2007 HSC Notes from the Marking Centre
Earth and Environmental Science

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Contents

2007 HSC NOTES FROM THE MARKING CENTRE EARTH AND ENVIRONMENTAL SCIENCE

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Earth and Environmental Science. It contains comments on candidate responses to the 2007 Higher School Certificate examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the relevant syllabus, the 2007 Higher School Certificate examination, the marking guidelines and other support documents which have been developed by the Board of Studies to assist in the teaching and learning of Earth and Environmental Science.

General Comments

In 2007, approximately 1240 candidates attempted the Earth and Environmental Science examination. The most popular options were Introduced Species and the Australian Environment (78%) and Oceanography (8%).

Teachers and candidates should be aware that examiners may write questions that address the syllabus outcomes in a manner that requires candidates to respond by integrating their knowledge, understanding and skills developed through studying the course, including the Prescribed Focus Areas. This reflects the fact that the knowledge, understanding and skills developed through the study of discrete sections should accumulate to a more comprehensive understanding than may be described in each section separately. It is important to understand that the Preliminary HSC course is assumed knowledge for the HSC course.

Teachers and candidates are reminded that mandatory skills content in Module 9.1 is examinable in both the core and option questions.

Candidates need to be reminded that the answer space provided and the marks allocated are guides to the maximum length of response required. Candidates should use examination time to analyse the question and plan responses carefully, working within that framework to produce clear and concise responses. This may include the use of dot points, diagrams and/or tables, and avoids internal contradictions. This is particularly so in holistic questions which need to be logical and well structured. Of particular concern in 2007 was that many candidates confused the terms and concepts of global warming/ozone depletion and the Cambrian Explosion with a mass extinction event.

Better responses indicate that candidates are following the instructions provided on the examination paper. In these responses, candidates:

- show all working where required by the question
- do not repeat the question as part of the response
- look at the structure of the whole question and note that in some questions the parts follow from each other, ie responses in part (a) lead to the required response in part (b), etc
- use appropriate equipment, eg pencils and a ruler to draw diagrams and graphs (a clear plastic ruler would aid candidates to plot points that are further from the axes and rule straight lines of best fit).

In Section II, the option question is divided into a number of parts. Candidates should clearly label each part of the question when writing in their answer booklets.

In part (d) of the 2007 option questions, the best responses presented ideas coherently and included the correct use of scientific principles and ideas. Many candidates wrote a lot of information that was not relevant to the question. Some responses showed evidence of rote learning an anticipated answer. These responses did not address the syllabus content and/or outcomes being assessed and hence did not score full marks. Candidates are required to attempt one question only in Section II, but some candidates responded to more than one option question. Candidates are strongly advised to answer the option they have studied in class.

Section I – Core

Part A – Multiple-choice

Question	Correct Response
1	B
2	A
3	C
4	A
5	A
6	B
7	C
8	D

Question	Correct Response
9	C
10	C
11	A
12	B
13	D
14	D
15	A

Part B

Question 16

(a) Most responses correctly identified a modern technology. Weaker responses did not address the term 'technology'.

(b) Better responses described a modern technology such as lasers placed across a fault line such as the San Andreas Fault. Some better responses answered the question with a labelled scientific diagram. Weaker responses lacked details of how devices worked to measure relative motion, particularly those regarding GPS and other satellite technologies. Weaker responses did not address time, distance and/or repeated measurements.

Question 17

(a) In better responses, candidates constructed a table and correctly identified the required three properties of the respective lithospheric plates. The best responses used terminology such as mafic/felsic in reference to mineralogy, and density rather than referring to weight. Weaker responses confused tectonic processes with properties.

(b) Better responses described the role of density and gravity as key features of the slab pull hypothesis, and correctly used these features to explain the continued motion of the lithospheric plates.

Question 18

(a)(i) The majority of responses correctly identified either a specific disaster such as the eruption of Mt St Helens in 1980 or a general disaster such as an earthquake, tsunami or volcanic eruption. Weaker responses named a place such as Mt Pinatubo or Newcastle but did not associate it with an actual disastrous event.

(ii) Better responses concentrated on specific tectonic processes such as plate subduction with partial melting of the subducting plate, leading to volcanic eruptions. Earthquakes were associated with a build up of stress due to plate interaction with sudden release of energy at the fault line, generating an earthquake. In many of the better responses, actual plates were named. Labelled scientific diagrams were often included as part of the better responses. Weaker responses simply described the hazards associated with the disaster rather than explaining the causes of them.

(b) Better responses linked the production and weathering of igneous material to increased soil fertility. This was then directly associated with increased crop yields. Many responses mentioned mineral ions such as iron and magnesium as important contributors to soil fertility. There was evidence that some candidates misinterpreted the question and referred to the hazards of farming in volcanic areas instead of the advantages. Weaker responses discussed only cultural or aesthetic reasons for farming in these regions and did not address the scientific focus of the question.

Question 19

A variety of appropriate scale diagrams were used, eg pie charts, timelines and histograms. The best responses correctly identified the eons, their relative sizes and the scale used and/or the duration of the eons. In the better responses, candidates referred to the geological timescale provided. In better responses, candidates used a ruler and a calculator where appropriate to accurately construct their diagram.

Question 20

(a) Many of the weaker responses incorrectly included CFCs, methane and acids.

(b) The best responses demonstrated that the fuel was combusted with oxygen to produce the exhaust emission. In weaker responses, there was evidence of confusion between the equation for combustion and those for respiration, photosynthesis and acid rain formation.

Question 21

(a) The better responses demonstrated an understanding of increased diversity in a short period of time, while the weaker responses misunderstood the word explosion, taking it to mean the meteorite collision with the Earth at the end of the Permian.

(b) Better responses gave two examples of differences between the groups but weaker responses only identified the presence or lack of hard parts as a feature of difference.

Question 22

Better responses presented an analysis of the data. Better responses directly referred to the information in the stem of the question but weaker candidates failed to recognise the significance of this information. Weaker responses demonstrated knowledge of the theories for the Permian Mass Extinction but failed to apply that knowledge to the data. Many responses focused on describing the depositional environment of the rock layers rather than the processes and events which caused the changes in fossil numbers, diversity and dominant types.

Question 23

Better responses demonstrated an understanding of the term *technology* and gave multiple examples of how technology had improved our understanding of fossil life forms. They referred to specific technologies and described how these have enabled us to improve our understanding.

Question 24

(a) In the better responses, candidates clearly labelled the inputs and outputs in their diagrams. In weaker responses, flowcharts of an industrial process were drawn rather than a classroom simulation of a process.

(b) Better responses included reference to the results of their simulation as well as referring to successes and limitations of the simulation.

Question 25

(b) Better responses gave correct reasons for stopping ozone depletion and provided support for their reason. Weaker responses demonstrated confusion between the problem of ozone depletion and that of global warming.

(c) Better responses used diagrams and word equations to explain all the necessary steps leading to the depletion of ozone. Weaker responses outlined only some of the steps. Some responses showed that candidates were not aware that halides include CFCs.

(d) Better responses named an existing scientist and/or organisation and outlined current research rather than research from the 1990s. Weaker responses made general responses about Australia's role in ozone research and restated the question.

Question 26

Better responses discussed multiple issues, providing arguments for and/or against each. They also related each issue to the long-term use of a chemical and its consequences.

Weaker responses listed the issues (such as bioaccumulation and biomagnification in food chains/webs) and provided arguments for and/or against them. They used specific examples of pesticides to argue the issues, including the impact on non-target species. However, they gave

minimal detail, only mentioning 'harm' or 'suffer' in their negative arguments instead of more specific effects on the environment.

Question 27

Better responses assessed the recency of the article, the support provided by other scientific studies and the validity of the source of the data and its author. These could be stated in general terms without reference to the stimulus provided.

Weaker responses included only one or two features of assessment and tried to summarise the article rather than to actually assess its value as a piece of science reporting.

Many candidates focused on the 'assess' part of the question rather than the more general 'how' to assess the reliability.

Section II – Options

General Comments

In part (c)(i) of each of the option questions, candidates were asked to state a suitable hypothesis for the first-hand investigation detailed in the stem of the question. Better responses stated an easily testable hypothesis that related to the experiment that was later explained in (c)(ii).

Question 28

(a) (i) Better responses acknowledged that biological controls were used to reduce the numbers of another species. Weaker responses confused biological control with control by pesticides while others simply re-stated the question in definition form.

(ii) Better responses named an appropriate type of control, used a current Australian example and clearly identified the effect of the control agent on the target species. They also tended to use a well-documented biological control such as the cactoblastis moth and Prickly Pear.

(b) (i) Better responses indicated the trend as a rapid increase between 1800 and 1860 and then related this increase to the increasing colonisation of Australia and the deliberate or accidental importation of mammals for a range of appropriate reasons. Weaker responses failed to explain the causes of the trend.

(ii) The best responses clearly stated two mechanisms for accidental introduction and, for each mechanism, gave detailed characteristics and named examples. The best responses clearly explained how the organisms arrived in Australia.

(c) (i) The best responses provided easily testable hypotheses. In doing this, candidates avoided subjective terms such as 'overpower' or 'effect' and chose terms that related directly to measurable characteristics.

(ii) The best responses clearly reflected a thorough first-hand investigation where measurement and identification tools were used and comparisons of data or conditions were made.

(iii) The best responses identified the risk and then the prevention method to reduce/eliminate it.

(d) Better responses clearly distinguished between the biotic and abiotic components and related these back to the species and its effects on the environment. The best responses demonstrated a logical structure.

Better responses chose an appropriate example of an introduced species, such as rabbits, salvinia or lantana, which allowed candidates to discuss both biotic and abiotic effects.

(e) (i) The best responses used two different scales to plot rabbits and native plant seedlings. They also chose a line graph.

(ii) The best responses addressed the relationship between both factors when they were both high and low.

(iii) The best responses sketched the condition in general terms rather than just identifying a condition.

Question 29

(a) (i) The best responses identified two renewable resources. Weaker responses included nuclear energy which is not a renewable resource.

(ii) The best responses outlined a specific use for their identified renewable resource and then gave a reason as to why this resource would or wouldn't be used in the future.

(b) (i) The best responses described a trend as well as identifying a cause for the trend. Weaker responses only described the trend.

(ii) The best responses described two advantages of petrol over coal as a transport fuel. Advantages include petrol having a higher energy yield and being easier to use in transport due to its state as a liquid.

(c) (i) The best responses included a hypothesis that stated which of two or more non-fossil fuels was most efficient. Weaker responses either compared the energy efficiency of a fossil fuel to a non-fossil fuel, or failed to mention two non-fossil fuels. Weaker responses showed confusion between an aim and a hypothesis.

(ii) The best responses compared the energy given out by non-fossil fuels such as methanol, ethanol or propanol when used to heat a specific quantity of water to a set temperature. Weaker responses only mentioned heating one non-fossil fuel or generalised about non-fossil fuels with no clear procedure. Alternatively, they mentioned only fossil fuels.

(iii) Better responses outlined a risk and identified a safe work practice which minimised that risk.

(d) The best responses applied scientific principles in their description of methods of conserving energy through architectural design. They detailed how these methods specifically benefited both the individual and the environment.

(e) (i) The best responses used two different scales on the graph for temperature and rock density, their graph used the full grid and they provided a key. Weaker responses used awkward scales which led to poor plotting of points.

(ii) Better responses indicated that temperature increased with depth.

(iii) The strongest responses clearly outlined how higher temperatures reduce the viscosity of oil thus helping its migration, while lower rock densities increase permeability, which allows oil to migrate more easily. Weaker responses indicated how oil and gas were generated at varying temperatures but did not relate their answer to oil migration, or confused the density of oil with that of the rocks.

Question 30

(a) (ii) The best responses established a link between a valid government policy and the sustainability of mining operations.

(b) (i) The best responses described a trend as well as identifying a cause for the trend. Weaker responses only described the trend.

(ii) The strongest responses identified two factors, such as grade, tonnage or market prices, and described how each factor would influence production and income.

(c) (i) Better responses stated that if an ore mineral or metal was present then it would respond to a physical or chemical test. The test was outlined. Weaker responses showed confusion between an aim and a hypothesis.

(ii) Better responses outlined the procedure and equipment required in a first-hand investigation that modelled the methods used to test for the presence of ore minerals, such as burying radioactive isotopes in a tray of sand and using a Geiger counter to test for the presence of the ore. Weaker responses failed to name specific equipment or made reference to second-hand data.

(d) The best responses used scientific principles to show a thorough understanding of an environmental impact statement (EIS) by describing the effect of the mine on biotic and abiotic features, and infrastructure.

These responses stated the need for an environmental impact statement clearly and related their judgement to the benefits of having an environmental impact statement. Weaker responses confused an environmental impact statement with a feasibility study.

(e) (i) Stronger responses used the same scale for copper and lead concentration on the vertical axis. Their graph used the full grid and provided a key.

(ii) Stronger responses calculated the answer from their graphs. Weaker responses tried to calculate the answer from the table.

Question 31

(a) (i) The best responses identified calcareous and siliceous oozes as the source of sediment. Weaker responses confused clay, basalt and granite as sediment that are biological in origin.

(ii) The better responses stated that manganese nodules begin to grow on a previously existing particle, such as a small fishbone, forming layers through the process of precipitation from seawater supersaturated in manganese.

(b) (i) The best responses identified that the temperature was constant for the top 200 metres of the ocean due to the sun's ability to penetrate and warm to this depth.

(ii) The best responses described two factors, such as light, pressure, salinity, current characteristics, and clearly stated how they changed with depth.

(c) (i) The best responses gave a hypothesis that stated that common salts would be more soluble in water as the temperature of the water increased. Weaker responses confused an aim with a hypothesis.

(ii) The best responses compared the mass of at least two named salts that can be added to a specific volume of water at three different temperatures to obtain a saturated solution. Weaker responses did not state the equipment used or name the salts that were used, or discussed dissolving the salts at one temperature only.

(d) The best responses described the scientific principles associated with the laws of the ocean that they included. They stated the need for each law clearly, and related their judgement to the consequences of not having those laws.

(e) (i) The best responses had graphs that included appropriate scales and labelling of axes, filled the full grid and had a key.

(ii) The best responses stated that phosphorus concentration levels tracked temperature. Weak responses described the graph without linking the relationship between phosphorus concentration and temperature.

(iii) The best responses related hydrothermal waters to their mobility in the hot crust, leaching out minerals into super hot water. They also noted that high pressure allowed the water to remain liquid at high temperatures.

Earth and Environmental Science

2007 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.5.2.1, 9.2.4.2.5	H4
2	1	9.3.2.2.1	H7
3	1	9.3.2.3.1, 9.3.4.3.1, 9.3.4.3.2, 9.3.3.3.2	H7
4	1	9.2.4.3.2, 9.2.4.2.2, 14.1(f)	H14
5	1	9.3.1.2.4	H7
6	1	9.4.1.3.1	H7, H8
7	1	9.4.2.2.1, 9.4.5.2.1	H9, H10
8	1	14.1(a)	H14
9	1	9.4.3.3.1, 14.1(g)	H9, H10, H14
10	1	9.4.7.2.1, 14.2(d)	H9, H10, H14
11	1	9.2.3.2.1, 9.2.3.3.1, 12.3(c)	H7, H8, H12
12	1	9.2.4.2.8	H4, H7, H8
13	1	9.3.2.2.3	H7
14	1	9.2.4.2.1, 9.2.1.2.3, 14.3(d)	H7, H14
15	1	9.3.3.2.2, 14.1(a)	H3, H14
Section I Part B			
16 (a)	1	9.2.4.3.2	H3
16 (b)	2	9.2.4.3.2	H1, H3
17 (a)	4	9.2.1.2.1, 9.2.1.2.2, 13.1(e)	H8, H13
17 (b)	3	9.2.1.2.4	H2, H7, H8
18 (a) i)	1	9.2.4.3.3	H4, H7
18 (a) ii)	2	9.2.4.3.3	H4, H7
18 (b)	3	9.2.4.2.3	H4, H6
19	3	9.3.1.3.1, 13.1(f)	H13
20 (a)	1	9.4.6.3.1	H9
20 (b)	2	9.4.6.2.1	H10
21 (a)	1	9.3.3.2.4	H7
21 (b)	2	9.3.3.2.5	H7
21 (c)	2	9.3.3.2.5	H7
22	8	9.2.5.2.1, 9.3.4.2.1, 9.3.5.2.5, 9.3.4.3.1, 14.3(b), 14.1(a)	H14
23	5	9.3.1.2.5, 9.3.3.2.3	H1, H7

Question	Marks	Content	Syllabus outcomes
24 (a)	3	9.4.7.3.1, 13.1(e)	H13
24 (b)	3	9.4.7.3.1, 12.4(a)	H12
25 (a)	1	9.4.4.3.2, 9.4.4.2.2	H9
25 (b)	1	9.3.2.2.3, 14.1(g)	H9, H10, H14
25 (c)	2	9.4.6.2.3	H9, H10
25 (d)	2	9.4.6.2.4	H5
26	5	9.4.4.2.1	H10
27	3	9.1.12.4, 12.3(a), 12.4(e)	H12
Section II **Question 28 — Introduced Species and the Australian Environment**			
28 (a) (i)	1	9.5.5.2.1	H10
28 (a) (ii)	2	9.5.5.2.2	H10
28 (b) (i)	2	9.5.1.2.4, 14.1(a)	H10, H14
28 (b) (ii)	2	9.5.1.3.3, 14.1(g)	H10, H14
28 (c) (i)	1	9.5.1.3.2, 14.3(c)	H14
28 (c) (ii)	2	9.5.1.3.2, 11.2(c), 11.3(a, c)	H11
28 (c) (iii)	2	9.5.1.3.2, 12.1(d)	H12
28 (d)	6	9.5.2.3.1, 14.1(c, g), 14.3(b)	H4, H10, H14
28 (e) (i)	4	13.1(f)	H13
28 (e) (ii)	1	9.5.4.2.1, 14.1(a)	H10, H14
28 (e) (iii)	2	9.5.4.2.1, 9.5.3.2.1	H10
Section II **Question 29 — Organic Geology – A non–renewable Resource**			
29 (a) (i)	1	9.6.1.2.1	H6
29 (a) (ii)	2	9.6.6.2.1	H4, H6
29 (b) (i)	2	9.6.2.2.2, 14.1(a)	H7, H14
29 (b) (ii)	2	9.6.4.2.3, 14.1(g)	H6, H9, H14
29 (c) (i)	1	9.6.6.3.2, 14.3(c)	H14
29 (c) (ii)	2	9.6.6.3.2, 11.2(c), 11.3(a, c)	H11
29 (c) (iii)	2	9.6.6.3.2, 12.1(d)	H12
29 (d)	6	9.6.6.2.2, 14.3(b)	H3, H4, H9, H14
29 (e) (i)	4	13.1(f)	H13
29 (e) (ii)	1	9.6.2.2.4, 14.1(a)	H10, H14
29 (e) (iii)	2	9.6.2.2.5	H7
Section II **Question 30 — Mining and the Australian Environment**			
30 (a) (i)	1	9.7.3.2.2	H6
30 (a) (ii)	2	9.7.2.2.2	H9

Question	Marks	Content	Syllabus outcomes
30 b (i)	2	9.7.3, 14.1(a)	H6, H14
30 (b) (ii)	2	9.7.3.3.2, 14.1(g)	H6, H14
30 (c) (i)	1	9.7.4.3.2, 11.2(c)	H11
30 (c) (ii)	2	9.7.4.3.2, 11.2(e), 11.3(a, c)	H11
30 (c) (iii)	2	9.7.4.3.2, 12.1(d)	H12
30 (d)	6	9.7.5, 14.3(b)	H3, H4, H10, H14
30 (e) (i)	4	13.1(f)	H13
30 (e) (ii)	1	9.7.4, 14.1(a)	H14
30 (e) (iii)	2	9.7.5	H10
Section II **Question 31 — Oceanography**			
31 (a) (i)	1	9.8.7.2.1	H7
31 (a) (ii)	2	9.8.7.2.1	H7
31 (b) (i)	2	9.8.1, 14.1(a)	H7, H14
31 (b) (ii)	2	9.8.1.2.1, 14.1(g), 14.3(b)	H7, H14
31 (c) (i)	1	9.8.3.3.3, 14.3(c)	H14
31 (c) (ii)	2	9.8.3.3.3, 11.3(a, c), 11.2(c)	H11
31 (c) (iii)	2	9.8.3.3.3, 12.1(d)	H12
31 (d)	6	9.8.4.3.2, 14.3(b)	H4, H9, H14
31 (e) (i)	4	13.1(f)	H13
31 (e) (ii)	1	9.8, 14.1(a)	H14
31 (e) (iii)	2	9.8.6.2.3	H7

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2007 HSC Earth and Environmental Science Marking Guidelines

Section I, Part B

Question 16 (a)

Outcomes assessed: H3

MARKING GUIDELINES

Criteria	Marks
• Recognises and names ONE modern technology used to measure relative motion of lithospheric plates	1

Question 16 (b)

Outcomes assessed: H1, H3

MARKING GUIDELINES

Criteria	Marks
• Provides the main features of how the technology in (a) is used to measure relative motion	2
• Provides the main feature of the named technology OR • Sketches in general terms the way a technology can be used	1

Question 17 (a)

Outcomes assessed: H8, H13

MARKING GUIDELINES

Criteria	Marks
• Notes THREE different properties between oceanic plates and continental plates • Correctly constructs a table (rows, columns, headings)	4
• Notes TWO different properties between oceanic plates and continental plates • Correctly constructs a table	3
• Notes ONE different property between oceanic plates and continental plates • Attempts to construct a table OR • Notes TWO different properties between oceanic and continental plates	2
• Some relevant information about ocean/continental plates OR • Correctly constructs a table	1

Question 17 (b)

Outcomes assessed: H2, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of the hypothesis that explains how subduction drives plate motion	3
• Outlines the hypothesis used to explain how subduction drives plate motion	2
• Indicates correct plate motion for subduction OR • States an appropriate hypothesis	1

Question 18 (a) (i)

Outcomes assessed: H4, H7

MARKING GUIDELINES

Criteria	Marks
• Identifies a natural disaster caused by tectonic activity	1

Question 18 (a) (ii)

Outcomes assessed: H4, H7

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of the tectonic process causing the named disaster	2
• Outlines a valid tectonic process that could cause the named disaster	1

Question 18 (b)

Outcomes assessed: H4, H6

MARKING GUIDELINES

Criteria	Marks
• Relates the cause and effect as to why people risk farming in active volcanic regions	3
• Describes one reason why people risk farming in a volcanic region OR • Identifies TWO reasons why people risk farming in a volcanic region • Describes the risks of farming in active volcanic regions	2
• Identifies a feature of farming in a volcanic region	1

Question 19

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies names/labels • Uses correct duration/lengths/sizes • Uses an appropriate scale	3
• Any TWO of the above	2
• Any ONE of the above	1

Question 20 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Names two gaseous compounds found in vehicle emissions	1

Question 20 (b)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies reactants (left side of word equation) • Links together product(s) of combustion (right side of word equation)	2
• Correctly identifies reactants (left side of word equation) OR • Links together product(s) of combustion (right side of word equation)	1

Question 21 (a)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies features of Cambrian explosion (relating to apparent rapidity of change)	1

Question 21 (b)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Indicates differences between Ediacaran and Cambrian life-forms	2
• Indicates a difference between Ediacaran and Cambrian life-forms	1

Question 21 (c)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Draws conclusions about possible advantages that Cambrian life forms had over earlier metazoans	2
• Identifies a possible advantage that Cambrian life forms had over earlier metazoans	1

Question 22

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Identifies possible events and processes that caused the changes to occur • Relates the implications of the events and process to the changes • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas.	7-8
• Identifies possible events and processes that caused the changes to occur AND/EITHER • Attempts to draw out the implications of the events and processes to the changes OR • Recognises the significance of the volcanic layers	5-6
• Identifies possible events or processes OR • Relates a change in the table to an event	3-4
• Identifies possible event or process or changes in the diagram	1-2

Question 23

Outcomes assessed: H1, H7

MARKING GUIDELINES

Criteria	Marks
• Identifies a technology that has changed our understanding of fossil life forms • Compares our understanding before and after the technology	4–5
• Identifies a technology that has changed our understanding of fossil life forms • Relates this technology to our understanding of fossil life forms	2–3
• Identifies a technology that has changed our understanding of fossil lifeforms OR • Identifies knowledge that has changed as a result of technology	1

Question 24 (a)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws a clear diagram related to the named process • Labels apparatus correctly • Identifies input and output correctly	3
• Draws clear diagram related to the named process • Labels most apparatus correctly	2
• Labels apparatus, process not named, or incorrectly named OR • Draws an obviously correct process without clear labels	1

Question 24 (b)

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Makes a judgement about how successful their investigation was linked to their results • Makes a judgement about the limitation of the simulation linked to their results	3
• Makes a statement about the success of their investigation • Makes a statement about the limitation of the simulation OR • Makes a judgement about the limitation or success, linking it to their results	2
• Makes a statement about the success of their investigation OR • Makes a statement about the limitation of the simulation	1

Question 25 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Identifies a non-chemical alternative to using pesticides	1

Question 25 (b)

Outcomes assessed: H9, H10

MARKING GUIDELINES

Criteria	Marks
• Outlines a correct reason to stop ozone depletion	1

Sample answer/Answers could include:

Ozone layer absorbs ultraviolet light from the sun, which is generally accepted to be a contributory factor to skin cancer.

Question 25 (c)

Outcomes assessed: H9, H10

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the steps in breaking down of ozone	2
• Correctly outlines a step in the process	1

Question 25 (d)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Names an Australian scientist or scientific organisation • Gives the main feature of the research related to ozone depletion	2
• Names an Australian scientist or scientific organisation OR • Gives the main feature of research OR • States the general reason for research into ozone depletion	1

Question 26

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Identifies issues concerned with continually introducing new pesticides • Gives points for and/or against introduction of new pesticides • Relates the issues concerned with the new pesticide to the environment as a whole	4–5
• Describes issues concerned with continually introducing new pesticides OR • Identifies an issue concerned with introducing pesticides • Provides point(s) for and/or against the introduction	2–3
• Identifies an issue concerned with continually introducing new pesticides • Gives a relevant point	1

Question 27

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Gives THREE features of how to assess the reliability of an article	3
• Gives TWO features of the assessment	2
• Gives a feature of the assessment	1

Section II

Question 28 (a) (i)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• States the meaning of the term biological control	1

Question 28 (a) (ii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Provides the main features of a type of biological control • Uses an Australian example – both pest and biological control in organisms identified	2
• Identifies a type of biological control OR • Identifies an Australian example (both organisms named)	1

Question 28 (b) (i)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Makes a relationship between the trend and the reason/cause evident	2
• Describes the trend OR • Attempts to link the trend to the cause OR • Provides a detailed cause for the trend	1

Question 28 (b) (ii)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Gives the characteristics and/or features of mechanisms related to the accidental introduction	2
• Identifies mechanisms OR • Gives the characteristics of a mechanism	1

Question 28 (c) (i)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Puts forward a suitable hypothesis that is linked to an investigation	1

Question 28 (c) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms an appropriate procedure relating to c (i) • Identifies apparatus and/or equipment used that is appropriate OR • Sketches in general terms a technique that is appropriate	2
• Provides an incomplete procedure OR • Names apparatus and/or equipment identified	1

Question 28 (c) (iii)

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Relates risk identified to a safe work practice for the investigation	2
• Identifies a risk for the investigation OR • Identifies a safe work practice for the investigation OR • Relates a risk to a safe work practice not related to the investigation	1

Question 28 (d)

Outcomes assessed: H4, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of biotic and abiotic components of the environment • Names an introduced species to Australia • Describes the effects of the introduced species on biotic and abiotic components of the environment • Draws a relationship between species and the environment • Demonstrates a coherence and logical progression and includes correct use of scientific principles and ideas	5-6
• Demonstrates a sound knowledge of biotic and abiotic components AND/EITHER • Describes effects on biotic and abiotic components of the environment • Attempts to draw a relationship between species and the environment OR • Names an introduced species • Outlines an effect on biotic and abiotic components OR • Names an introduced species • Describes an effect on biotic and/or biotic components	3-4
• Names an introduced species AND/OR • Identifies an effect on the biotic and/or abiotic component	1-2

Question 28 (e) (i)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws an appropriate graph to suit data • Labels axes correctly • Provides correct and suitable scale • Plots data correctly • Uses full grid • Provides an appropriate key	4
• Any FOUR of the above criteria	3
• Any THREE of the above criteria	2
• Any TWO of the above criteria	1

Question 28 (e) (ii)

Outcomes assessed: H10, H14,

MARKING GUIDELINES

Criteria	Marks
• Uses the information on the graph to correctly state the relationship between rabbit density and number of native seedlings	1

Sample answer/Answers could include:

Number of native seedlings per $100m^2$ increases with decreasing rabbit density (no. of rabbits per hectare).

Question 28 (e) (iii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms TWO conditions required for an organism to become a pest	2
• Sketches in general terms ONE condition required for an organism to become a pest OR • Identifies TWO conditions required for an organism to become a pest	1

Question 29 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Names TWO renewable resources	1

Question 29 (a) (ii)

Outcomes assessed: H4, H6

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms a future use of a renewable resources identified in (a) (i)	2
• Identifies a future use of a renewable resource	1

Question 29 (b) (i)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
• Makes a relationship between the trend and the reason/cause evident	2
• Describes the trend OR • Attempts to link the trend to the cause OR • Provides a detailed cause for the trend	1

Question 29 (b) (ii)

Outcomes assessed: H6, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Describes feasible advantages of petrol over coal as a transport fuel	2
• Describes a feasible advantage or petrol over coal as a transport fuel	1

Question 29 (c) (i)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Puts forward a suitable hypothesis that is linked to the investigation	1

Question 29 (c) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms an appropriate procedure to (c) (i) • Identifies apparatus and/or equipment used	2
• Provides an incomplete procedure OR • Names apparatus and/or equipment	1

Question 29 (c) (iii)

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Relates risk identified to a safe work practice for the investigation	2
• Identifies a risk for the investigation OR • Identifies a safe work practice for the investigation OR • Relates a risk to a safe work practice	1

Question 29 (d)

Outcomes assessed: H3, H4, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of architectural design and its energy conserving properties • Describes energy conserving methods through architectural design • Makes a judgement about benefit to the individual AND the environment • Demonstrates a coherence and logical progression and includes correct use of scientific principles	5-6
• Demonstrates a sound knowledge of architectural design and its energy conserving properties AND/EITHER • Describes energy conserving methods through architectural design OR • Outlines energy conserving methods through architectural design • Provides a judgement about the benefit to individual or environment	3-4
• Identifies energy conserving method(s) through architectural design AND/OR • Provides a judgement about the benefits	1-2

Question 29 (e) (i)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws an appropriate graph to suit data • Labels axes correctly • Provides correct and suitable scale • Plots data correctly • Uses full grid • Provides a appropriate key	4
• Any FOUR of the above criteria	3
• Any THREE of the above criteria	2
• Any TWO of the above criteria	1

Question 29 (e) (ii)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Uses the information in the graph to correctly state the relationship between temperature and depth	1

Question 29 (e) (iii)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• States in general terms how temperature and rock density influences oil migration mechanism	2
• States in general terms how either temperature or rock density influences oil migration	1

Question 30 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• States the meaning of the term ore	1

Question 30 (a) (ii)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms a government policy that affects the sustainability of a mining operation	2
• Names a government policy OR • Outlines aspects of sustainability of mining operations	1

Question 30 (b) (i)

Outcomes assessed: H6, H14

MARKING GUIDELINES

Criteria	Marks
• Makes a relationship between the trend and the reason/cause evident	2
• Describes the trend OR • Attempts to link the trend to the cause OR • Provides a detailed cause for the trend	1

Question 30 (b) (ii)

Outcomes assessed: H6, H14

MARKING GUIDELINES

Criteria	Marks
• Describes factors that affect the relationship	2
• Describes a factor that affects the relationship	1

Question 30 (c) (i)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Puts forward a suitable hypothesis that is linked to the investigation	1

Question 30 (c) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms an appropriate procedure relating to (c) (i) • Identifies apparatus and/or equipment used	2
• Provides an incomplete procedure OR • Names apparatus and/or equipment used	1

Question 30 (c) (iii)

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Relates risk identified to a safe work practice for the investigation	2
• Identifies a risk for the investigation OR • Identifies a safe work practice for the investigation OR • Relates a risk to a safe work practice	1

Question 30 (d)

Outcomes assessed: H3, H4, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrate a thorough knowledge of environmental impact statements • Describes EIS and the need for a company to have an EIS for a new mine • Makes a judgement about the need for an EIS • Makes a judgement about the importance of laws about the ocean for our world society • Demonstrates a coherence and logical progression and includes correct use of scientific principles and ideas	5-6
• Demonstrates a sound knowledge of EIS AND EITHER • Describes EIS and the need for a company to have an EIS for a new mine OR • Outlines what an EIS is • Provides a judgement about the need for a company to have one	3-4
• Identifies the needs for an EIS for a company to open a new mine AND/OR • Provides a judgement about the need • Identifies some components of an EIS	1-2

Question 30 (e) (i)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws an appropriate graph to suit data • Labels axes correctly • Provides correct and suitable scale • Plots data correctly • Uses full grid • Provides an appropriate key	4
• Any FOUR of the above criteria	3
• Any THREE of the above criteria	2
• Any TWO of the above criteria	1

Question 30 (e) (ii)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Correctly states the width of the ore-body that could be mined within 5 metres	1

Question 30 (e) (iii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms rehabilitation practices that could be applied after mining a lead-copper ore body	2
• Sketches in general terms a practice that could be applied after mining this ore-body OR • Identifies two practices	1

Question 31 (a) (i)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Names TWO types of sediment of biogenic origin found in deep ocean basin	1

Question 31 (a) (ii)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms the processes of metal derivation, transport in solution and precipitation due to organic activity	2
• Identifies one process OR • Gives a general description of a process	1

Question 31 (b) (i)

Outcomes assessed:H7, H14

MARKING GUIDELINES

Criteria	Marks
• Makes a relationship between the trend and the reason/cause evident	2
• Describes the trend OR • Attempts to link the trend to the cause OR • Provides a detailed cause for the trend	1

Question 31 (b) (ii)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
• Provides characteristics and features of factors other than temperature that change with depth	2
• Outlines factors other than temperature that change with depth OR • Provides characteristics and features of a factor other than temperature that change with depth	1

Question 31 (c) (i)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Puts forward a suitable hypothesis that is linked to the investigation	1

Question 31 (c) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms an appropriate procedure relating to (c) (i) • Identifies apparatus and/or equipment used identifies	2
• Provides an incomplete procedure OR • Names apparatus and/or equipment	1

Question 31 (c) (iii)

Outcomes assessed: H12

MARKING GUIDELINES

Criteria	Marks
• Relates risk identified to a safe work practice for the investigation	2
• Identifies a risk for the investigation OR • Identifies a safe work practice for the investigation OR • Relates a risk to a safe work practice	1

Question 31 (d)

Outcomes assessed: H4, H6, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of laws about oceans and their need for world society • Describes the need for laws about the ocean for our world society • Makes a judgement about the importance of laws about the ocean for our world society • Demonstrates a coherence and logical progression and includes correct use of scientific principles and ideas	5-6
• Demonstrates a sound knowledge of laws about oceans and their need AND/EITHER • Describes the need for laws about ocean for our world society OR • Outlines the need for laws about oceans for our world society • Provides a judgement about the importance of having laws about the ocean	3-4
• Identifies the need for laws about the ocean AND/OR • Provides a judgement about the importance of laws about the ocean	1-2

Question 31 (e) (i)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws an appropriate graph to suit data • Labels axes correctly • Provides correct and suitable scale • Plots data correctly • Uses full grid • Provides an appropriate key	4
• Any FOUR of the above criteria	3
• Any THREE of the above criteria	2
• Any TWO of the above criteria	1

Question 31 (e) (ii)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Uses information in the graph and correctly states the relationship between temperature and phosphorus concentration	1

Question 31 (e) (iii)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms conditions for hydrothermal waters to scavenge elements from rocks	2
• Sketches in general terms a condition for hydrothermal water to scavenge elements from rocks OR • Identifies conditions	1