

This document shows the layout of the examination and provides some sample questions for each of the sections.

Earth and Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used
- A Geological Time Scale is provided at the back of this paper

Total marks: 100

Section I – 20 marks (pages 3–5)

- Attempt Questions 1–20
- Allow about 35 minutes for this section

Section II – 80 marks (pages 6–17)

- Attempt Questions 21–xx
- Allow about 2 hours and 25 minutes for this section

The first HSC examination for the new Earth and Environmental Science Stage 6 syllabus will be held in 2019.

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The Earth and Environmental Science examination specifications can be found in the *Assessment and Reporting in Earth and Environmental Science Stage 6* document.

Questions may require candidates to integrate knowledge, understanding and skills developed through studying the course. The Year 11 course is assumed knowledge for the Year 12 course.

There is no expectation that all of the Year 12 content will be examined each year. The examination will test a representative sample of the Year 12 content in any given year.

The following sample questions provide examples of some questions that may be found in HSC examinations for Earth and Environmental Science. Each question has been mapped to show how the sample question relates to syllabus outcomes and content. Answers for the objective-response questions (Section I) and marking guidelines for the short-answer questions (Section II) are provided. The marking guidelines indicate the criteria associated with each mark or mark range.

In the examination, students will record their answers to Section I on a multiple-choice answer sheet and their answers to Section II in the spaces provided on the examination paper.

The sample questions and marking guidelines provide teachers and students with guidance as to the types of questions to expect and how they may be marked. They are not meant to be prescriptive. Each year the structure of the examination may differ in the number and type of questions, focus on different syllabus outcomes and content, or have a different range and balance to those in this set of sample questions.

Note:

- Comments in coloured boxes are annotations for the purpose of providing guidance for future examinations.
- In this set of sample questions, some stimuli are used in both Section I and Section II. This is to illustrate how the same content area can be examined differently.
- Teachers and students should still refer to past HSC examination papers for examples of questions that may be included.

Section I

20 marks

Attempt Questions 1–20

Allow about 35 minutes for this section

This is NOT a complete sample examination paper. Four sample questions are included in this section.

Past examination papers provide guidance for other types of multiple-choice questions that could be included.

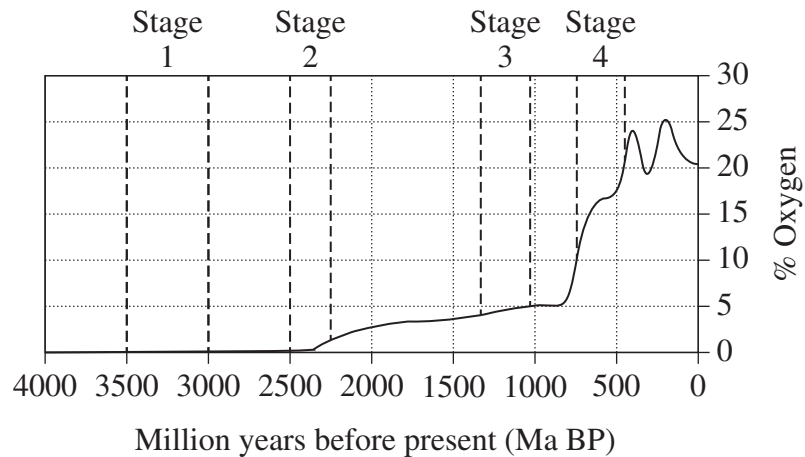
Use the multiple-choice answer sheet for Questions 1–20.

- 1** Which of the following has resulted in many Australian soils being relatively infertile?
- A. Age, low topographic relief and geological stability of Australia
 - B. Excessive use of fertilisers and pesticides over the last two hundred years in Australia
 - C. Lower rainfall experienced in Australia since it started moving towards the equator after the break-up of Gondwana
 - D. Depletion of the majority of nutrients by dense forests that covered the Australian continent during the Carboniferous period

A variety of stimulus material, such as text, diagrams, pictures, graphs, photographs and illustrations, may be included in questions in Section I. However, stimulus material will only be included when it is essential for answering the question.

Multiple-choice options (A–D) may be presented in different formats, for example, text, numbers, tables, graphs, photographs, diagrams.

- 2 The graph shows an estimate of the percentage of oxygen in Earth's atmosphere over time.



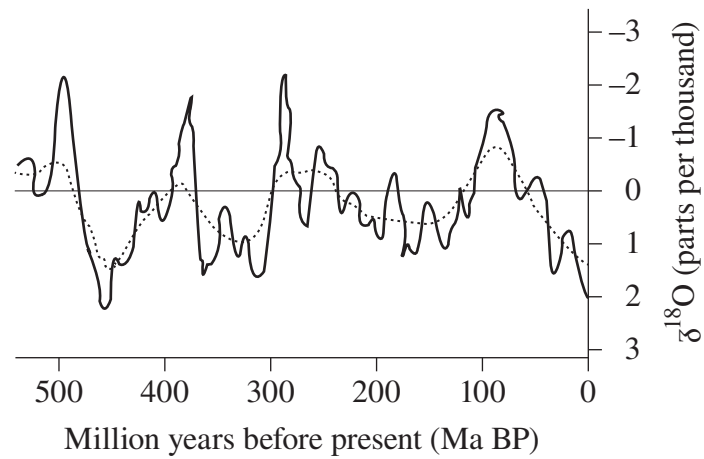
During which stage were most of the Australian banded iron formations produced?

- A. Stage 1
- B. Stage 2
- C. Stage 3
- D. Stage 4

Question 24 is a short-answer question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

- 3 Which product of a large Plinian volcanic eruption, such as the Mt Pinatubo eruption in 1991, would have a cooling effect on global climate for the longest period of time?
- A. Ash clouds that reached the stratosphere
 - B. Dacitic lava on the slopes of the volcano
 - C. Sulfur dioxide that reached up to 12 kilometres
 - D. Water vapour that absorbed heat from the atmosphere

- 4 The graph shows the short-term and long-term averages of the $\delta^{18}\text{O}$ isotope over time.



KEY

———— Short-term average

..... Long-term average

Which of the following statements is correct?

- A. The next glacial period to occur will be 100 million years from now.
- B. The most recent interglacial period peaked during the Jurassic period.
- C. The next glacial period to occur will not be as severe as previous glacial periods.
- D. The earliest glacial period shown occurred during the late Silurian–early Ordovician periods.

Earth and Environmental Science

Section II Answer Booklet

Questions in Section II may contain parts. There should be 20 to 25 items and at least two items will be worth 7 to 9 marks.

This is NOT a complete sample examination paper. Six sample questions (seven items) are included in this section.

80 marks

Attempt Questions 21–XX

Allow about 2 hours and 25 minutes for this section

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
 - Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.
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Question 21 (7 marks)

A variety of stimulus material, such as text, diagrams, pictures, graphs, photographs and illustrations, may be included in questions in Section II. However, stimulus material will only be included when it is essential for answering the question.

- (a) Using examples, describe human activities that have negatively affected the sustainability of Australian resources. **3**

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Some questions in this section may specify that the response must be supported with examples or other material such as diagrams and graphs.

In some cases, students may find it useful to support their answer with a diagram or other material even though no specific requirement is made in the question.

Question 21 continues on page 8

Question 22 (3 marks)

Complete the following table to show the cause and physical impact of each climatic phenomenon in Australia.

3

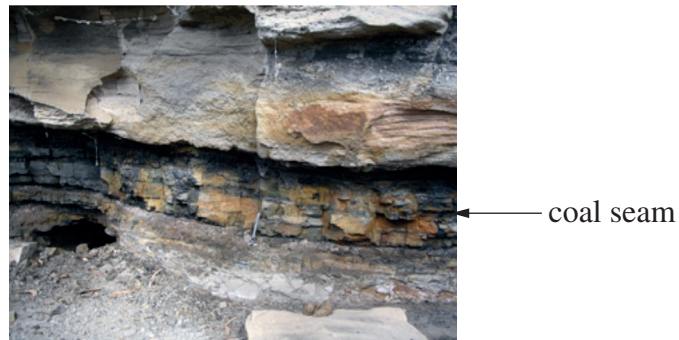
<i>Climatic phenomenon</i>	<i>Cause of phenomenon</i>	<i>Physical impact on Australian ecosystems</i>
East coast low		
Drought		
Bushfire		

Some questions in this section may require responses to be expressed in a particular format such as text, tables, flow charts, diagrams, graphs.

Question 23 (4 marks)

The photograph shows a coal seam with a fossiliferous marine sandstone 30 cm below the coal and a zircon-bearing tuff layer immediately above the top layer.

4



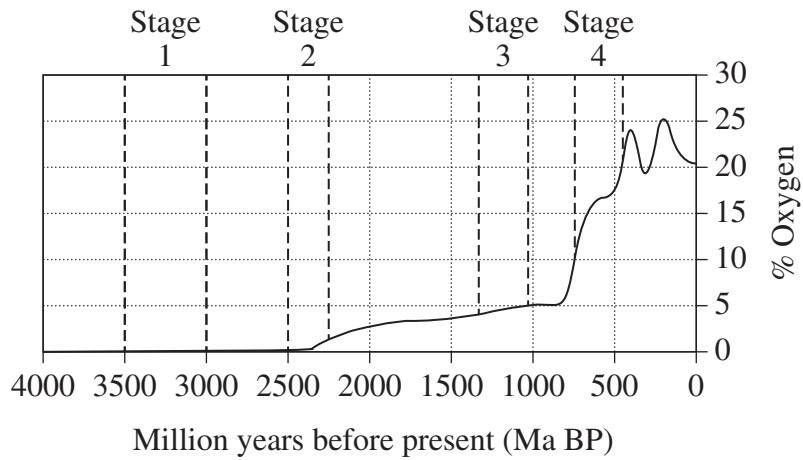
Use a flow chart to show how the age of the coal seam can be determined. You may assume that the outcrop is accessible and appropriate technologies are available for the investigation.

Additional information is provided so that students do not need to address these issues in their responses.

Question 24 (4 marks)

The graph shows an estimate of the percentage of oxygen in Earth's atmosphere over time.

4



Based on the diagram provided, during which stage were most Australian banded iron formations produced? Justify your answer.

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Question 2 is a multiple-choice question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

Question 25 (continued)

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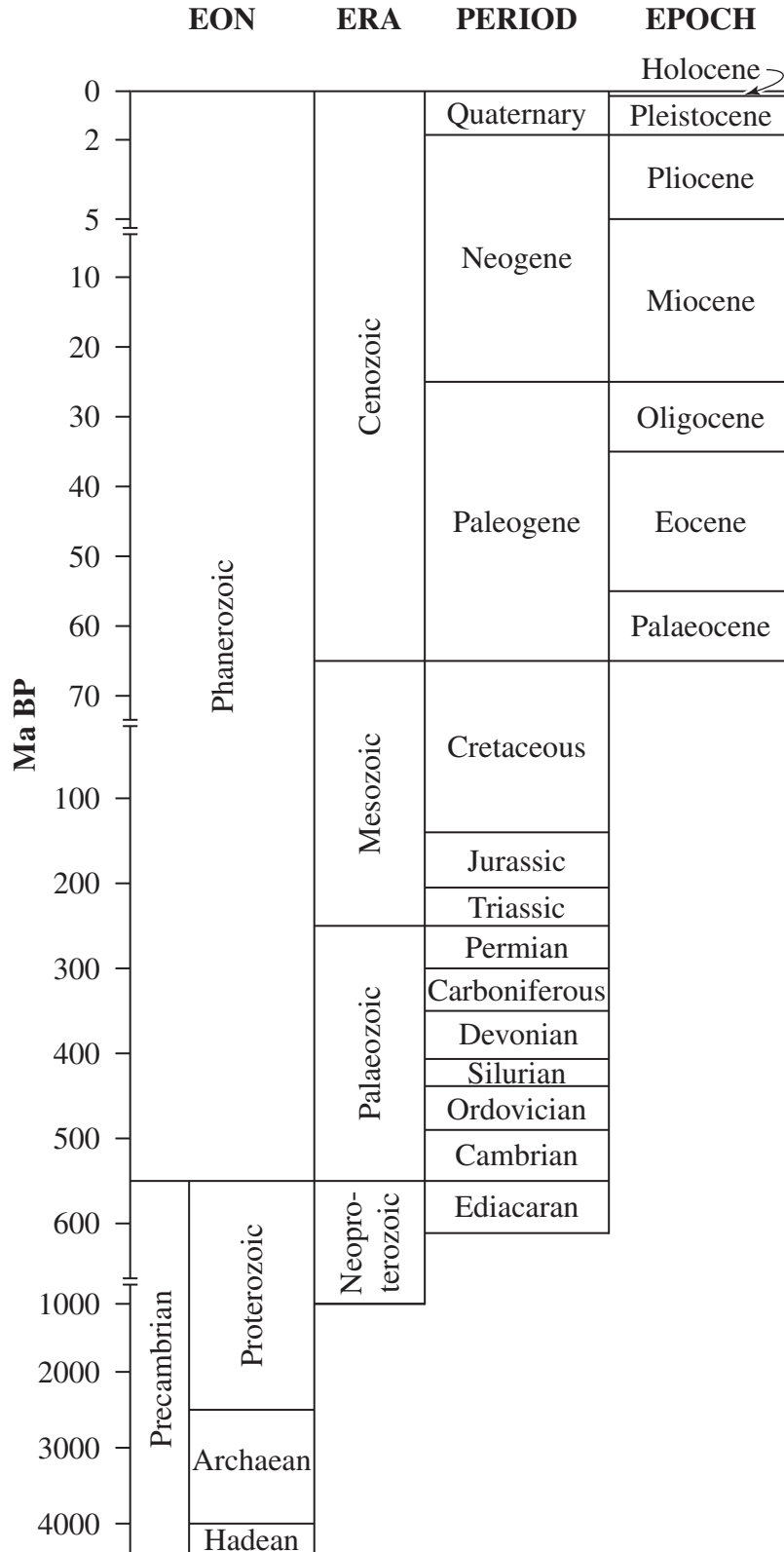
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End of Question 25

Earth and Environmental Science

Geological Time Scale



HSC Earth and Environmental Science Sample Questions Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	A
2	B
3	C
4	D

Section II

Question 21 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides relevant examples Uses the examples to describe human activities that have negatively affected the sustainability of Australian resources 	3
<ul style="list-style-type: none"> Provides relevant examples and shows some link between the examples and sustainability <p>OR</p> <ul style="list-style-type: none"> Uses an example to describe human activities that have negatively affected sustainability 	2
<ul style="list-style-type: none"> Identifies a negative effect of human activities on sustainability 	1

Sample answer:

Humans have over-logged old-growth forests. This has resulted in the destruction of animal and plant habitats as not enough trees remain to permit seed germination and regrowth.

Manufacturing activities, such as metal smelters, have released waste products including toxic elements into waterways, causing the death of fish populations. The fish cannot breed and the population is not sustainable.

Question 21 (b)

Criteria	Marks
<ul style="list-style-type: none"> • Explains why Aboriginal and Torres Strait Islander Peoples can be described as sustainable resource managers 	4
<ul style="list-style-type: none"> • Outlines activities practised by Aboriginal and Torres Strait Islander Peoples that contribute to sustainable resource management 	3
<ul style="list-style-type: none"> • Identifies activities practised by Aboriginal and Torres Strait Islander Peoples that are related to sustainable resource management <p>OR</p> <ul style="list-style-type: none"> • Outlines an activity practised by Aboriginal and/or Torres Strait Islander Peoples that is related to sustainable resource management 	2
<ul style="list-style-type: none"> • Provides some relevant information about Aboriginal and/or Torres Strait Islander Peoples' culture 	1

Sample answer:

Aboriginal and Torres Strait Islander Peoples' culture has a deeply symbolic and emotional connection to 'Country and Place' and this underpins life activities. Food gathering relates to the seasons, with specific times for hunting, fishing and harvesting, especially for Torres Strait Islanders. The people move from area to area, maintaining sustainability, so no area is over-utilised. They have, more recently, used items that have been washed up on particular islands and repurposed them, eg ghost netting to create art works.

In addition, fire is used to maintain areas of burnt land and regrowth, particularly in Aboriginal cultures. The philosophy behind the fires ensures they can plan and predict areas where animals will graze on grasslands, and areas with edible plants and fresh drinking water can be sustained, ensuring that there is always a supply of food.

Question 22

Criteria	Marks
• Correctly completes the table to show causes and physical impacts	3
• Provides some causes and/or physical impacts	2
• Provides some relevant information	1

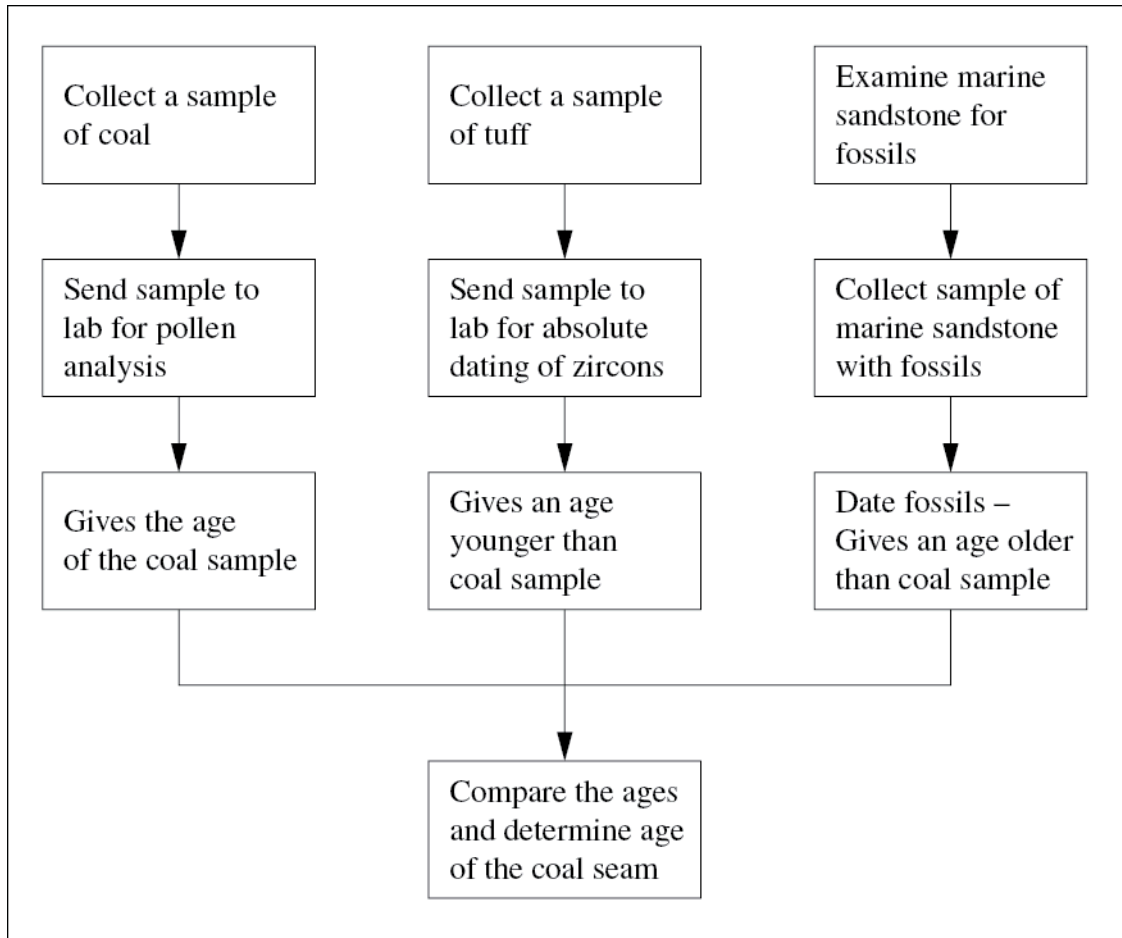
Sample answer:

<i>Climatic phenomenon</i>	<i>Cause of phenomenon</i>	<i>Physical impact on Australian ecosystems</i>
East coast low	Low-pressure trough intensifies due to favourable upper atmospheric condition	Large waves erode beaches on the east coast of Australia
Drought	A long period of below-average rainfall	Rivers dry out, resulting in non-typical migration of waterbirds
Bushfire	Lightning strike ignites dry vegetation	Loss of habitat for native fauna such as koalas

Question 23

Criteria	Marks
• Uses a logical and comprehensive flow chart to show the steps for dating the coal seam	4
• Provides a flow chart that shows the main steps for dating the coal seam	3
• Identifies some steps for dating the coal seam	2
• Provides some relevant information	1

Sample answer:



Question 24

Criteria	Marks
<ul style="list-style-type: none"> • Identifies the correct stage • Shows knowledge of atmospheric oxygen and banded iron formations • Relates the presence of oxygen to banded iron formations • Refers to the diagram 	4
<ul style="list-style-type: none"> • Identifies the correct stage • Shows some knowledge of atmospheric oxygen and banded iron formations • Refers to the diagram 	3
<ul style="list-style-type: none"> • Shows some knowledge of atmospheric oxygen and/or banded iron formations 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

Stage 2

Oxygen started to accumulate in the atmosphere in Stage 2. Before this, cyanobacteria in the oceans were producing oxygen but most of it was used in chemical reactions, eg combining with iron salts dissolved in the water, to form insoluble iron oxides. These insoluble salts were laid down and formed the banded iron formations.

Once the available iron salts had reacted to form sediments, the oxygen that the cyanobacteria produced remained dissolved in the oceans until the concentration of oxygen became too great and the excess oxygen was released into the atmosphere.

The first occurrence of oxygen in the atmosphere indicates the end of the deposition of the banded iron formations.

Question 25

Criteria	Marks
<ul style="list-style-type: none"> • Shows a thorough knowledge and understanding of both natural processes and anthropogenic activities in Australia • Relates these processes and activities to their effects on the Australian environment • Draws out and relates implications of these effects 	7
<ul style="list-style-type: none"> • Shows a sound knowledge and understanding of both natural processes and anthropogenic activities in Australia • Relates these processes and activities to their effects on the Australian environment 	6
<ul style="list-style-type: none"> • Shows some knowledge and/or understanding of natural processes and/or anthropogenic activities in Australia • Links some of these processes and/or activities to their effects on the Australian environment 	4–5
<ul style="list-style-type: none"> • Outlines some features of natural processes and/or anthropogenic activities 	2–3
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

The Australian environment is the product of both anthropogenic activities and natural processes.

The impacts of natural processes can be either negative or positive. For example, the earthquake that occurred in Newcastle in 1989 caused damage to infrastructure although it was short lived. Bushfires destroy native vegetation and floods remove soil – all negative. On the other hand, regeneration after bushfires allows younger and healthier plants to grow and deposition of sediment on flood plains increases fertility – both positive effects.

Many anthropogenic activities have, in the main, a negative impact on the environment. Overgrazing, poor land management practices and deforestation have immediate effects on the environment. There is a loss of habitat for native fauna and flora, which rapidly decrease in numbers and can become extinct. In addition, these activities have promoted erosion, increased salinity and higher sediment input to the oceans with serious negative impact on features such as the Great Barrier Reef. One of the greatest negative impacts on the environment has been the combustion of fossil fuels. This has produced greenhouse gases that have resulted in global climate change, which has flow-on effects such as acidification of the oceans and more extreme weather conditions. These have a far-reaching impact on the biotic and abiotic features of the environment. The negative impacts of anthropogenic activities on the environment will affect our future unless different strategies are introduced.

Question 26

Criteria	Marks
<ul style="list-style-type: none"> Shows a comprehensive knowledge and understanding of both the short-term impact and longer-term impact on the biosphere and atmosphere Clearly shows how the short-term impact and longer-term impact are different 	9
<ul style="list-style-type: none"> Shows a sound knowledge and understanding of both the short-term impact and longer-term impact on the biosphere and/or atmosphere Provides some indication of how the short-term impact and longer-term impact are different 	7–8
<ul style="list-style-type: none"> Outlines some short-term impact and some longer-term impact of the volcanic eruption on the biosphere and/or atmosphere 	5–6
<ul style="list-style-type: none"> Outlines some short-term and/or longer-term impact of the volcanic eruption on the biosphere and/or atmosphere 	3–4
<ul style="list-style-type: none"> Provides some relevant information about the volcanic eruption 	1–2

Sample answer:

Name of volcanic eruption: Mount St Helens

The short-term impact of the eruption was very destructive. The eruption released millions of tonnes of ash and other materials into the atmosphere. The flows of superheated gas and rock debris killed an enormous number of living things in a huge area around the volcano. 57 people died (mainly of asphyxiation), hundreds of square kilometres of forest were destroyed, thousands of large game animals and millions of fish, birds and insects were killed within the first few hours of the eruption.

The initial landslide caused the north side of the volcano to collapse. As soon as this collapse happened the release of pressure over the magma chamber resulted in a plume of ash rising nearly 20 km into the sky. This plume of ash travelled throughout the immediate area and resulted in complete darkness up to 250 km away from the volcano.

The ash and fine particles remained suspended in the atmosphere and eventually rained down on surviving trees. The ash settled on leaves and reflected much of the light, which reduced the amount of photosynthesis, often resulting in trees and smaller plants dying months after the eruption.

The increased amount of volcanic ash in the atmosphere also reduced light absorption and atmospheric temperatures for several months.

In contrast, the longer-term impact was far more positive. The deposition of vast areas of volcanic ash, while initially blocking rivers, causing flooding and destruction of crops and livestock, has resulted in an increase in the fertility of the soil.

Many animal and plant species have been able to recolonise areas that were destroyed. Since they have not had their usual predators, they have repopulated, are healthy and are reproducing. For example, lupins, which can grow in nitrogen-low soils, have been a very successful recoloniser.

A number of smaller animals – particularly those that burrow – survived the eruption. They have also flourished due to the lack of larger predators.

The rock debris and fine plumes of ash that initially caused much of the devastation have actually enabled the recovery of the ecosystem, and there is no significant longer-term impact on the atmosphere.

HSC Earth and Environmental Science Sample Questions Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
1	1	Mod 8 Using Australia's Natural Resources	EES11/12-6, EES12-15	2-3
2	1	Mod 5 Changes in the Geosphere, Atmosphere and Hydrosphere	EES12-12	3-4
3	1	Mod 6 Impact of Natural Disasters on the Biosphere	EES12-13, EES12-14, EES11/12-6	4-5
4	1	Mod 7 Natural Processes of Variations in Climate	EES12-14, EES11/12-5	5-6

Section II

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
21 (a)	3	Mod 8 Using Australia's Natural Resources Mod 8 Sustainability	EES12-15	2-4
21 (b)	4	Mod 8 Sustainability	EES12-15	2-5
22	3	Mod 6 Impact of Natural Disasters on the Biosphere	EES12-13, EES11/12-7	2-4
23	4	Mod 5 Fossil Formation and Stratigraphy	EES11/12-2, EES11/12-6, EES11/12-7, EES12-12	2-5
24	4	Mod 5 Changes in the Geosphere, Atmosphere and Hydrosphere	EES12-12, EES11/12-4, EES11/12-5, EES11/12-6	2-5
25	7	Mod 6 Hazards Mod 7 Climate Science Mod 8 Resource Management	EES11-11, EES12-13, EES12-14, EES12-15, EES11/12-4, EES11/12-5, EES11/12-7	2-6
26	9	Mod 6 Impact of Natural Disasters on the Biosphere	EES11/12-3, EES11/12-6, EES12-13	2-6