2003 Environmental Science GA 3: Written examination 2

GENERAL COMMENTS

Some students were well prepared for the examination. It is obvious that teachers are increasingly working to the spirit of the course, namely in-depth studies of a specific pollutant and an environmental project, and teaching the key concepts through these. There were fewer occurrences of very generalised responses in the generic questions (short answers Questions 1 and 4). For the paper the setting panel expected students to use the detailed case studies they had undertaken in responding to questions, and set scenario questions which would encourage students to respond using skills covered in their specific studies.

SPECIFIC INFORMATION

Part 1 Multiple-choice

This table indicates the approximate percentage of students choosing each distractor. The correct answer is the shaded alternative.

Question	A	B	C	D	
		%			
1	2	0	97	1	This question was intended to be straightforward as it proved to be.
2	23	0	2	75	This block of questions tested the standard characteristics that students should know about a pollutant – its source, transport mechanism and sink.
3	35	59	3	3	
4	7	85	7	1	
5	86	4	6	4	This block tested some of the key knowledge concepts in a scenario situation – ozone in photochemical smog. It was well answered with no obvious pattern of incorrect responses.
6	1	1	9	89	
7	9	2	2	87	
8	1	45	0	54	This tested the knowledge of environmental risk assessment. No risk assessment will eliminate some effect. Presumably B was chosen because the word ‘risk’ appeared.
9	5	32	59	4	This block of scenario questions tested fieldwork and practical work skills, and the interpretation of graphs. Many students correctly realised that trees that are planted will absorb moisture through the roots and ultimately transfer it to atmosphere from leaves, thus increasing the depth to the sub-surface water level. Despite the attempts of the examiners to define ‘depth to the sub-surface water’ carefully in the stem, perhaps some students still misunderstood as they chose B – reducing bioaccumulation. No knowledge of the specific scenario was implied – all required information was in the stem. Students should be made aware of this and instructed to look for any required information in the stem of questions.
10	34	12	9	45	Question 10 was poorly answered with many students perhaps reading this value straight off the graph. As is evident in other answers, more emphasis needs to be put on graphical interpretation in laboratory and field work.
11	3	4	83	10	
12	10	8	80	2	
13	24	2	70	4	Most students knew that the metal frames will remove items from many different sources. More can be placed on understanding ‘sinks’.
14	2	50	45	3	This question asked about allergic reactions; it was relatively poorly answered.

15	9	17	14	60	This required a simple calculation with no obvious pattern in the incorrect responses.
16	12	36	3	49	This question tested thinking about figures. As more input (recycled paper) is required than product produced, D was the only answer meeting this requirement.
17	8	83	6	3	This restated the concept of bioaccumulation – that is' that an organism has more input of the pollutant than it expels, thus the material accumulates.
18	9	5	10	76	Environmental risk assessment is really the only management tool in the list of answers.
19	43	32	13	12	This block of scenario type questions was intended to be discriminating and proved to be. Students had to realise that A, C, and D would have produced the same variation in both pH and lead concentrations. The fact that only the pH varied in a systematic way means the effect must have been related to the acid only, that is, B – seepage from an acid storage tank.
20	26	44	16	14	Question 20 asked about the variation in lead readings, which were obviously random, B. Others would have produced some systematic variation.

The multiple-choice questions are moving towards scenario and interpretative type questions rather than definitional type questions, although some of these will remain. In particular students should be familiar with interpretation of graphs and simple calculations. Students are expected to do calculations such as the determining of averages and concentrations, and hence volumes and units.

Short answer

Terminology

Students should be aware of the different requirements of different instructions in questions:

Name/nominate:	simply state, for example, name a pollutant – carbon monoxide.
Define:	requires a description that identifies and differentiates the term or concept.
Describe/outline:	requires giving some properties of the subject – for example, describe the pollutant: a pink liquid, volatile, lower density than water, toxic to humans or, for example, outline a management plan: list measures to safeguard the environment, set up equipment to monitor emissions, establish acceptable limits, determine whether limits met, if necessary modify procedure.
Evaluate:	requires a judgment based on evidence or data.
Compare:	list similarities and differences.

Specific Pollutant and Environment Project Questions

There were two 'generic' questions (1 and 4) that were to be answered in terms of an in-depth study conducted during the year. Although there has been significant improvement in this area some students' responses still lacked specific details, names, dates, quantities, evidence. As there is sufficient opportunity to prepare these areas in detail, very specific answers are expected from students.

Question 1a–g

a

Marks	0	1	2	3	Average
%	2	12	30	56	**2.41**

b

Marks	0	1	2	3	Average
%	2	7	33	58	**2.46**

c

Marks	0	1	2	Average
%	4	18	78	**1.73**

d

Marks	0	1	2	Average
%	6	21	73	**1.67**

e

Marks	0	1	2	Average
%	15	37	48	**1.33**

f

Marks	0	1	2	Average
%	3	26	71	**1.68**

g

Marks	0	1	2	3	Average
%	8	17	46	29	**1.94**

This was the generic question on the one pollutant that should have been studied in depth through the year. Students should know the properties of the pollutant they have studied – this includes the physical (for example, solid, liquid, gas; density, volatility), chemical (for example, solubility, reactivity) and biological (if relevant) probabilities. They should be able to relate these to the characteristics of a pollutant – its origin, source (how it enters the environment), transport mechanism, health effects (exposure, toxicity); sink (both how it would naturally dissipate from the environment and how it is removed or reduced by management). While source and transport mechanism are well dealt with, sinks and dissipation was often less well understood. Students should be able to relate the properties of the pollutant to its characteristics and behaviour. Students should know management strategies for coping with the pollutant and its effects, and be able to evaluate, with evidence and data, the effectiveness of such strategies. Teachers are encouraged to select pollutants which will enable these things to be discussed.

The first four parts a to d were dealt with quite well. In part e, a lack of knowledge of how the pollutant dissipates naturally was apparent. In part g, students found 'evaluate the effectiveness' a difficult concept to address.

Question 2

This was a scenario question relating to an oil spill.

a

Marks	0	1	2	3	4	Average
%	6	10	26	27	31	**2.66**

An explicit mention of a source and a transport mechanism was required. Students were required to comment on the different values at different sites. Students were asked to give some explanation for the higher concentrations to the east, for example, currents or wind from west to east.

b

Marks	0	1	2	3	4	Average
%	2	15	32	33	18	**2.48**

Two disadvantages had to be mentioned – for example, carbon dioxide and other emissions, impact on wild life, etc. It should be noted that burning oil on the surface is unlikely to raise the temperature of the water.

c

Marks	0	1	2	3	4	Average
%	6	8	27	28	31	**2.71**

Two steps to minimise the damage were requested and almost any reasonable suggestion was accepted, for example, barriers, chemical dispersion, pumping oil out, sealing the ship. Responses involving 'up the shore' and 'aiding affected wildlife' were accepted.

d

Marks	0	1	2	3	Average
%	17	13	41	29	**1.82**

This required a response in terms of bioaccumulation: students had to mention bioaccumulation, and refer to and explain the different levels in fish and plants – that is to say fish are higher up the food chain, and take in more lead than they can expel.

Question 3

A scenario question which required the comparison of three different pollutants.

a

Marks	0	1	2	Average
%	37	32	31	**0.94**

This question sought some reference to random variation or experimental area; however, other imaginative responses by some students were partially rewarded.

b

Marks	0	1	2	3	Average
%	29	21	21	29	**1.49**

mg of Copper per litre = (0.011 + 0.010 + 0.009) / 3 = 0.010
mg of Copper per minute = 0.010 x 5 000 = 50 mg
mg of Copper per day = 50 x 60 x 24 = 72 000mg = 72 g

Marks were given for some idea about the procedure or some workings but a wrong answer.

c

Marks	0	1	2	Average
%	29	11	60	**1.30**

The increase in all pollutants between a and b indicated that the plant was located between a and b (b was also accepted). Some explanation was required for full marks.

d

Marks	0	1	2	Average
%	41	31	28	**0.86**

This question was poorly answered although any reasonable explanation was accepted. The responses sought were either absorption by sand or evaporation. Many students left this question blank.

e

Marks	0	1	2	Average
%	12	65	23	**1.11**

The response sought was that the existence of some fish does not mean that other species may not have been affected.

f

Marks	0	1	2	3	Average
%	14	10	17	59	**2.20**

Location A is suitable for drinking as all values are below the safety limit; both B and C are unsuitable due to excess hydrocarbons, although nitrates and copper are below the limit. Some explanation was required for full marks.

Question 4

This was a generic environmental science question. Presumably students have had the opportunity to prepare this question in detail so more specific information was sought such as specific locations, time frames. It is important that the project be time limited; that is, has an obvious completion so that its effectiveness can be evaluated; for example, to reduce the levels of oxides of nitrogen in a specific location (for example, Melbourne city) between 1995 and 2000.

a

Marks	0	1	2	Average
%	4	12	84	**1.79**

Most students could name and describe the project. Other students gained a mark by naming the project without giving explicit description.

b

Marks	0	1	2	Average
%	12	42	46	**1.34**

This required a definition of ecological sustainability – the project could continue indefinitely without any serious permanent detriment to the environment. Full marks required some reference to ‘indefinitely’ or ‘for future generations’ or similar rather than a general reference to a lack of damage to an ecosystem.

c

Marks	0	1	2	Average
%	13	38	49	**1.35**

Full marks required relating the meaning of ecological sustainability to the specific project. Marks were lost if no relationship between the two was shown.

d

Marks	0	1	2	Average
%	11	28	61	**1.50**

The project could either be a positive one (for example, cleaning up a river) or avoiding negative impact of a particular project (for example, a construction of a freeway) or a monitoring process, provided this led to some specific action or plan. Most students were able to find two impacts.

e

Marks	0	1	2	Average
%	26	36	38	**1.12**

A very explicit answer was sought here – that is to say a specific plan, which had to relate to the specific project. Many students gave too general an answer.

f

Marks	0	1	2	Average
%	54	24	22	**0.68**

Responses to this question lacked specificity and many students left it blank. As regulatory frameworks are an explicit part of the course, reference should be made to them in studying a project.

g–h

Marks	0	1	2	Average
%	18	34	48	**1.29**

h

Marks	0	1	2	Average
%	35	33	32	**0.96**

The spread of marks in g. and h. suggests that insufficient emphasis is being placed on the closure of the project – evaluating its success or failure.

Question 5

This question related to a scenario of cleaning up a river, and focussed on the role of different groups.

a

Marks	0	1	2	Average
%	21	29	50	**1.28**

This required the naming of a government or regulatory agency. A single mark could be achieved by mentioning a non-government organisation. Not relating it at all to its role in the project scored zero.

b

Marks	0	1	2	Average
%	8	33	59	**1.50**

This required a comment on how community groups could be involved, and was generally well answered.

c

Marks	0	1	2	3	4	Average
%	9	6	36	36	13	**2.38**

As this was the last question on the paper it was meant to allow for some broader thinking. A significant number of students simply repeated example 1 in a slightly different format in example 2, for example, local government should do x; state government should do x. There was little evidence of time restraints affecting students, as hardly any left the last question blank.

Published by the Victorian Curriculum and Assessment Authority
41 St Andrews Place, East Melbourne 3002