2007 Environmental Science GA 1: Written examination 1

GENERAL COMMENTS

Again this year students displayed an impressive knowledge of the study. The standard of answers from students seems to be improving each year.

SPECIFIC INFORMATION

Section A – Multiple-choice questions

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

Question	% A	% B	% C	% D	% No Answer	Comments
1	1	2	82	15	0	
2	9	88	3	0	0	
3	8	9	65	17	1	
4	10	88	1	1	0	
5	6	37	45	11	0	Conservation of energy means that no energy is destroyed; that is, all the water's energy is converted into some other form of energy (alternative C). The most common incorrect answer was B; although this may be true, it is not a consequence of the law of conservation of energy. Similarly, alternative D is true but, again, not relevant to the question.
6	10	15	9	66	0	
7	9	2	77	13	0	
8	0	2	1	97	0	
9	92	6	1	0	0	
10	8	7	79	5	1	
11	97	1	2	1	0	
12	68	2	6	23	0	
13	45	9	7	40	0	The decrease between 2004 and 2006 was 3, which is well within the normal variation as indicated by random variation over other years. Therefore alternative A is correct.
14	4	5	88	3	0	
15	2	1	9	88	0	
16	2	4	2	91	0	
17	2	2	11	86	0	
18	89	5	4	2	0	
19	2	90	1	6	1	
20	6	81	6	6	0	

Section B – Short answer questions

Question 1a.

For full marks for Question 1a. students needed to include appropriate reference to absorption of visible radiation and re-emission of infrared radiation, and absorption of infrared radiation by greenhouse gases.

1ai.

Marks	0	1	2	3	Average
%	7	19	56	18	1.9

A decrease in the sun's output would **lower** the temperature. Equilibrium temperature on earth depends on the balance between in-coming and out-going energy. Lowering the sun's energy output would decrease in-coming energy to earth, therefore lowering the equilibrium temperature.

1aii.

Marks	0	1	2	3	Average
%	3	22	50	25	2.0

An increase in carbon dioxide concentration in the atmosphere would lead to a **higher** temperature. Carbon dioxide, a greenhouse gas, absorbs out-going energy (infrared), so equilibrium moves to a higher temperature.

1aiii.

Marks	0	1	2	3	Average
%	39	20	24	18	1.2

A decrease in the ozone layer in the stratosphere would leave the surface temperature **unchanged**. Negligible energy from the sun reaches the earth's surface as UV. The ozone layer absorbs in the UV region – so this absorption will have no effect on the earth's equilibrium temperature.

Marks were also given if students stated that there would be a small increase in temperature, so long as there was a reasonable explanation for this. Unfortunately, many students still see a strong link between the ozone layer depletion and the enhanced greenhouse effect, presumably since both are 'bad'.

Question 1b.

Marks	0	1	2	Average
%	6	46	48	1.4

The natural greenhouse effect is caused by naturally occurring gases in the atmosphere – mainly water vapour and carbon dioxide. This maintains the temperature on Earth that allows life as we know it.

Question 1c.

Marks	0	1	2	Average
%	7	38	55	1.5

Increased temperatures cause changes in ecosystems/habitats/human food production.

There were many acceptable answers to this question, including that given above.

Question 2a.

Marks	0	1	2	3	Average
%	21	23	34	22	1.6

For full marks students needed to show that they understood the difference between the two concepts (fossil and renewable). For example, 'a fossil fuel comes from dead plant matter that has decayed underground over a long period. Renewable means the supply is or can be constantly replenished as it is used.'

Some students incorrectly equated renewable with non-fossil, and non-renewable with fossil. The obvious example of a non-renewable, non-fossil energy source is Uranium, which was used by most students.

Question 2b.

Marks	0	1	2	3	4	Average
%	1	4	13	38	45	3.2

Students were required to name one fossil and one non-fossil fuel (one mark was lost if both were not correct). Students then needed to correctly state whether each was renewable or non-renewable and give a reason why it can or cannot be renewed.

Most students scored at least three marks out of four. The most common reason for lost marks was giving no explanation for the categorisation given. Only a very small number incorrectly identified whether or not the two were renewable.

A small group of students identified natural gas as either non-fossil, renewable or both. This misunderstanding also occurred in multiple-choice Question 7. Natural gas is a fossil fuel and is non-renewable.

Question 2c.

Marks	0	1	2	3	4	Average
%	4	2	18	37	40	**3.1**

Question 2d.

Marks	0	1	2	3	4	Average
%	4	2	22	39	33	**2.9**

For full marks, students needed to:

- name and briefly describe a very specific location
- refer to the energy demands of the location, and the contribution that the energy source could make to the location
- give an advantage which referred to the location and nominated source
- give a disadvantage which referred to the location and nominated source.

These questions required students to apply the two energy sources that they had studied in depth to the energy requirements of a specific location, as indicated in the question. As students could apply their own case studies, it was expected that they would provide quite specific answers. Nevertheless, some very general examples were seen, such as 'a sunny place' for solar power and 'a windy place' for wind power.

Question 3a.

Marks	0	1	2	Average
%	17	53	30	**1.1**

Biodiversity refers to differences both within and between living species.

There were different ways of expressing an acceptable answer to this question. Marks were given for listing different types of biodiversity that showed differences within and across species; for example, genetic and species diversity.

Question 3b.

Marks	0	1	2	3	Average
%	19	16	32	33	**1.8**

Suitable answers included the need for diversity to allow for the health of food sources, sources of medications, etc.

For full marks, two different ways were required, and students needed to refer to how their examples contributed to human wellbeing.

Question 3c.

Marks	0	1	2	3	4	Average
%	1	0	6	30	63	**3.5**

For full marks, students had to:

- refer to a specific geographic location with a population of the species (even if it was a large population)
- give a description of the habitat
- list at least one, and preferably more than one, threat to the species. If the threats mentioned did not include the main threat or threats to the particular species, full marks were not given.

If the species listed was not really threatened (for example, kangaroos), a maximum of three marks could be awarded.

Question 3d.

Marks	0	1	2	3	Average
%	5	10	41	43	**2.2**

Students needed to specify which conservation category their species belongs to – vulnerable, endangered or critical. Critically endangered was also accepted, although it is not one of the categories listed in the study design. A very clear explanation was then required, with some data to support the categorisation; for example, time, numbers, etc.

'Threatened' is not a category and was not accepted on its own; however, because the Victorian *Flora and Fauna Guarantee Act 1988* does not follow accepted terminology, 'listed as threatened under the FFGA' was accepted.

Question 3e.

Marks	0	1	2	3	4	5	Average
%	2	4	15	35	33	10	**3.2**

Many students successfully listed a management strategy, for which they received partial marks, but relatively few actually went on to describe criteria for monitoring the success of the strategy.

As this question related to a species students had studied in depth as a case study and as success of management strategies has featured in most examinations, it was surprising that students did not perform better on this question.

Question 4a.

Marks	0	1	2	Average
%	11	42	47	**1.4**

Advantage

- protection of the tree frog

Disadvantage

- disruption to the food chain
- disruption to the breeding or feeding patterns of other species
- possible effects on ecosystems by excluding fish species

Most students successfully gave an advantage for the strategy. For the disadvantage, some students stated that the frogs would be impeded from moving downstream; however, this would not seem to be a disadvantage and, in fact, a tree frog (an amphibian) would not be particularly impeded by a fish barrier.

Question 4b.

Marks	0	1	2	Average
%	9	52	39	**1.3**

Below are two ways the calculation could have been done; the first calculates an average, the second uses the total abundance found across the eight survey sites.

$$\frac{\text{total abundance for surveyed sites}}{\text{number of surveyed sites}} \times \frac{\text{total number of hectares}}{\text{size of survey sites}} = \frac{32}{8} \times \frac{300}{0.25} = 4800$$

or

$$\frac{\text{total abundance for survey sites} \times \text{total number of hectares}}{\text{number of hectares in survey sites}} = \frac{32 \times 300}{2} = 4800$$

Question 4c.

Marks	0	1	2	3	Average
%	13	17	32	38	**1.9**

The strategy was unsuccessful because there was no obvious increase in the population.

For full marks, students needed to quote some data; for example, the average before and after was 4, or the total number before and after was 32.

Question 4d.

Marks	0	1	2	Average
%	27	48	25	**1.0**

The most obvious answer was that, under the *Flora and Fauna Guarantee Act 1988* (FFGA), a management plan must be drawn up to protect the Spotted Tree Frog.

For full marks, students were required to explicitly refer to legal protection or an action statement. Simply mentioning a management strategy with no reference to the requirements of the FFGA received one mark.

Question 5a.

Marks	0	1	2	3	4	Average
%	18	13	29	28	12	**2.0**

Susan was correct. In addition to the total numbers and number of species, the **relative abundance** must also be considered.

Students were required to support this by referring to the data, by quoting different index values or referring to the changed relative abundance; for example, species 4 now dominates, while before the species were reasonably evenly distributed.

This question was not very well answered given that, in effect, it merely required elaborating on the information given in the question. A number of students merely stated that Bob was correct because the total numbers were still the same.

Question 5b.

Marks	0	1	2	Average
%	4	4	92	**1.9**

- mean in 2001 – 20
- mean in 2004 – 20

This question was very well done. This question led in to part c. and allowed the next question to be marked consequentially if students had miscalculated the mean.

Question 5c.

Marks	0	1	2	3	4	5	Average
%	6	5	8	9	15	57	**3.9**

	2001		**2004**	
	Number	**Difference from mean**	**Number**	**Difference from mean**
Species A	10	10	5	15
Species B	20	0	10	10
Species C	30	10	70	50
Species D	30	10	10	10
Species E	10	10	5	15
Total no	100		100	
Mean	20		20	

Susan's index $= \frac{10+0+10+10+10}{5} = \frac{40}{5} = 8.0$ Susan's index $= \frac{15+10+50+10+15}{5} = \frac{100}{5} = 20$

Partial marks were given for working, and only one mark was deducted if a mathematical slip was made. The question was marked consequentially to part b. – if an incorrect answer was found for 5b. and that answer was worked through correctly in 5c., full marks were given.

This question was very well done. Students are obviously gaining experience in handling data and calculations, which is commendable.

Question 5d.

Marks	0	1	2	3	4	5	Average
%	28	16	21	19	13	3	**1.8**

For full marks students needed to:

- state clearly that relative abundance is important in addition to simply considering the total number of individuals and different species present
- refer to each set of data
- refer to the different relative abundance before and after for each case study
- indicate that Susan's index allows this to be quantitatively assessed.

The last question on the paper tested students' ability to carry through an argument supported by data and evidence. It was rather poorly answered, although there was some evidence that this was due to time pressures.

It should be noted that Susan's index was invented for the purposes of the examination. It is typical of indices in use, but without the complexities in standard indices, which generally involve more difficult logarithmic or exponential functions.