

BOARD OF STUDIES
NEW SOUTH WALES

2008

HIGHER SCHOOL CERTIFICATE
EXAMINATION

Earth and Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A Geological Time Scale is provided at the back of this paper
- Write your Centre Number and Student Number at the top of pages 9, 13, and 17

Total marks – 100

Section I Pages 2–20

75 marks

This section has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1–15
- Allow about 30 minutes for this part

Part B – 60 marks

- Attempt Questions 16–27
- Allow about 1 hour and 45 minutes for this part

Section II Pages 21–27

25 marks

- Attempt ONE question from Questions 28–31
- Allow about 45 minutes for this section

Section I
75 marks

Part A – 15 marks

Attempt Questions 1–15

Allow about 30 minutes for this part

Use the multiple-choice answer sheet for Questions 1–15.

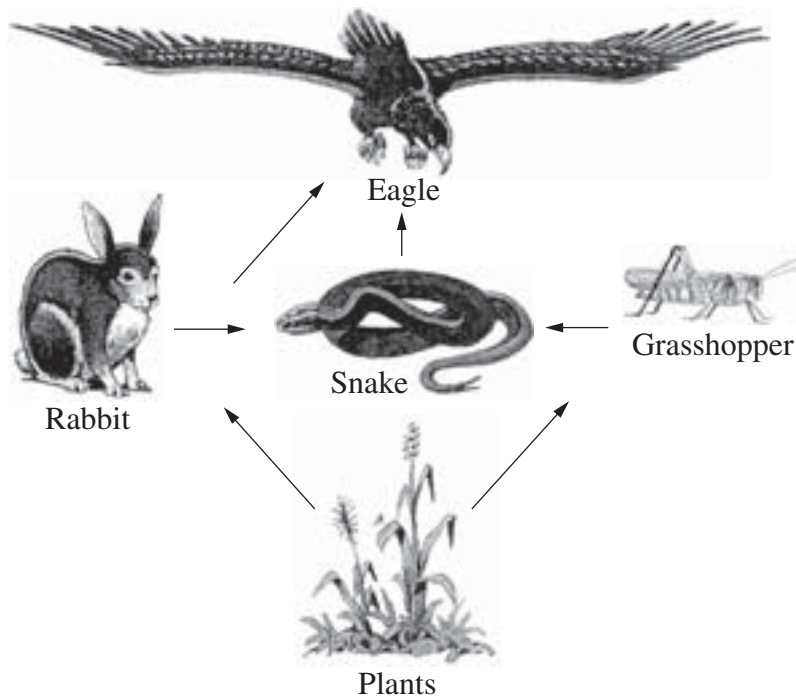
1 The table gives data for an Australian stream catchment.

Awaiting copyright

Which of the following statements describes the changes from 1998 to 2006?

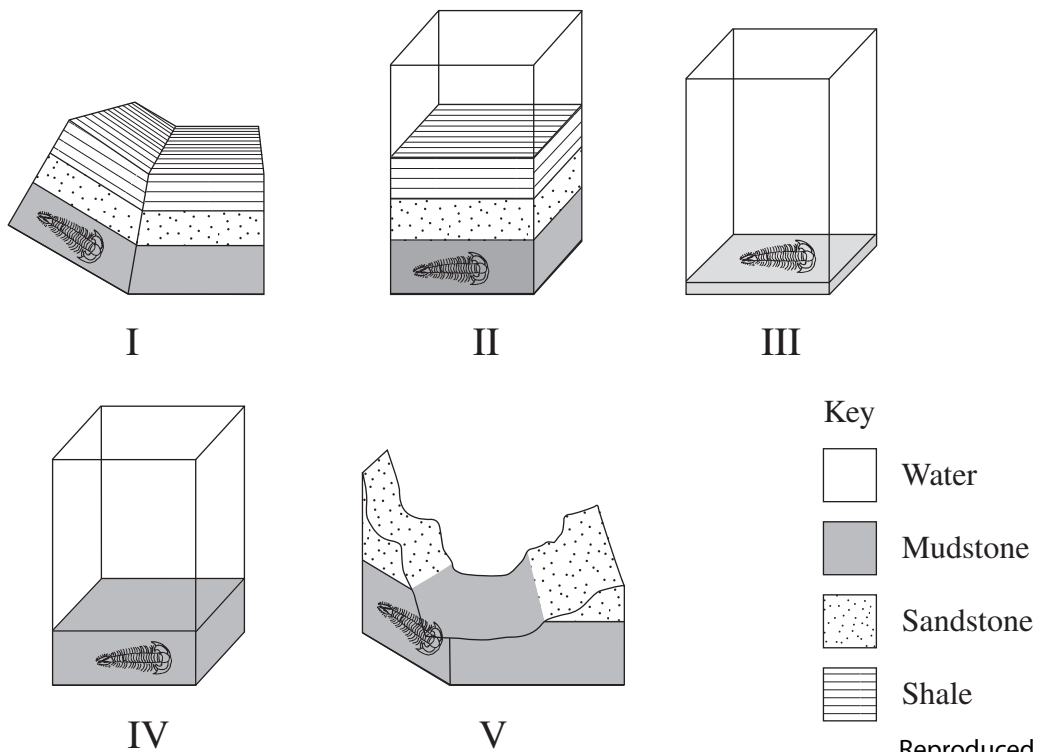
- (A) The number of plant species per 100 m² increased.
 - (B) The number of invertebrate species per 100 m² increased.
 - (C) Both the number of plant and invertebrate species per 100 m² decreased.
 - (D) The number of plant species per 100 m² decreased but the number of invertebrate species per 100 m² increased.
- 2** Which of the following is a consequence of soil compaction?
- (A) Increased soil salinity
 - (B) Decreased soil fertility
 - (C) Increased weathering of rocks
 - (D) Decreased absorption of water
- 3** Which pair of gases may contribute to the formation of acid rain?
- (A) Methane and ozone
 - (B) Oxygen and nitrous oxide
 - (C) Methane and sulfur dioxide
 - (D) Carbon dioxide and sulfur dioxide

- 4 In which organism in the food web shown would biomagnification be greatest?



- (A) Eagle
(B) Grasshopper
(C) Plants
(D) Rabbit
- 5 Which of the following is the most likely consequence of the continuing release of CFCs into the atmosphere?
- (A) Global warming will decrease.
(B) The upper atmosphere will disappear.
(C) Sunlight intensity at the Earth's surface will decrease.
(D) Ultraviolet radiation reaching the Earth's surface will increase.
- 6 On what basis has the geological time scale been divided into eons?
- (A) Types of rocks
(B) Thickness of rock strata
(C) Fossil evidence in rock layers
(D) Radio-isotopes in the different rock strata

7 The diagrams represent events that take place during the formation of a fossil.



Reproduced with the kind permission of Doug Mann, http://www.fossils-facts-and-finds.com/fossil_formation.html

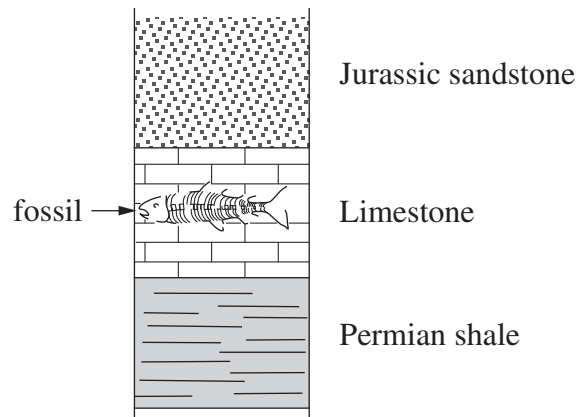
What is the correct order of events for the formation of a fossil?

- (A) III, IV, II, I, V
- (B) III, IV, V, II, I
- (C) IV, I, II, V, III
- (D) IV, III, I, II, V

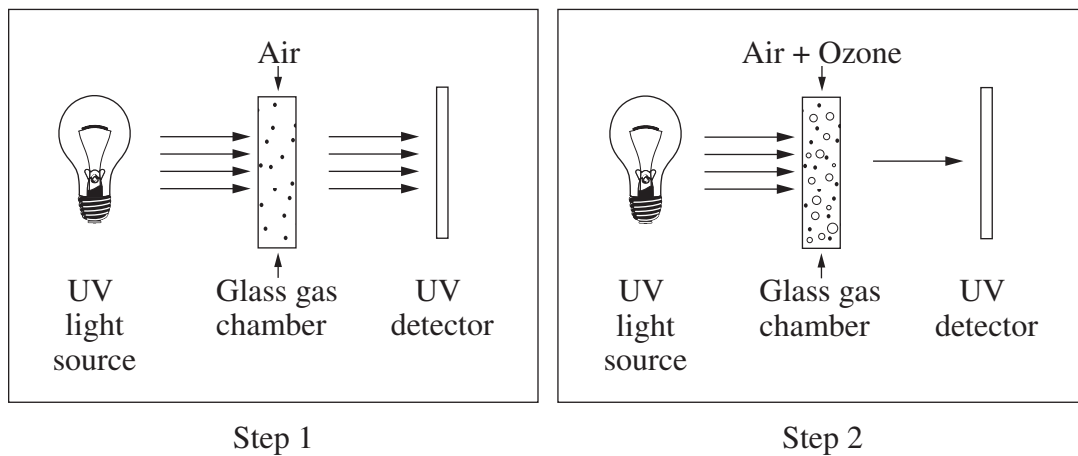
8 Why was the development of hardened body parts an advantage during the ‘Cambrian event’?

- (A) The Ediacaran fauna were able to flourish.
- (B) Organisms were able to live in cooler environments.
- (C) Animals were able to grow larger than they would have otherwise.
- (D) Organisms were able to survive increasing oxygen concentrations.

- 9 What is the likely age of the fossil shown in the stratigraphic sequence?



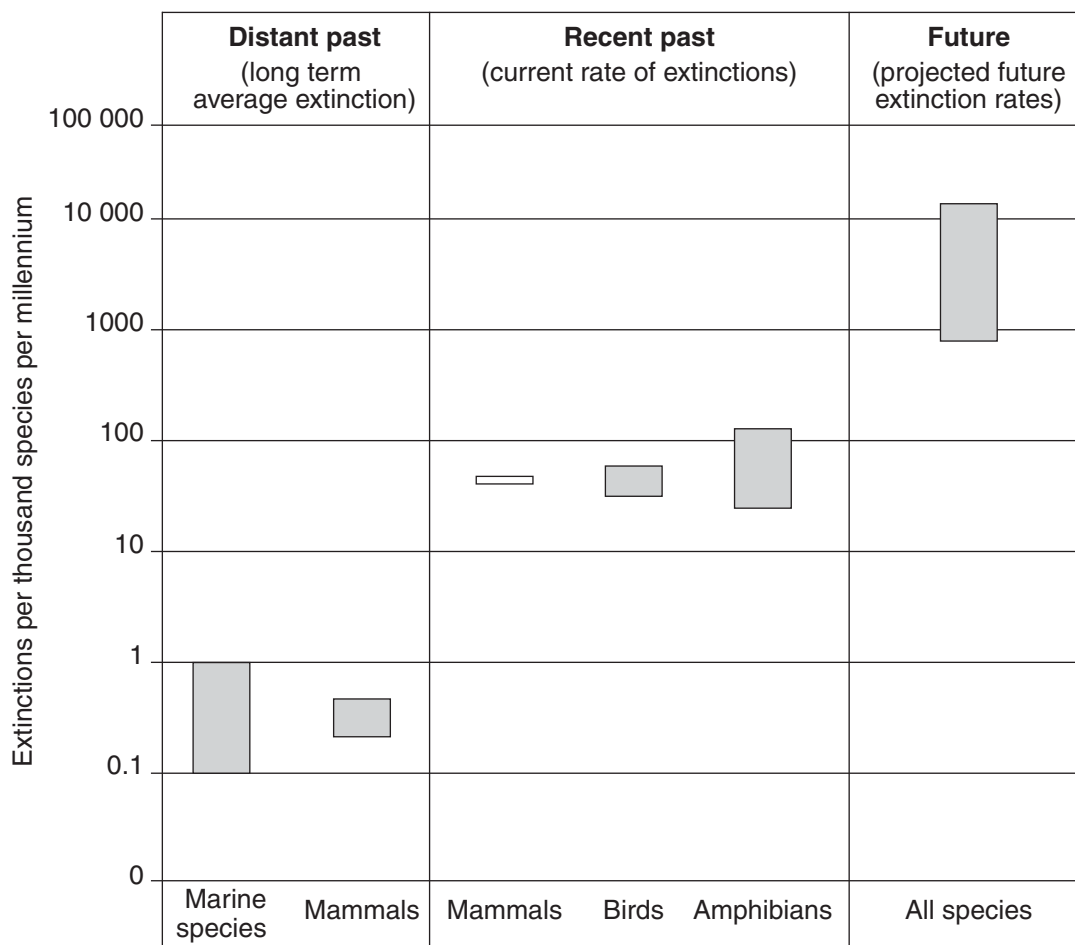
- (A) 100 Ma
(B) 230 Ma
(C) 390 Ma
(D) 400 Ma
- 10 The effect of ozone in filtering ultraviolet light was investigated.



What would the detection of UV light be classified as in the above investigation?

- (A) The controlled variable
(B) The dependent variable
(C) The independent variable
(D) The experimental variable

11 The graph gives information on the extinction rates of species.



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Which of the following statements is the best inference that can be drawn from this graph?

- (A) There will be an increased rate of species extinction in the future.
- (B) Human activities have contributed to increased extinctions in the recent past.
- (C) Fewer mammals have become extinct in the recent past compared to the distant past.
- (D) The current extinction rate is one thousand times higher than the long term average extinction.

- 12** What is the best explanation for the origin of the Tonga-Kermadec deep sea trench in the Pacific Ocean?

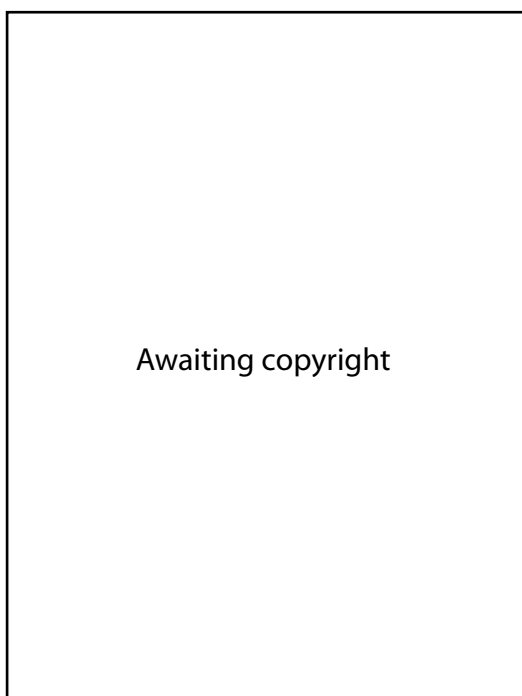


- (A) Convergence of two lithospheric plates
 - (B) North-south movement along a transform fault
 - (C) Divergence of a lithospheric plate from the Pacific Plate
 - (D) Subduction of the Pacific Plate below a lithospheric plate
- 13** A super volcano erupts ejecting material up to 50 km into the atmosphere.
- Which of the following results of the eruption would cause the greatest effect on global climate?
- (A) Acid rain
 - (B) Tsunamis
 - (C) Lava flows
 - (D) Fine ash particles

- 14 During the Palaeozoic Era a series of andesitic volcanic island arcs, trending north-south, existed in what is now central NSW.

Which tectonic setting best accounts for these island arcs?

- (A) The collision of two continental plates
 - (B) A large transform fault with north-south motion
 - (C) The east-west collision of Australia with an oceanic plate
 - (D) An emergent mid-oceanic ridge with an ocean to the east of Australia
- 15 The diagram shows a cross-section of part of the Earth's crust.



In which setting would this section be found?

- (A) Sea floor
- (B) Mid-ocean ridge
- (C) Continental interior
- (D) Fold mountain region

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Earth and Environmental Science

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Centre Number

Section I (continued)

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Student Number

Part B – 60 marks

Attempt Questions 16–27

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 16 (4 marks)

The diagram shows a section through the Earth.



- (a) In which of the zones (*A*, *B* or *C*) is new crust being formed? **1**

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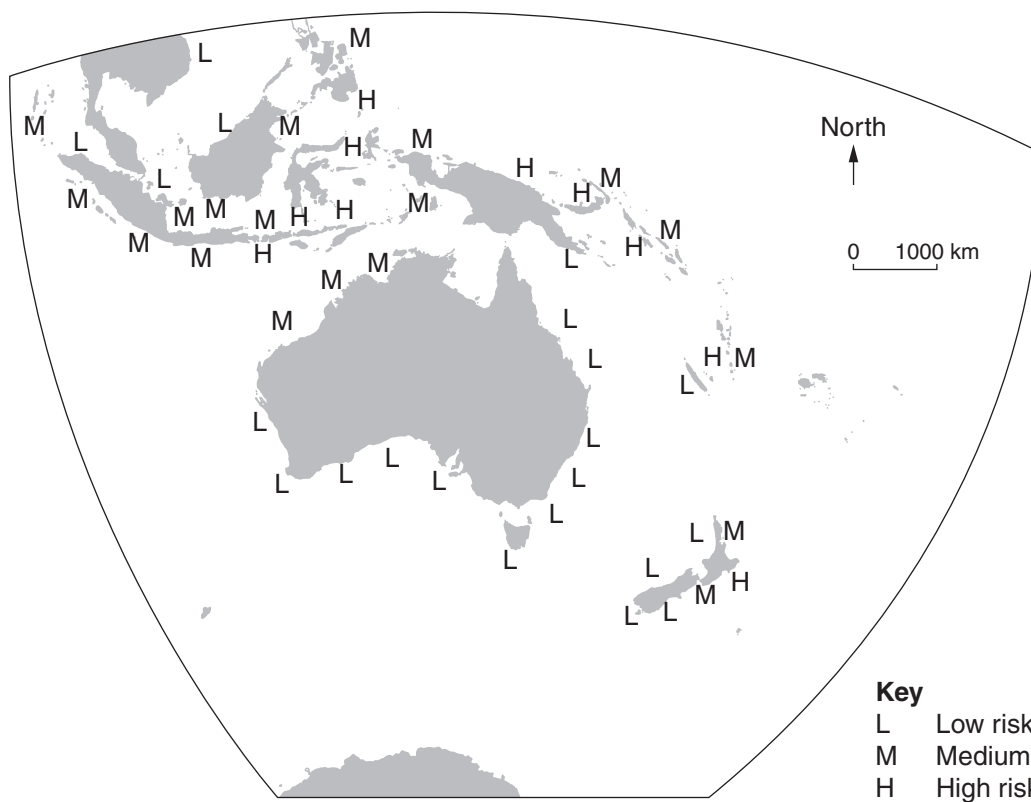
- (b) Describe possible mechanisms for the movement of lithospheric plates such as those shown in the diagram. **3**

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Question 17 (4 marks)

The diagram shows the tsunami risk for the Australian–Indonesian region.

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Explain why there is a medium tsunami risk along the north-western margin of Australia and a low tsunami risk along the southern margin of Australia.

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Question 18 (3 marks)

Complete the table to contrast the characteristics of divergent and convergent plate boundaries.

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	Divergent plate boundary	Convergent plate boundary
Common rock type		
Typical geological structure		
Type of volcanic activity		

Question 19 (4 marks)

Distinguish between short-term and long-term effects of a large explosive volcanic eruption.

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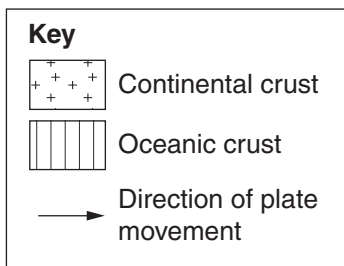
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Question 20 (6 marks)

Using the key provided construct a sequence of labelled diagrams to describe the plate tectonic supercycle.

6



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Centre Number

Section I – Part B (continued)

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Student Number

Marks

Question 21 (4 marks)

- (a) Identify TWO adaptations that allowed plants to colonise terrestrial environments. **2**

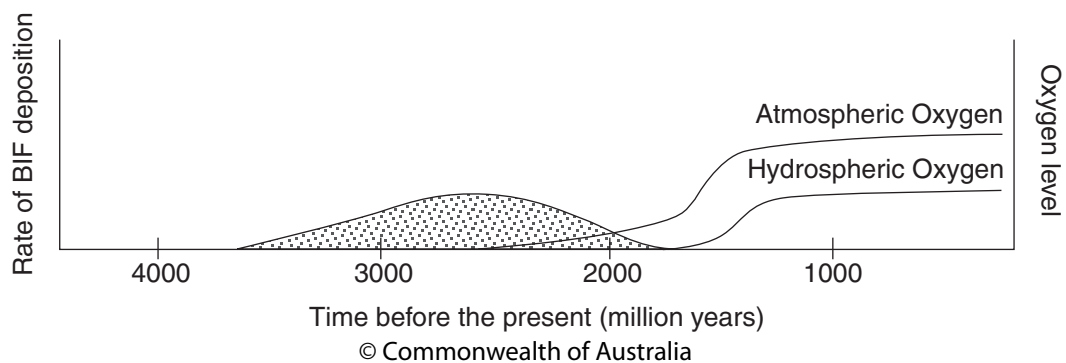
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- (b) Explain how ONE of these adaptations enabled plants to survive terrestrial environments. **2**

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Question 22 (6 marks)

The graph shows the level of atmospheric oxygen, hydrospheric oxygen (oxygen level in water) and deposition of Banded Iron Formations (BIFs) over time.



- (a) Define the term *Banded Iron Formation*. **1**

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- (b) Identify the trends in oxygen levels in the graph. **2**

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- (c) Explain the relationship between the occurrence of simple photosynthetic organisms and BIFs. **3**

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Question 23 (4 marks)

(a) According to stable isotope evidence, when did life first appear on Earth? **1**

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(b) Describe how stable isotopes can provide evidence for the first presence of life. **3**

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Please turn over

Question 24 (6 marks)

Analyse TWO different hypotheses used to explain the extinction of the Australian megafauna.

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Centre Number

Section I – Part B (continued)

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Student Number

Marks

Question 25 (5 marks)

- (a) Outline a strategy to rehabilitate a salt-affected area. **2**

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- (b) Explain the scientific principles behind this strategy. **3**

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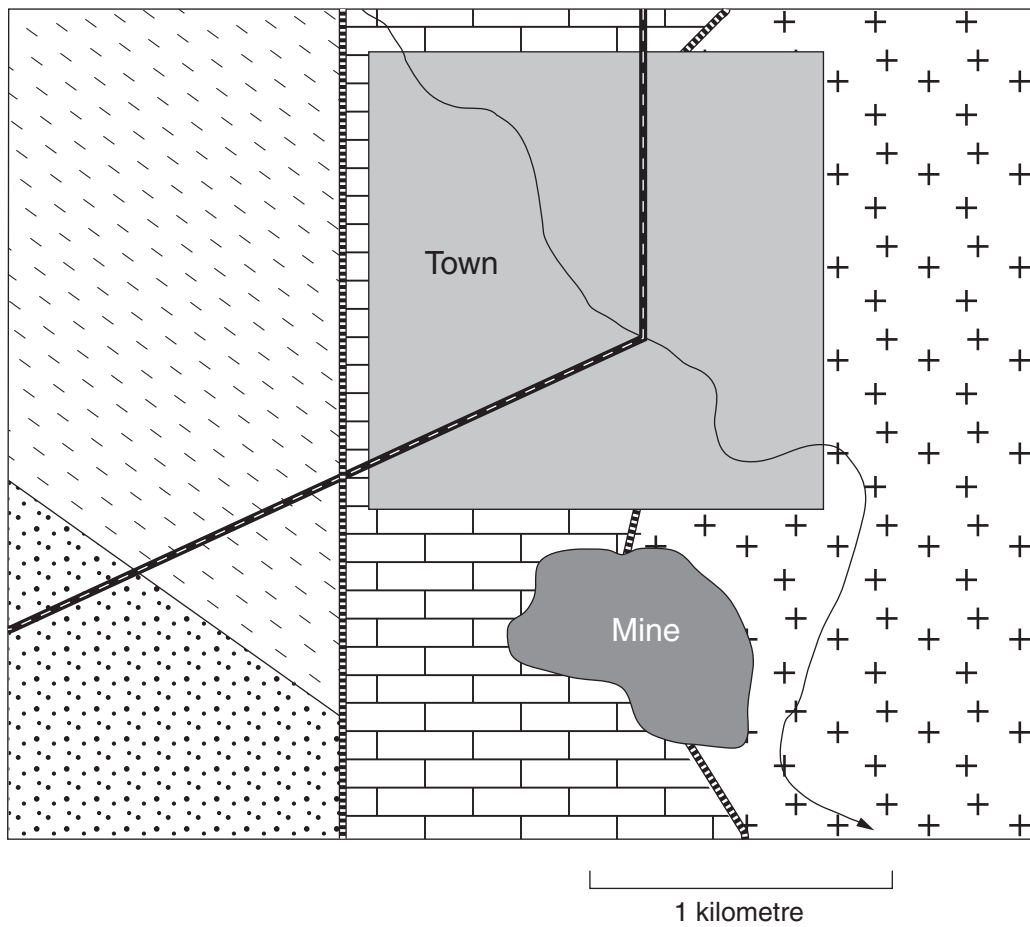
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Question 26 (7 marks)

The geological map shows the location of a town and an open pit gold and copper mine.



Key

 River

 Fault

 Highway



Granite with many vertical fractures



Porous sandstone



Impermeable, horizontally bedded shale



Limestone with numerous underground caves

Question 26 continues on page 19

Question 26 (continued)

(a) (i) On the map on page 18, mark with an X the best locality for a waste disposal site. **1**

(ii) Justify your choice of the site selected. **2**

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(b) The town council asked an environmental scientist to determine whether the mine could be used as a waste disposal site when mining ceases.

Why should the environmental scientist recommend against this proposed use? **4**

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End of Question 26

Question 27 (7 marks)

Analyse the geological and environmental factors that contribute to the fragile nature of the Australian continent.

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Section II

25 marks

Attempt ONE question from Questions 28–31

Allow about 45 minutes for this section

Answer the question in a writing booklet. Extra writing booklets are available.

	Pages
Question 28 Introduced Species and the Australian Environment	22
Question 29 Organic Geology – a Non-renewable Resource	23–24
Question 30 Mining and the Australian Environment	25–26
Question 31 Oceanography	27

Question 28 — Introduced Species and the Australian Environment (25 marks)

- | | | | |
|-----|-------|---|---|
| (a) | (i) | Define the term <i>introduced species</i> . | 1 |
| | (ii) | What is the role of modern quarantine organisations? | 1 |
| | (iii) | Identify ONE Australian quarantine practice. | 1 |
| | (iv) | Outline ONE way an organism has been accidentally brought into Australia. | 1 |
| | (v) | Suggest ONE reason why an organism could be deliberately brought into Australia. | 1 |
| (b) | | Explain the conditions that allowed a named introduced animal to become a pest in Australia. | 3 |
| (c) | | Construct a flow diagram showing the history of Prickly Pear from its introduction to its successful control. | 4 |
| (d) | (i) | Identify TWO abiotic components of an environment that may have been affected by introduced species. | 1 |
| | (ii) | Describe an appropriate procedure to determine how one of the abiotic factors has been affected by an introduced species. | 3 |
| | (iii) | How could you assess the reliability of data obtained? | 2 |
| (e) | | Analyse the impacts that a named introduced animal has had on the Australian environment. | 7 |

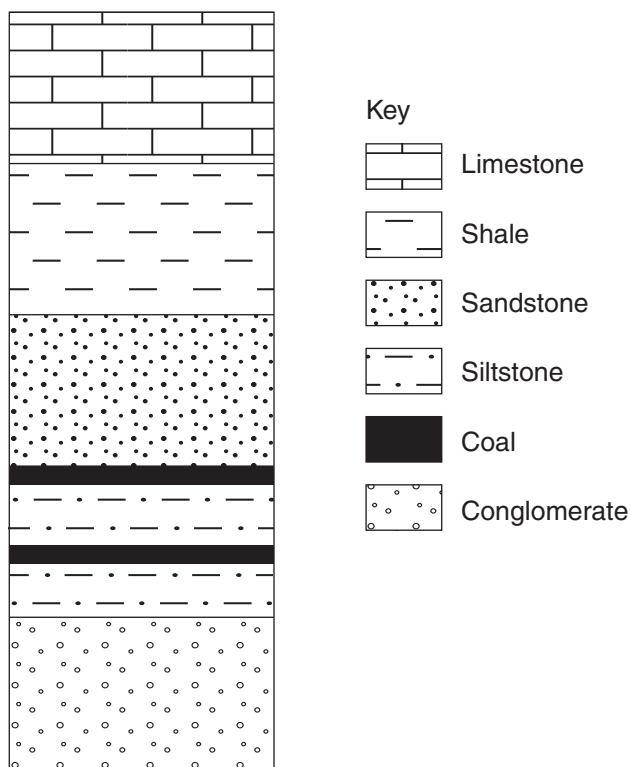
End of Question 28

		Marks
Question 29 — Organic Geology – a Non-renewable Resource (25 marks)		
(a)	(i) Identify ONE petroleum producing area.	1
	(ii) Name ONE component of coal that increases as rank increases.	1
	(iii) Define the term <i>fossil fuel</i> .	1
	(iv) What is meant by the term <i>non-renewable</i> ?	1
	(v) Give ONE condition that is common to the formation of both coal and petroleum.	1
(b)	Compare TWO exploration methods used to locate coal and oil.	3

Question 29 continues on page 24

Question 29 (continued)

- (c) Using information in the stratigraphic column shown, construct in your writing booklet a fully labelled geological cross-section showing a structure where oil, gas and water would accumulate. 4



- (d) (i) Identify TWO products generated by complete combustion of a fossil fuel. 1
- (ii) Describe an appropriate procedure to distinguish between the products of incomplete and complete combustion of a fossil fuel. 3
- (iii) How could you assess the reliability of data obtained? 2
- (e) Analyse the effects of replacing electricity generated by fossil fuels with electricity generated from alternative sources. 7

End of Question 29

Question 30 — Mining and the Australian Environment (25 marks)

- (a) (i) What is an *ore*? 1
 - (ii) Name ONE locality in an Australian island arc terrane where precious metals are produced. 1
 - (iii) Identify ONE landmark government decision that has had an impact on mining operations in Australia. 1
 - (iv) What is meant by the term *grade of ore*? 1
 - (v) Define the term *renewable resource*. 1
- (b) Explain how a common gangue mineral might become an ore mineral in the future. 3
- (c) The photographs show two stages in the life of a mine.



Stage A



Stage B

- Construct a flow diagram in your writing booklet showing the steps involved in getting from Stage A to Stage B. 4

Question 30 continues on page 26

Question 30 (continued)		Marks
(d)	(i) Identify TWO techniques that can be used to distinguish between waste rock and ore.	1
	(ii) Describe an appropriate procedure to test for an ore or metal in a rock.	3
	(iii) How could you assess the reliability of data obtained?	2
(e)	Analyse the impacts of government policies on Australian mining operations.	7

End of Question 30

Question 31 — Oceanography (25 marks)

- (a) (i) Name ONE type of mass motion of water in the oceans. **1**
- (ii) What proportion of the Earth is covered by oceans? **1**
- (iii) Name ONE natural substance that scavenges elements from the oceans' rocks. **1**
- (iv) Name ONE potential mineral resource formed on the ocean floor. **1**
- (v) Define the term *community of organisms*. **1**
- (b) Explain the distribution of calcareous and siliceous oozes in the oceans. **3**
- (c) Construct a table in your writing booklet to compare a food chain in the top layers of the ocean with a food chain found near a hydrothermal vent. **4**
- (d) (i) Identify TWO factors that affect the cooling rate of solids in water. **1**
- (ii) Describe an appropriate procedure to assess one of the factors that affects the cooling rate of a solid in water. **3**
- (iii) How could you assess the reliability of data obtained? **2**
- (e) Analyse the impacts that new technologies have on our understanding of ocean environments. **7**

End of paper

Geological Time Scale

