BOARD OF STUDIES
NEW SOUTH WALES

2005

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, 17 and 33

Total marks – 100

Section I Pages 2–19

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 16–26
- Allow about 1 hour and 45 minutes for this part

Section II Pages 21–29

25 marks

- Attempt ONE question from Questions 27–30
- 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.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

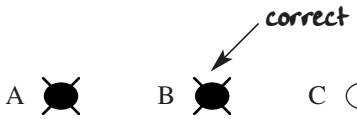
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



A ⊗ B ⊗ C ○ D ○

1 Which of the following best explains why there are few earthquakes in Australia?

(A) Its tectonic setting leads to volcanic activity but not to seismic activity.

(B) Earthquakes occur only at depth and are not felt at the surface.

(C) The continent is in an intra-plate environment.

(D) The continent is only subjected to subduction.

2 Which of the following best explains why island arcs such as Indonesia and the Philippines have similar rock types?

(A) Both locations are ancient continental crustal areas.

(B) Oceanic crust is the source of the rocks in both locations.

(C) The weathering of rocks in both locations is very similar.

(D) Volcanoes in both locations produce mainly basaltic lava.

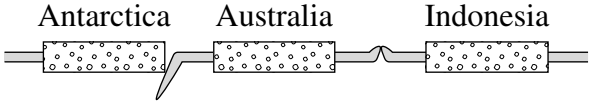
3 Which row in the table correctly relates plate boundary types to tectonic activities?

	Plate boundary with volcanic eruptions but NOT major destructive earthquakes	*Plate boundary with volcanic eruptions AND major destructive earthquakes*
(A)	Continent–continent convergent	Ocean–ocean divergent
(B)	Continent–continent convergent	Ocean–continent convergent
(C)	Ocean–ocean divergent	Ocean–continent convergent
(D)	Ocean–continent convergent	Continent–continent convergent

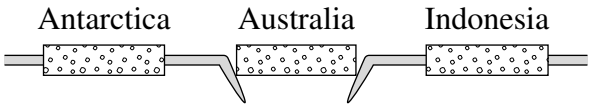
4 Which of the following diagrams represents the tectonic setting of the Australian continent?

(A)

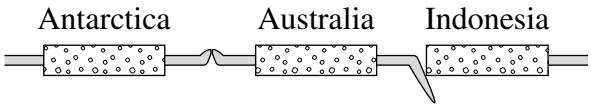
(B)

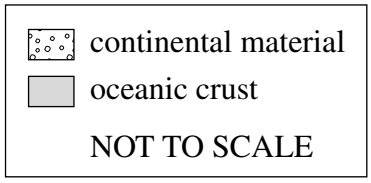


(C)



(D)





5 Which of the following pairs of technologies is used to measure crustal movements at collision boundaries?

(A) Creep meter, tiltmeter

(B) Geiger counter, seismometer

(C) Magnetometer, Richtermeter

(D) Radon-gas counter, tectometer

6 Which of the following statements about cyanobacteria is true?

(A) Cyanobacteria are heterotrophic organisms.

(B) Cyanobacteria are simple photosynthetic organisms.

(C) Cyanobacteria are known only from the fossil record.

(D) Cyanobacteria represent an evolutionary advance on green algae.

7 Which of the following places the first appearance of organisms in correct order from oldest to youngest?

(A) Reptiles, fish, birds, mammals

(B) Fish, mammals, birds, reptiles

(C) Fish, amphibians, reptiles, birds

(D) Reptiles, fish, amphibians, birds

8 Why was the formation of the ozone layer important to the evolution of life on Earth?

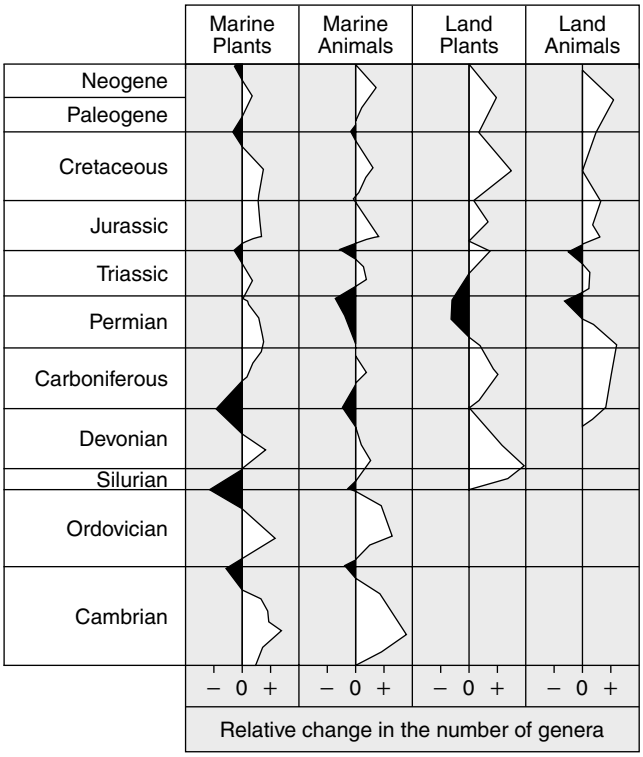
(A) Ozone filters visible light.

(B) Ozone filters ultraviolet radiation.

(C) Ozone allows the build-up of ultraviolet radiation.

(D) Ozone allows the build-up of long-wave radiation.

9 The diagram shows the main divisions within the geological time scale and the relative change in the number of genera.



Which of the following statements is best supported by the information in the diagram?

(A) The division boundaries correspond to major extinction events.

(B) The increase of land plant genera corresponds with the extinction of marine plant genera.

(C) Relative changes in the number of marine plant genera have increased over geological time.

(D) There is poor correlation between extinctions and increases in marine plants versus that in marine animals.

10 What are three essential requirements for fossil formation?

(A) Bacteria, slow burial, water

(B) Limited decay, quick burial, water

(C) Limited decay, remaining undisturbed, water

(D) Limited decay, quick burial, remaining undisturbed

11 Which of the following lists contains only greenhouse gases?

(A) Carbon dioxide, chlorofluorocarbons, hydrogen

(B) Carbon dioxide, carbon monoxide, nitrogen

(C) Carbon dioxide, methane, water vapour

(D) Methane, nitrogen, nitrous oxide

12 Which of the following is a consequence of increased SO_2 in our atmosphere?

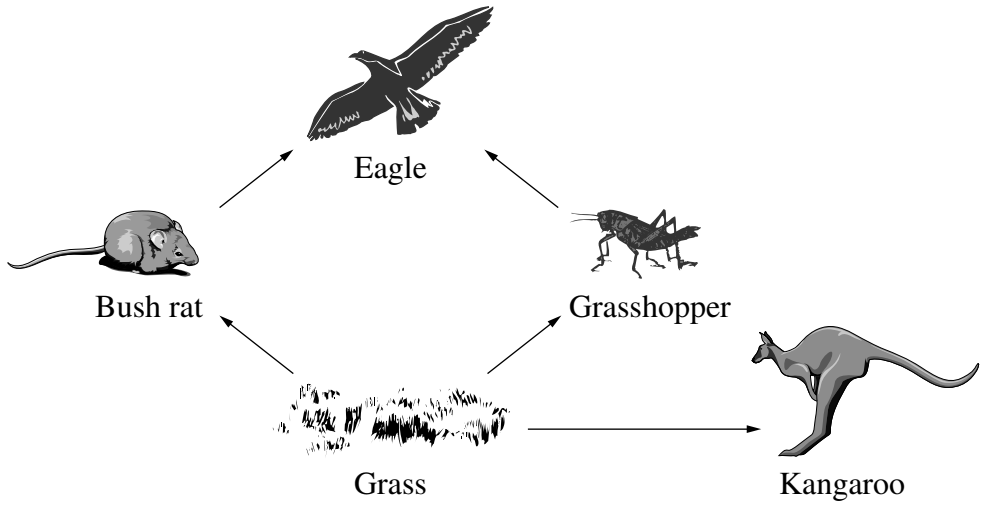
(A) Acid rain

(B) Global warming

(C) Ozone depletion

(D) Photochemical smog

13 The diagram represents some feeding relationships in an Australian ecosystem.



If a non-biodegradable pesticide were widely used in such an ecosystem, where would you expect the greatest residual levels to be found?

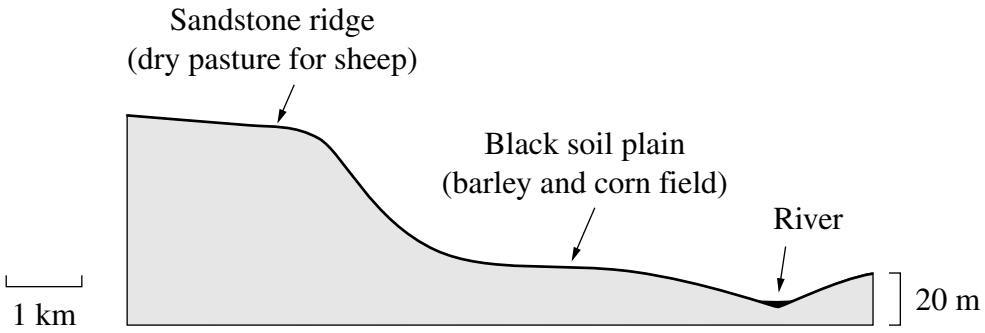
(A) Bush rats

(B) Eagles

(C) Grasses

(D) Kangaroos

14 A farmer experienced reduced yields in his barley and corn field, because of salinity.



Farm profile

Why would the Rural Land Protection Board suggest planting eucalypt trees on the sandstone ridge?

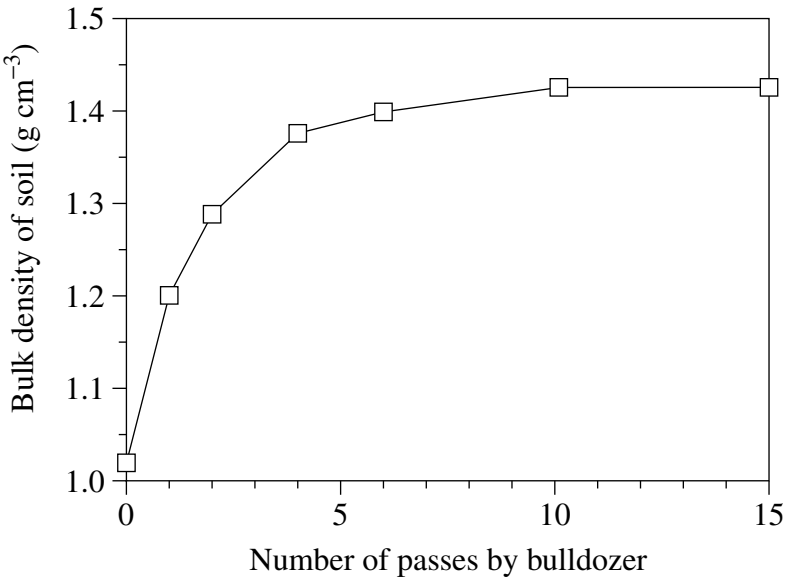
(A) The trees will reduce the recharge in the sandstone and lower the water table.

(B) The roots of the trees will grow below the crops and help lower the water table.

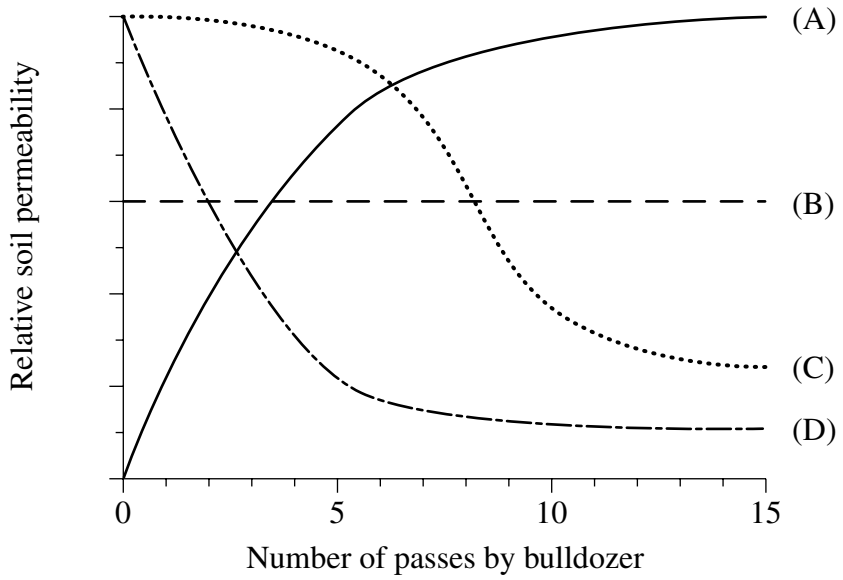
(C) The roots of the trees will control soil erosion on the black soil plain.

(D) The increased shade from the trees will reduce the loss of crops.

15 The graph shows the relationship between compaction measured as the bulk density of soil in a field and the number of passes over the field by a bulldozer.



Which of the following represents the relationship between the number of passes by a bulldozer and the relative soil permeability to water?



Centre Number

Student Number

Section I (continued)

Part B – 60 marks
Attempt Questions 16–26
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 16 (6 marks)

Mountain building processes and the associated geological structures are controlled by the type of plate boundary where mountains form.

(a) Sketch and label ONE geological structure formed at a divergent plate boundary. **2**

(b) State TWO differences between continental and oceanic crust. **2**

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(c) Explain why mountains formed at convergent plate boundaries contain deformed rocks. **2**

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Marks

Question 17 (5 marks)

The Sumatran volcano, Toba, erupted approximately 75 000 years ago and ejected around 2 800 km^3 of material.

(a) Identify TWO immediate hazards that living things in Sumatra would have faced when Toba erupted. **2**

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(b) Explain why Toba and many other volcanoes are present on the island of Sumatra. **3**

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Marks

Question 18 (5 marks)

(a) Describe how ONE named scientific technology is used to predict earthquakes. **2**

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(b) Justify why scientists should continue to develop or improve methods for predicting earthquakes. **3**

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Please turn over

Marks

Question 19 (6 marks)

In your course you gathered and analysed information from secondary sources about the forces driving plate motion. **6**

Using supporting diagrams, analyse ONE model used to explain this motion.

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Marks

Question 20 (6 marks)

(a) With reference to the Geological Time Scale, calculate the duration of the following four time divisions and place them in the table in order from longest to shortest. **3**

Archaean Cenozoic Triassic Proterozoic

Time division	*Length of time* (Ma)

(b) Compare life-forms before and after the 'Cambrian event'. **3**

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Marks

Question 21 (5 marks)

(a) Describe the significance of Banded Iron Formations in terms of environmental conditions. **3**

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(b) The media announced the discovery of a Banded Iron Formation which was thought to be Cretaceous in age. **2**

Using your understanding of Banded Iron Formations, evaluate the reliability of the media report.

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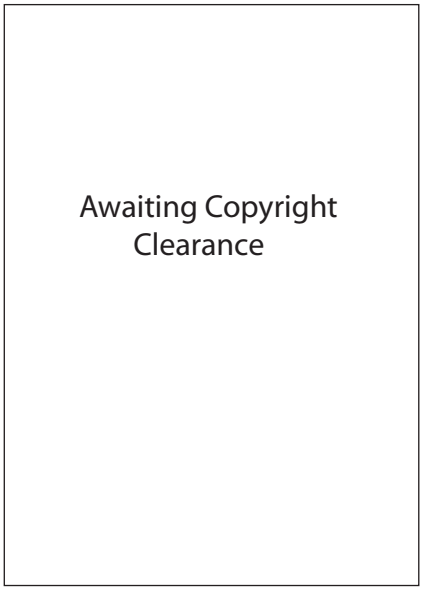
Marks

Question 22 (6 marks)

Cooksonia was a Silurian plant that was probably confined to swampy environments. **6**

Artist's impression of *Cooksonia*



Discuss the features of *Cooksonia* that would have suited a swampy environment but that would require modification through evolutionary changes to permit survival in terrestrial environments.

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Marks

Question 23 (6 marks)

(a) What is the chemical difference between oxygen and ozone? **1**

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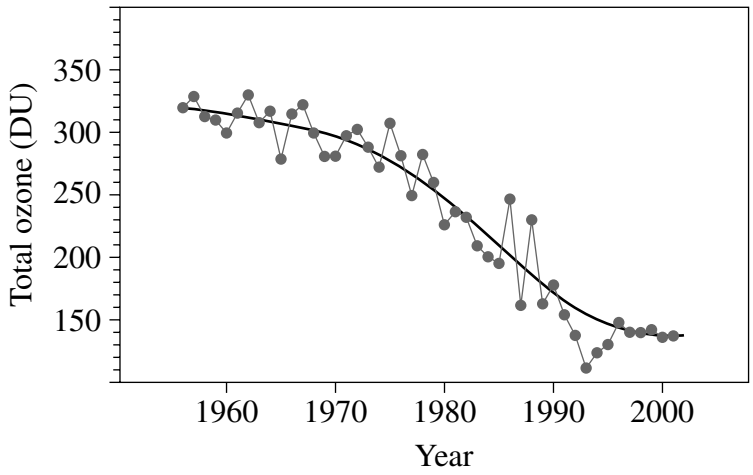
(b) The figure shows total ozone at Halley Station in Antarctica in the period 1956–2001. **2**



Describe the trends in total ozone at Halley Station.

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(c) Name an international strategy for reducing ozone depletion, and assess its impact on society and the environment. **3**

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Centre Number

Section I – Part B (continued)

Student Number

Marks

Question 24 (5 marks)

Evaluate a current method for the treatment of liquid waste that allows for the recycling of water. **5**

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Marks

Question 25 (4 marks)

Discuss the importance of maintaining environmental flows in rivers. **4**

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Marks

Question 26 (6 marks)

The Australian continent has grown over geological time from west to east, as a result of plate tectonic processes. **6**

Analyse differences in the fertility of soils in eastern and western Australia.

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Earth and Environmental Science

Section II

25 marks
Attempt ONE question from Questions 27–30
Allow about 45 minutes for this section

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

Marks

Question 27 — Introduced Species and the Australian Environment (25 marks)

(a) In your study of this option you were required to visit a local environment to identify and classify non-indigenous flora and fauna.

(i) Describe ONE appropriate method you used to present the data you gathered. **2**

(ii) Justify whether this investigation was best undertaken individually or by a team. **2**

(b) The National Parks and Wildlife Service conducted a survey in a western region of New South Wales and, over a period of time, estimated the abundance of two introduced species. The data collected is shown in the table.

Time	*Temperature* (°C) *(maximum daily)*	*Number of species 1*	*Number of species 2*
30 July 2000	11	23	52
24 February 2001	43	57	50
3 August 2001	9	74	43
20 February 2002	41	92	39
5 August 2002	12	135	28
17 February 2003	49	15	35
31 July 2003	8	21	37
10 February 2004	39	25	34
3 August 2004	12	29	29
31 January 2005	40	32	25

(i) On the graph paper provided on page 33, draw a graph to show the abundance of the two introduced species over the period of time. **4**

(ii) Propose a reason for the trend shown in the abundance of both species over the period of time. **2**

Question 27 continues on page 23

(c) Assess the effectiveness of strategies that are currently being used to rehabilitate a named ecosystem that has been damaged by introduced species. **7**

(d) Study the photographs of two different gardens in Australia.

Photo 1

Photo 2

T Dixon & J Churchill, 1988, Gardens in Time: In the Footsteps of Edna Walling, Angus & Robertson, Sydney, p 113.
Peter Spooner (ed), 1973, Practical Guide to Home Landscaping, Reader's Digest Services Pty Ltd, Sydney, page 60

(i) Explain why people may have introduced plants into the Australian environment. **2**

(ii) Explain how the establishment of the garden in **Photo 1** may have altered the abiotic characteristics of the environment. **3**

(iii) Predict what will happen to each garden during a long period of drought, and give reasons for your prediction. **3**

End of Question 27

Marks

Question 28 — Organic Geology – a Non-renewable Resource (25 marks)

(a) In your study of this option you carried out an investigation to distinguish between the products of complete and incomplete combustion.

(i) Describe ONE appropriate method you used to present the data you gathered. **2**

(ii) Justify whether this investigation was best undertaken individually or by a team. **2**

(b) Examine the data table of coal characteristics.

Coal rank	*Carbon* (%)	*Specific energy* (MJ kg^{-1})	*In-situ moisture* (%)	*Volatile material* (%)
(Peat)	60	14.7	75	65
Brown	71	23.0	30	52
Sub-bituminous	80	33.5	5	40
High volatile bituminous	86	35.6	3	31
Medium volatile bituminous	90	36.0	1	22
Low volatile bituminous	91	36.4	<1	14
Semi-anthracite	92	36.0	<1	8
Anthracite	95	35.2	<1	2

(i) On the graph paper provided on page 33, draw a graph to show the effect of changing coal rank on carbon content and volatile material. **4**

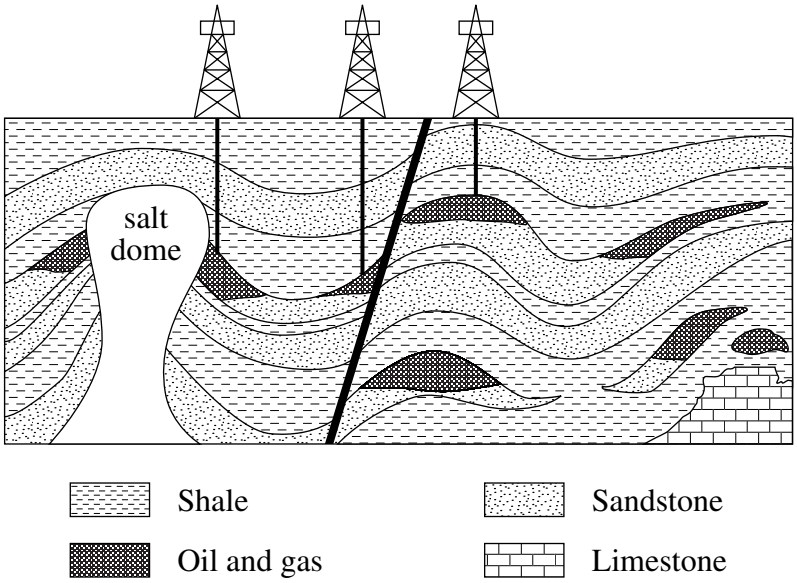
(ii) Propose a reason for the trends in carbon content and volatile material with coal rank. **2**

(c) Assess the effectiveness of strategies that are currently being used to reduce the environmental impacts of burning fossil fuels. **7**

Question 28 continues on page 25

Question 28 (continued)

(d)



(i) Explain the formation of TWO major geological traps for petroleum indicated in the diagram. **3**

(ii) Predict the ancient geological setting most likely to have generated large petroleum accumulations. **3**

(iii) Describe the process by which petroleum is refined into fuel for use in motor vehicles. **2**

End of Question 28

Marks

Question 29 — Mining and the Australian Environment (25 marks)

(a) In your study of this option you were required to perform a first-hand investigation to distinguish between waste rock and ore, and ore minerals and gangue minerals.

(i) Describe ONE appropriate method you used to present the data you gathered. **2**

(ii) Justify whether this investigation was best undertaken individually or by a team. **2**

(b) Examine the data table of production figures for the Madpass gold mine.

	Years							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Mine production (kt) ore mined	0	0	300	1200	1400	1300	650	0
Ore refined (kt)	0	0	200	1150	1360	1250	520	0
Gold metal produced ('000 oz)	0	0	85	240	319	335	160	0
Price ($ per oz)	420	440	420	435	440	425	380	360
Total mine costs ($ millions)	18	30	23	60	70	67	40	28
Income ($ millions)	0	0	36	105	141	142	61	0
Profits ($ millions)	–18	–30	13	45	71	75	21	–28

(i) On the graph paper provided on page 33, draw a graph to show total mine costs and profits for the duration of the mining activity. **4**

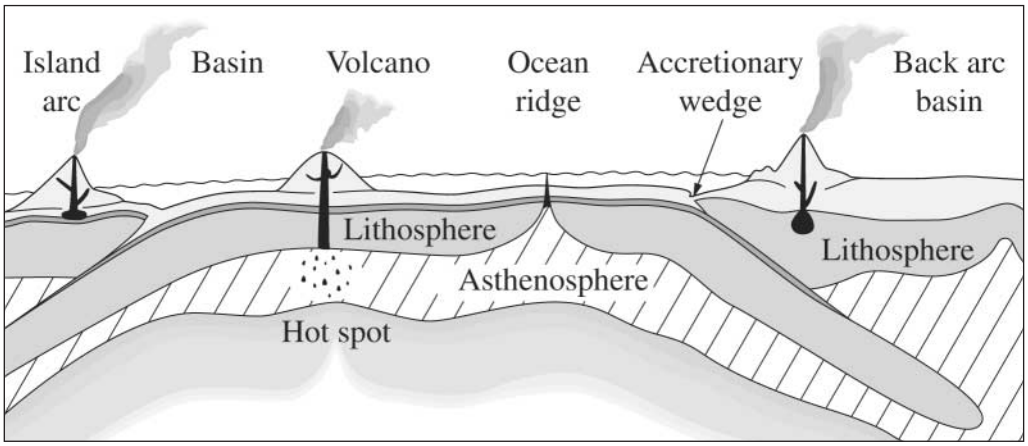
(ii) Propose a reason related to the mining activities for the mine losing money during some years. **2**

Question 29 continues on page 27

Question 29 (continued)

(c) Assess the effectiveness of environmental rehabilitation strategies for the main mining methods at a named deposit. **7**

(d) The diagram depicts a variety of tectonic settings.



(i) Describe the geological features of ONE of the tectonic settings depicted in the diagram. **2**

(ii) Predict where you would find EITHER a base/precious metal producing locality OR an iron ore producing locality in the above diagram, and give reasons for your prediction. **3**

(iii) Propose ONE exploration method that could be used to identify the ore deposit that you predicted. **3**

End of Question 29

Marks

Question 30 — Oceanography (25 marks)

(a) In your study of this option you were required to carry out an investigation to demonstrate the precipitation of salts from a cooling solution.

(i) Describe ONE appropriate method you used to present the data you gathered. **2**

(ii) Justify whether this investigation was best undertaken individually or by a team. **2**

(b) Examine the data table for Station 184 in the Tasman Sea.

Station 184

Depth (m)	*Turbidity index*	*Temperature* (°C)	*pH*	*Salinity* (ppt)
155	35	20.5	7.5	36.9
304	35	16.4	7.3	36.2
698	36	10.6	7.0	35.4
895	36	7.7	7.0	35.1
1202	39	5.4	6.7	35.0
1699	43	4.3	6.5	35.0
1992	35	3.9	6.8	35.0
2493	32	3.1	6.8	34.9
2993	39	2.7	6.8	34.9

(i) On the graph paper provided on page 33, draw a graph to show the change in salinity and temperature with increasing depth. **4**

(ii) Propose a reason for the trend in salinity and temperature. **2**

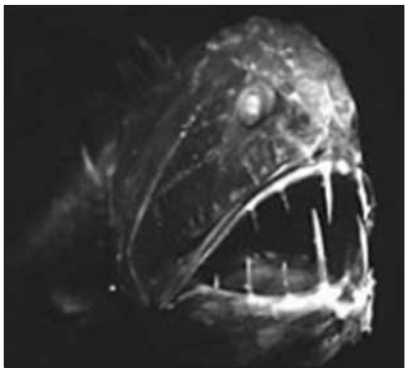
Question 30 continues on page 29

Question 30 (continued)

(c) Evaluate the role of oceanographic technologies in increasing knowledge and understanding about the oceans. **7**

(d) The photographs show life from two different locations in the ocean.

Coral reef



Deep ocean

Courtesy of the California Academy of Sciences.

(i) Describe ONE adaptation of deep ocean organisms. **2**

(ii) Describe the characteristics of hydrothermal vents and their unique biotic communities. **3**

(iii) Discuss why most ocean life occurs in the upper 30 metres of the ocean. **3**

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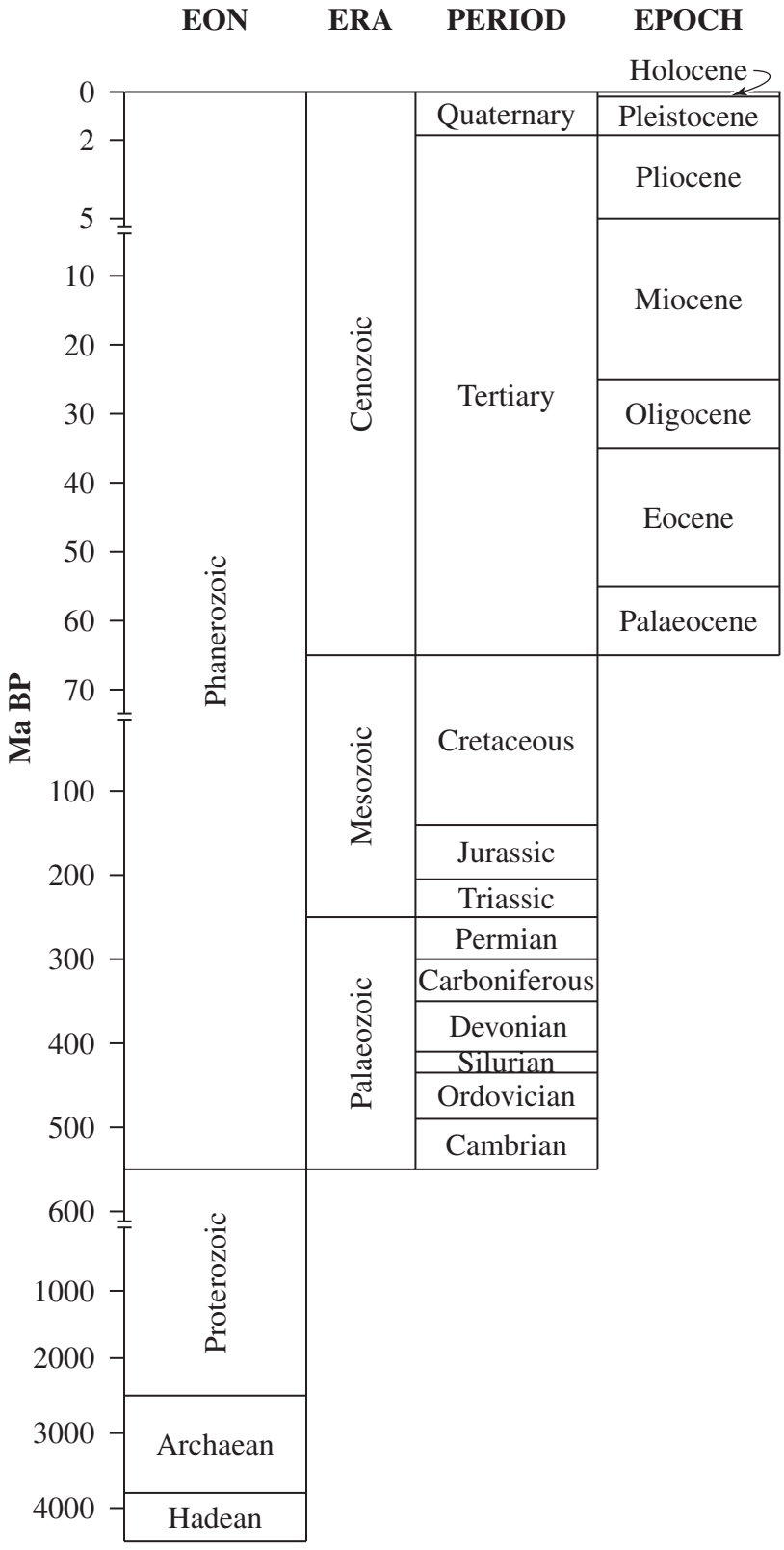
Geological Time Scale



2005 HIGHER SCHOOL CERTIFICATE EXAMINATION

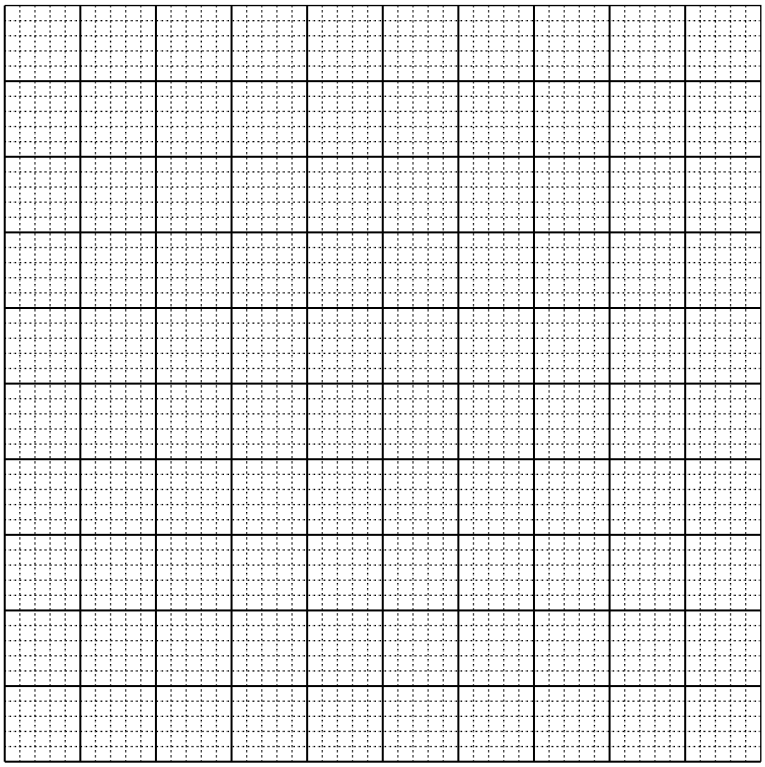
Earth and Environmental Science

Centre Number

Student Number

This page is to be detached, completed and attached to the inside front cover of your writing booklet for the option question you have completed.

Question attempted



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