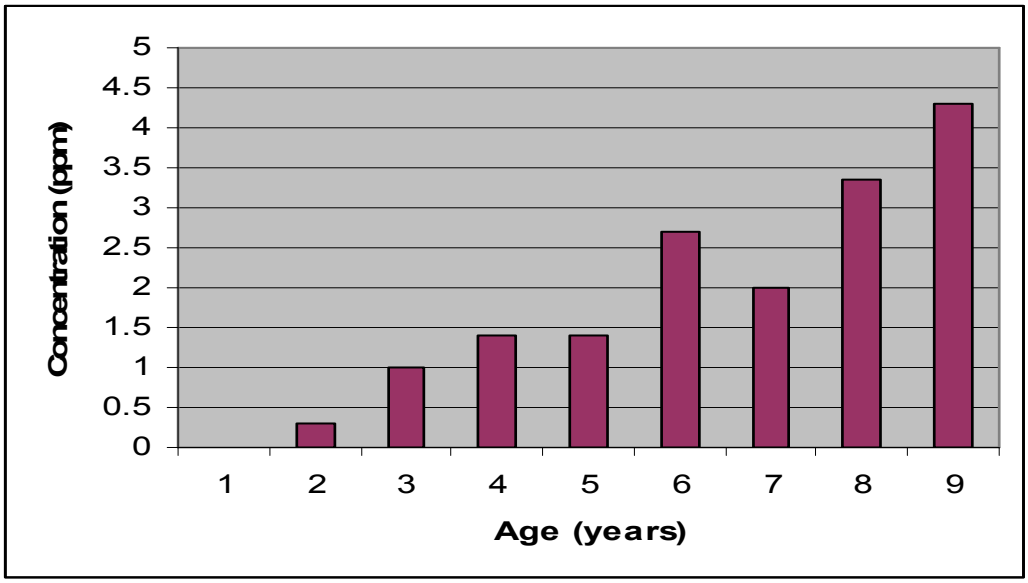


a. The cormorant and the lake trout have identical food sources. The cormorant has an average mass of 2.0 kg and the lake trout 0.5kg. In which of these animals would you expect the higher concentration of DDT? Explain:

[2] *Toxic Chemicals in the Great Lakes and Associated Effects,* vol 1, part 2, 1991 Ottowa, Canade: Minister of Supply and Services

2 marks

The following graph shows the variation with age of the average DDT concentration in Lake Ontario trout[3]:



b. Calculate the percentage increase in average DDT concentrations in trout between ages 2 to 9:

1 mark

c. Circle the correct answer, the increase in concentration is due to:

Bioaccumulation / Biomagnification

1 mark

d. State one age where the data is anomalous. Suggest one improvement to the data gathering method that could be undertaken to correct this.

[3] *Ibid*

2 marks

The table below shows the solubility in water and bioconcentration factor (a high factor indicates a high level of bioconcentration) of several pesticides:

Pesticide	Solubility in H_2O (ppm)	Bioconcentration factor
HCB	0.0062	5.75
DDT	0.0034	6.2
Dieldrin	0.1	6.2
Mirex	0.20	7.3
Malathion	145	2.9
Parathion	24	3.8
Atrazine	52	2.45

Source: K. Verschueren. 1996. *Handbook of Environmental Data on Organic Chemicals*. New York: Van Nostrand Reinhold.

e. Using the table above, describe the relationship between solubility in water and bioconcentration factor:

2 marks

f. Explain this relationship in terms of mobility:

2 marks

g. The U.S. EPA have carried out a risk assessment analysis on DDT. Outline 3 essential pieces of information required to perform the analysis:

i.

ii.

iii.

3 marks

h. Describe a likely consequence of this risk assessment analysis:

1 mark

Question 4 (Total 7 marks)

In 1982, California rancher Jim Callender bought 50 acres of a Sacramento rice field that had been a wetland habitat until the early 1970s. At the time of Jim's purchase, the habitat had been greatly altered by bulldozing, draining, uprooting native plants, and spraying with chemicals to kill the snails that serve as food for wetland birds. Aided by a water bank program of the U.S. Fish and Wildlife Service and by guidance of biologists from the Canadian Waterfowl Association, Jim set out to hollow out low areas, replant tules and bulrushes and plant fast-growing Peking willows. After six years of care, hand-planting, and annual seeding, the marsh is once again part of the pacific flyway used by migratory waterfowl. The area is now a biodiverse habitat, housing species of ducks, hawks, shorebirds, native insects and snails as well as larger mammals such as muskrat, deer and beaver.[4]

Source: http://static.howstuffworks.com/gif/south-carolina-waterfowl-association-1.jpg

a. Jim Callender decided to restore the wetlands although there was not quantitative evidence that wetland species were in decline. State the principle he employed in this case.

1 mark

b. Describe the interest of two stakeholders that were or should have been consulted before reaching a decision on whether to restore the wetlands.

2 marks

[4] G. Tyler Miller, Jr. *Living in the Environment,* 8th Ed. 1994 Belmont, California: International Thomson Publishing

c. Outline two essential components of the environmental management plan for the restored wetlands.

4 marks

Question 5 (Total 20 marks)
Name an environmental science project that you have investigated this year.

a. Describe:
   i. the location of the project.

   ii. the timeline of the project.

   iii. the main stakeholder in the project and their interest.

   iv. the primary aims of the project.

1 + 1 + 1 + 1 marks

b. Explain how regulatory frameworks have assisted or informed the environmental management process:

2 marks

c. Describe an ecotourism activity, including location, activities and how environmental education is achieved:

3 marks

d. Evaluate the magnitude of the environmental risks of the nominated environmental science project compared to the environmental risks of the nominated ecotourism activity.

4 marks

e. Evaluate, using data, the success of the environmental science project in mitigating the risks described in d. above.

4 marks

f. Discuss whether the nominated environmental science project **OR** ecotourism activity meets the principles of ecologically sustainable development:

3 marks

- END OF EXAM -