2005 Assessment Report

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2005 Environmental Science GA1: Written Examination 1

GENERAL COMMENTS

The members of the setting and marking panels commend teachers again this year for the obvious way they are entering into the spirit of the course by using teaching methods that involve the in-depth study of cases, with (where possible) emphasis on local issues, and field and practical work.

This year students were required to undertake an in-depth study into a threatened species, and it was obvious from the students' responses that teachers had applied this well. Question 4 in the short-answer section tested this area. In many cases, students' responses were very specific and contained considerable depth.

There were relatively few instances where students were unable to complete the paper. Hence, the length of the examination seemed appropriate.

SPECIFIC INFORMATION

Section A – Multiple-choice

The table below indicates the number of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	Comments
1	3	17	7	72	A fossil fuel is one that is formed from ancient biological material. The most common distractor was B, 'a fuel that contains carbon'. However, wood contains carbon but is not a fossil fuel; hence this was not the 'best description'.
2	3	3	14	80	While 80% of students correctly chose uranium as the non-renewable, non-fossil energy resource, 14% surprisingly considered tidal (option C) to be non-renewable.
3	0	1	6	93	
4	12	7	79	3	The Ramsar Convention is one of the three treaties about which students are expected to have explicit knowledge. The Ramsar Convention covers the protection of the world's wetlands; hence C was the correct response
5	1	1	98	0	
6	8	19	68	5	When considering each of the options: the number of whales recorded in 2004 (after the introduction of commercial whale watching) was exactly the average of the previous six years; the between year variation ranged from two to ten; and there was obviously no significance in the variation between 2003 and 2004. Hence response C was correct. The popularity of distractor B may be because of the increase between 2002 and 2003.
7	16	66	13	6	Efficiency = 0.6 x 0.9 x 0.9 = 0.49 = approximately 50%.
8	32	50	12	6	The power station is 60% efficient, therefore the loss is 40%. 40% of 8000 = 3200 kJ (option B).
9	3	2	94	1	
10	76	2	6	16	Genetic diversity will be increased by breeding between previously separated populations; hence the wildlife corridor (option A) is the best choice. The most popular distractor, captive breeding program and re-introduction into same populations (option D), would not affect **genetic** diversity, although it may be advantageous in terms of population numbers.
11	3	93	3	1	
12	6	9	4	81	
13	0	4	8	88	

Question	% A	% B	% C	% D	Comments
14	83	2	14	1	The greenhouse effect is due to absorption of emitted infrared radiation in the Earth's atmosphere (option A). The common distractor was option C; however, the Earth's atmosphere is essentially transparent to visible light, and its surface is not hot enough to emit any significant amount of ultraviolet radiation.
15	95	3	1	1	
16	5	82	4	9	This block of questions tested students' ability to interpret data from graphs. From Graph 1, the total mass of **carbon** emitted in 2000 was 8 gigatonnes. Carbon comprises 27% of the mass of carbon dioxide. Hence, the mass of carbon dioxide emitted is $\frac{8}{0.27}$ = 30 gigatonnes (option D).
17	52	6	38	4	From Graph 2, the increase between 2000 and 2100 is 550 ppm – 350 ppm = 200 ppm. The percentage increase is $\frac{\text{increase}}{\text{orginal amount}} \times 100 = \frac{200}{350} \times 100 = 57\%$ = approximately 60% (option A).
18	80	4	11	4	The probability of extinction is 0.30 x 0.50 = 0.15 (option A).
19	2	21	75	2	If there are 10 possums in 10 acres, and the sample was representative, 10 x $\frac{1000}{10}$ = 1000 (option C).
20	4	94	0	2	

Section B – Short-answer

Question 1

This question tested students' knowledge of the fossil and non-fossil energy sources they had studied in depth. In parts a–d they were asked to outline advantages and disadvantages of each energy source, and in part e to apply this to a particular scenario. A few students based their answers to parts a–d on the scenario, but this was not necessarily required.

Fossil energy sources nominated included coal, oil, natural gas and petroleum; non-fossil sources included wind (the most common) uranium, hydro, solar, biomass and tidal.

1a

Marks	0	1	2	Average
%	2	28	70	**1.7**

1b

Marks	0	1	2	Average
%	1	22	77	**1.8**

1c

Marks	0	1	2	Average
%	2	31	66	**1.7**

1d

Marks	0	1	2	Average
%	2	29	69	**1.7**

Most students were able to list some advantages and disadvantages of their nominated energy sources. Full marks were not given if the very obvious advantages or disadvantages of a particular source were missed; for example, it was

expected that for the fossil fuel the disadvantage of carbon emissions would be referred to somewhere in the response. Similarly, for solar or wind, the need to have some sort of storage backup for night time or if there is no wind should have been mentioned.

1e

Marks	0	1	2	3	4	5	Average
%	2	9	25	33	19	12	**2.9**

A recommendation for one or other of the nominated sources was required. There had to be some reference to economic considerations and to environmental impacts.

For full marks the answer had to specifically address the particular needs of the city, especially the industrial and transport needs, both of which required heavy and continuous electricity supply. Some answers that did not do this recommended renewable sources which could not meet the 24 hours a day demand; in fact, these answers often made no reference to this need.

Question 2

2a

Marks	0	1	2	Average
%	7	22	71	**1.7**

The two obvious responses were carbon dioxide and sulphur dioxide; however, other answers such as oxides of nitrogen, water vapour and unburnt particles were allowed. Methane was not accepted on the basis that, although it is present in mined coal, it is not likely to survive unburnt in a boiler and hence be emitted though the chimneys.

2b

Marks	0	1	2	3	Average
%	22	21	32	25	**1.6**

This question asked for the mechanism by which these emissions contribute to global warming and the greenhouse effect. Hence, for full marks responses needed to make some reference to energy in/out, balance in achieving equilibrium temperature and/or incoming visible/ultraviolet radiation being re-emitted by Earth and absorbed in, and heating, the atmosphere.

Students were expected to have a reasonably detailed knowledge of the mechanism by which emissions contribute to the greenhouse effect and global warming.

2c

Marks	0	1	2	3	Average
%	5	16	43	37	**2.1**

The Kyoto Protocol is one of the mechanisms listed in the revised Study Design for reducing the enhanced greenhouse effect. Most students had clearly heard of it. For full marks some detail was required; for example, that it is signed by a number of countries, and/or it aims for specific targets, etc. Simply stating that it is a treaty for reducing global warming was not sufficient for full marks.

Question 3

3a

Marks	0	1	2	Average
%	5	5	90	**1.9**

Correctly totalling the power gave an answer of 9000 W.

Almost all students answered this correctly. One mark was given if the method was obviously correct but a simple calculation error had been made. Students should be aware of the necessity of showing their working in questions of this kind, so that they can be eligible for partial marks if a simple error in calculation is made.

3b

Marks	0	1	2	Average
%	12	34	53	**1.4**

This question required some discussion of the fact that only 30% of the incident energy emerges as electricity at the output of the solar cell. A common error was to include energy losses in transmission and usage.

3c

Marks	0	1	2	Average
%	16	38	47	**1.3**

To gain full marks here, reference was required to the losses implicit in all energy transformation and/or to where the lost energy goes; for example, to heat.

While many students correctly referred to the second law of thermodynamics in their answers, it is worth noting that this was not required. Neither the second law of thermodynamics nor entropy are included in the revised Study Design. Some students must have encountered some noisy solar cells, as several mentioned losses to sound!

3d

Marks	0	1	2	3	4	Average
%	30	56	1	3	11	**1.1**

$$\text{Input power required} = \frac{\text{power output required}}{\text{efficiency}} = \frac{4000}{0.3} = 13\,333 \text{ W}$$

$$\text{Area} = \frac{\text{power input required}}{\text{power per square meter}} = \frac{13333}{800} = 16.7 \text{ m}^2$$

Partial marks were given where the method was correct but a calculation error was made, and for partly correct responses. The most common error was ignoring the efficiency and using $\frac{4000}{800} = 5 \text{ m}^{2.}$

Question 4

This question tested another area that should have been the subject of an in-depth case study during the year. The revised Study Design requires a study of 'strategies to reduce the effects of threatening processes on one selected endangered animal'. For this year the examiners took a liberal view of 'endangered', accepting any species that was under some sort of threat. However, teachers should note that the selection of a species that is not particularly threatened makes it more difficult for students to provide effective answers to some of the questions. For example, the kangaroo as a threatened species somewhat stretched the interpretation of 'threatened' and, more significantly, it made adequate responses to parts d, f and g very difficult to achieve.

The most common species studied were Leadbeater's possum (about 40% of students) and Tuan (approximately 15%), with a smaller number studying dolphins, bandicoots, rakali (water rats), hooded plovers, rock wallabies, sharks, whales and others. The koala and kangaroo featured in very small numbers, but may not have actually been the species chosen by the teacher.

4a

Marks	0	1	2	3	Average
%	1	5	31	63	**2.6**

For full marks, this question required a fairly specific description of habitat and location, and some quantification of either a particular or total population. A wide variety of numbers was accepted to allow for uncertainty; in fact, quoted estimates of Leadbeater's possum total numbers varied from about 400 to 6000! Because this was a generic question, very specific responses were expected.

4b

Marks	0	1	2	3	Average
%	6	11	45	38	**2.2**

This question required either reference to the conservation categories listed in the Study Design (vulnerable, endangered or critical) or at least some indication of where the chosen threatened species lies on some spectrum of threat.

4c

Marks	0	1	2	3	Average
%	1	5	32	62	**2.6**

This question required mention of one or more threats which clearly and explicitly relate to the nominated species. Full marks were not given if a very obvious threat to the species was not mentioned, or for a very long list of general threats which were not necessarily relevant to the species (for example, logging is not a particularly great threat to the whale population).

4d

Marks	0	1	2	3	Average
%	2	6	29	63	**2.5**

The management strategies had to be applicable to the threats mentioned in part c, not just general strategies.

4e

Marks	0	1	Average
%	35	65	**0.7**

Responses needed to mention some scientific process that applies to the threats mentioned and the species nominated.

4f

Marks	0	1	2	Average
%	23	53	24	**1.0**

Responses to this question needed to be relevant to the threats mentioned and the species nominated.

4g

Marks	0	1	2	Average
%	18	60	22	**1.1**

The *Victorian Flora and Fauna Guarantee Act 1988* (FFG Act), as it applies to threatened animal species, is specifically mentioned in the Study Design. For full marks students were required to show knowledge of the FFG Act; for example, that it implies formally listing a threatened species, or similar. Students had to relate this to their selected species.

Again, teachers are encouraged to think carefully about the threatened species chosen for in-depth study, as this choice can have implications on how easily students are able to answer questions in the examination. Teachers should consider whether the threatened species studied has sufficient specificity as to population, locations, threats, management plans and evaluation.

Questions 5

5a

Marks	0	1	2	Average
%	10	44	46	**1.4**

The main point sought here was that honeybees are an introduced exotic species, and therefore compete in various ways with indigenous species. Other responses were also rewarded.

5b

Marks	0	1	2	Average
%	19	47	34	**1.2**

Any reasonable plan was rewarded. For full marks, the plan needed to relate and be relevant to the Major Mitchell Cockatoo. Good responses included increased vigilance of various kinds, both in the park and at the point of export.

5c

Marks	0	1	Average
%	47	53	**0.5**

The convention is CITES – the Convention on International Trade of Endangered Species.

This is one of the treaties explicitly mentioned in the revised Study Design, together with the Ramsar Convention and the relevant sections of the *Victorian Flora and Fauna Guarantee Act 1988* that apply to the protection of an endangered animal. The most common, although not frequent, incorrect response was the Ramsar Convention (which refers to wetlands).

5d

Marks	0	1	2	Average
%	31	41	28	**1.0**

Ecosystem diversity refers to the number of different ecosystems and habitats in the park. Common incorrect responses referred to diversity (usually species) within one ecosystem, or simply defined an ecosystem rather than referring to ecosystem diversity.

5e

Marks	0	1	2	3	Average
%	18	18	39	24	**1.7**

The key point sought here was that there will be different areas of the park at different stages of growth, and hence different ecosystems and habitats. Common, less satisfactory responses referred to the need for fire to cause the seeds of many Australian flora to germinate.

Question 6

6a

Marks	0	1	2	Average
%	23	2	75	**1.5**

Block C showed the highest species richness, because species richness is the total number of different species and there were six species recorded in Block C compared to three and five in the other two blocks.

To gain full marks comparison needed to be made between the blocks, although all numbers did not have to be mentioned. A common incorrect response was to refer to the total number of individuals rather than species.

6b

Marks	0	1	2	Average
%	22	42	36	**1.2**

	Working	Relative abundance
Block A	$\frac{48 \text{ animals}}{6 \times 2 \text{ hours}}$	4.0 individuals per spotlight hour
Block B	$\frac{18 \text{ animals}}{6 \times 2 \text{ hours}}$	1.5 individuals per spotlight hour
Block C	$\frac{28 \text{ animals}}{4 \times 2 \text{ hours}}$	3.5 individuals per spotlight hour

One mark was given to students who used the correct method, but made a calculation error.

Common incorrect answers ignored the fact that there were four rather than six transects in Block C, or ignored the number of transects and gave responses of 24, 9 and 14. One mark was given to students who made these errors.

6c

Marks	0	1	2	Average
%	28	36	36	**1.1**

Many strategies were suggested, including:

- instead of harvesting the entire block, leave some areas of unharvested forest within the block as refuge habitat for species – this is what would typically happen; entire forest blocks are rarely harvested
- leave a number of habitat trees (large, old trees that provide hollows for these animals) through the harvested sections of the forest block – this would also typically happen
- relocate some of the mammals prior to harvesting.

6d

Marks	0	1	2	3	4	5	6	Average
%	10	5	14	19	20	20	11	**3.4**

Block A could be harvested with the least impact on biodiversity. Students needed to refer to species diversity, relative abundance and endangered status. For example:

- **Block A** has the highest relative abundance, but all of the species observed are relatively common in other blocks
- **Block B** is important because it has an endangered species plus relatively high species richness (five species)
- **Block C** does not have the endangered species, but it has the highest species richness and so appears to be supporting the greatest diversity of tree-dwelling mammals. This is particularly relevant given that it had less survey time than the other blocks. It also has a relatively high abundance of animals.

Reponses to this question were marked on the quality and overall coherence of the argument presented. As it was marked predominantly on the coherence of the argument, responses that suggested a block other than A were rewarded; however, a maximum of three marks could be awarded if student nominated an area other than A.