STUDENT NAME	

Victorian Certificate of Education 2010

ENVIRONMENTAL SCIENCE

Trial Written Examination 1
June 2010
Time allowed 1.5 hours [90 minutes]

SUGGESTED SOLUTIONS

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	4	4	70
			Total 90

1	**A**	B	C	D
2	**A**	B	C	D
3	A	B	**C**	D
4	A	**B**	C	D
5	A	B	**C**	D
6	A	B	C	**D**
7	A	B	C	**D**
8	**A**	B	C	D
9	A	B	C	**D**
10	A	B	**C**	D

11	A	B	C	**D**
12	A	**B**	C	D
13	A	B	**C**	D
14	A	B	C	**D**
15	**A**	B	C	D
16	A	B	C	**D**
17	A	**B**	C	D
18	**A**	B	C	D
19	A	B	C	**D**
20	A	**B**	C	D

Please note this is a practice exam only and its degree of difficulty and content is different to the VCAA Unit 3 Examination. VAEE takes no responsibility for your success in completing the actual VCE Environmental Science Unit 3 exam.

SECTION B – Short answer questions

Specific instructions for Section B

Answer all questions in the spaces provided.

Question 1

a. Name the predominant type of incoming energy at point 1:

Visible radiation/light/energy [1 mark]

1 mark

b. Name the predominant type of radiation at point 2:

Infra-red radiation [1 mark]

1 mark

c. Describe the process occurring at point 3:

Absorption and re-emission of infra-red radiation by greenhouse gases [1 mark]

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d. State the process occurring at point 5:

Dissipation of infra-red radiation [1 mark] *OR Re-radiation of infra-red light*

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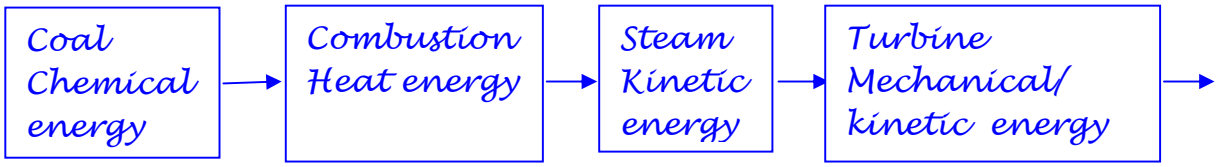
e. "Energy flows but elements cycle." State a link between diagrams 1 and 2 and explain how both diagrams illustrate this statement:

A link between the diagrams is in the atmospheric gases carbon dioxide and methane, as these are greenhouse gases at points 3 and 6 in diagram 1 and the atmospheric component of the carbon cycle in diagram 2 [1 mark]. *Diagram 1 shows energy changing form, with light energy flowing into the earth's atmosphere, being absorbed by the earth's crust and then ultimately removed from the atmosphere through dissipation to space (Flowing into and out of the atmosphere)* [1 mark]. *Diagram 2 shows that carbon cycles through the atmosphere and earth, not being lost to space but cycling continuously* [1 mark].

3 marks

f. If sufficient energy is transferred to a body of water to generate steam, the steam, so produced, can be used to drive a turbine. Draw a simple flow chart of the energy conversions in a coal-fired power station. Ensure you show the type of energy and its location in each step.



2 marks

g. State the first law of thermodynamics and use the diagram from **part f.** to explain its principles.

The first law of thermodynamics states that energy is neither created nor destroyed, but only changes form [1 mark]. *The flow chart shows energy changing form in each step eg. chemical → heat energy. Each type of energy originates from the previous step and is not created or destroyed in the overall process* [1 mark].

2 marks

h. The overall efficiency of a coal fired power station is generally between 25 –35%. Suggest two reasons as to why the overall efficiency is substantially lower than 100%:

Each time energy changes form, some is degraded, or leaves the system by being converted to non-useful forms such as sound or heat[1 mark]. This means that not all chemical energy present in coal at the start of the process (input energy) is converted to useful output energy[1 mark]. Because coal-fired power involves converting energy several times, with substantial losses at each step, the process is relatively inefficient[1 mark].

3 marks

Total 15 marks

Question 2

Name a fossil fuel source that you have studied this year _____

Name a non-fossil fuel source that you have studied this year _____

a. Outline how the **fossil** fuel source came to exist in the earth's crust.

Dead and decayed organic (carbon based) material[1 mark] was compacted underground over millions of years[1 mark] to produce a dense carbon based fuel source

2 marks

b. Outline how the **non-fossil** energy source generates useable energy.

Answers must describe the type of energy utilised by the source and how this is converted into electricity in a step-by-step description.

2 marks

c. The city of Melbourne has extensive energy needs, including a high continuous base load and even higher demand at peak times. Compare the suitability of the fossil to non-fossil source for meeting the energy needs of Melbourne.

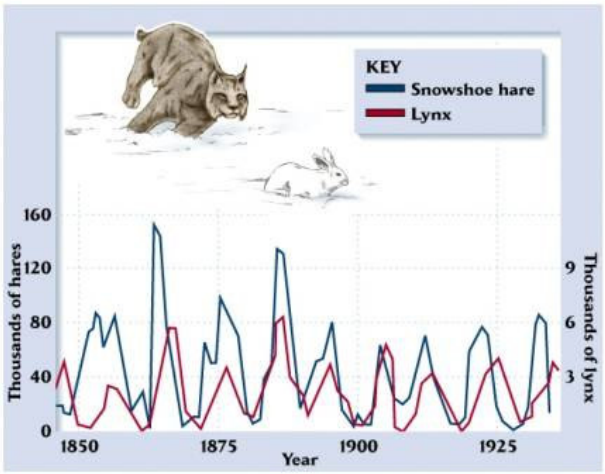
Answers should contain 3 valid advantages or disadvantages for each of the sources[3 marks]
Advantages or disadvantages must relate specifically to Melbourne's energy needs[1 mark]
Each advantage/disadvantage must be a direct comparison[1 mark]
Answers must be clear and concise[1 mark] – a suggestion is to rule a line down the page and to write dot points that make a direct comparison between sources.

6 marks

Total 10 marks

Question 3

The graph below shows the relationship between populations of the snowshoe hare and the Canadian lynx in Northern Canada. The lynx is the sole predator of the hare and the hare the sole prey for the lynx.



a. Compare the population size of the lynx to the hare in 1875 and explain the reason for this difference.

The population of the lynx is lower than the hare (eg. in 1875 lynx population ~ 3000 while the hare population ~100,000) [1 mark]. *The lynx consumes hare as its only source of chemical energy. Energy is lost in this process and the lynx is a larger animal than the hare* [1 mark], *so far less lynx can be sustained by consuming the hare population* [1 mark].

3 marks

b. Calculate the percentage decrease in hare numbers between the higher peak in 1875 and the peak in 1920. Show working.

$$\left(\frac{100{,}000 - 80{,}000}{100{,}000}\right) \times 100 = 25\% \text{ decrease}$$

1 marks

The current IUCN status of the Canadian lynx is "endangered", but numbers are declining so this status may soon be changed.

c. Explain what the new conservation category of the lynx will be if numbers decline sufficiently.

Critically endangered [1 mark] *- extremely high chance of extinction in the immediate future* [1 mark].

2 marks

Name one threatened animal you have studied this year

_____

d. Does your animal species have a greater chance of survival than the Canadian lynx? Explain.

Answers should state the conservation status of the nominated animal [1 mark] *and compare* [1 mark] *this to the conservation status of the lynx*

2 marks

e. The Canadian lynx is endemic to Northern Canada. Describe 3 reasons why extinctions of local isolated populations considerably decrease the survival chances of the lynx species.

1. *As the lynx is endemic to the area, localised extinctions result in a much higher risk of overall extinction because the lynx does not live anywhere else.* 1 mark
2. *Localised extinctions result in further isolation of populations that may have otherwise experienced occasional interbreeding when environmental conditions changed favourably.* 1 mark
3. *There are fewer populations to participate in captive breeding, wildlife corridors or relocation measures, reducing the effectiveness of these measures.* 1 mark
4. *Localised extinction can result in smaller more isolated populations with reduced genetic variability. This reduced genetic variability means the species is less likely to have inbuilt resistance to adverse changes in the environment.* 1 mark
5. *Small population size can also result in inbreeding depression, further reducing reproductive viability.* 1 mark
6. *Small populations can experience genetic drift which will result in further loss of genetic diversity and further reduced ability to resist adverse change.* 1 mark

3 marks

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f. In regions of localized extinction of the lynx, the hare numbers continue to fluctuate. State two reasons why this may be so.

The hare relies on a number of biotic (eg. food) and abiotic (eg. burrow sites) factors for survival 1 mark. *When these factors undergo seasonal fluctuation* 1 mark *the hare's population will fluctuate also.*

2 marks

The population growth rate of lynx is said to be **K-selected**, that is, in favorable conditions, they experience population increase at a relatively slow rate due to their low number of offspring and the high level of care needed by their offspring before maturity. In contrast, snowshoe hare demonstrate **r-selection**, as they show rapid population increase in favorable conditions due to the large number of offspring they produce and the speed with which these offspring reach maturity.

g. Discuss, using two specific pieces of evidence, whether the endangered species studied this year is an r- or K-selected species:

Answers must state two pieces of evidence (preferably quantitative) that relate to number of offspring and length of time offspring are cared for 2 marks. *Answers must correctly relate this information to r or K - selection* 1 mark.

3 marks

h. Describe the location or range as well as the habitat of the chosen species and outline two conditions within the habitat that could be called "favorable" for this species:

A specific location must be stated 1 mark. *A general statement about the habitat* 1 mark *and 2 conditions that relate directly to the species must be described* 2 marks.4 marks

i. Explain how the major threat to the chosen species reduces one or both of the favorable conditions stated in **part i**:

The threat must logically reduce the favourable conditions described in "h" and be thoroughly described [2 marks].

2 marks

j. Outline a strategy that is used to counteract the threat described in **part j.** and evaluate its effectiveness.

The strategy should be thoroughly described and related to the main threats. [2 marks]. *Answers should outline a quantitative method of monitoring the success of one strategy* [2 marks], *and give an indication of what numerical value would be used to evaluate success* [1 mark].

5 marks

Total 27 marks

Question 4

There are several wetland sites within Victoria, many of which have undergone measurable reduction in species diversity over the past 100 years.

Wetland habitat A has 15 different animal species with 100 individuals of one species and 1 individual within each of the other 14 species. Wetland habitat B also has 15 different animal species, but has 7 individuals within each of the 15 species.

a. Define the term "biodiversity".

The variation within and between species and between ecosystems (habitats) [2 marks]

b. Explain why it is not possible to quantify the genetic diversity of the habitats using the information in the stem.

The above information does not provide numerical evidence of variation within each individual species, only of variation between species. [2 marks]

c. Determine the Simpson's index of the two forest habitats:

Species	Number of individuals	P=Nº indiv/ Total Nº	P^2
1	100	0.877	0.769
2	1	0.0088	7.7×10^{-5}
3	1	0.0088	7.7×10^{-5}
4	1	0.0088	7.7×10^{-5}
5	1	0.0088	7.7×10^{-5}
6	1	0.0088	7.7×10^{-5}
7	1	0.0088	7.7×10^{-5}
8	1	0.0088	7.7×10^{-5}
9	1	0.0088	7.7×10^{-5}
10	1	0.0088	7.7×10^{-5}
11	1	0.0088	7.7×10^{-5}
12	1	0.0088	7.7×10^{-5}
13	1	0.0088	7.7×10^{-5}
14	1	0.0088	7.7×10^{-5}
15	1	0.0088	7.7×10^{-5}
TOTAL N^o = 114		**TOTAL p^2 =** 0.770	

Species	Number of individuals	p=Nº indiv/ Total Nº	p^2
1	7	0.067	4.4×10^{-3}
2	7	0.067	4.4×10^{-3}
3	7	0.067	4.4×10^{-3}
4	7	0.067	4.4×10^{-3}
5	7	0.067	4.4×10^{-3}
6	7	0.067	4.4×10^{-3}
7	7	0.067	4.4×10^{-3}
8	7	0.067	4.4×10^{-3}
9	7	0.067	4.4×10^{-3}
10	7	0.067	4.4×10^{-3}
11	7	0.067	4.4×10^{-3}
12	7	0.067	4.4×10^{-3}
13	7	0.067	4.4×10^{-3}
14	7	0.067	4.4×10^{-3}
15	7	0.067	4.4×10^{-3}
TOTAL N^o = 105		**TOTAL p^2 =** 0.067	

Simpson's index habitat A = 1-0.770 = 0.230
Simpson's index habitat B = 1-0.067 = 0.933

4 marks

d. Using data and the terms "species richness" and "relative abundance", evaluate which of the two wetlands has the greater species diversity.

Habitat B has far greater species diversity (Simpson's index =0.933) compared to Habitat A (Simpson's index = 0.23) [1 mark for quoting data, 1 mark for judgment]. *This is because whilst the species richness of the 2 areas is the same (15)* [1 mark], *Habitat B has a higher relative abundance of each species, showing no dominant species as in Habitat A* [1 mark].

e. Several measures can be undertaken to protect and manage the two habitats. Outline the possible advantages and disadvantages of the following strategies.

i. Captive breeding and reintroduction.

Advantages:
*Increased population size of each species.
*If habitat is favorable reintroduction allows population to grow in the wild.
*If all wild individuals die off, a captive population exists to prevent total extinction.
Disadvantages:
*A small captively bred population can suffer from the detrimental effects of reduced genetic diversity.
*Can become domesticated and unable to live in the wild.
Must have 3 good points for full marks.

3 marks

ii. Listing as a RAMSAR protected site.

Advantages:
*Provides protection from habitat destruction , allowing species to grow in number with minimal outside interference.
*The habitats will be available for use by migratory species.
Disadvantages:
*A RAMSAR listing is costly.
*Habitat A requires a strategic management plan to increase diversity, a local body such as National Parks Victoria would be more familiar with the habitats and may be better able to implement this management plan.
Must have 3 good points for full marks.

3 marks

Total 18 marks

- **END OF EXAM** -