

Student Number .....



*Pymble Ladies' College*

**2005**

**Trial 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 Student Number at the top of pages 1, 8 and your writing paper for Section II

**Total marks – 100**

**Section 1**                      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 16–27
- Allow about 1 hour and 45 minutes for this part

**Section II**                      Pages 20–22

**25 marks**

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

# Earth and Environmental Science

## Section I

75 marks

Part A – 15 marks

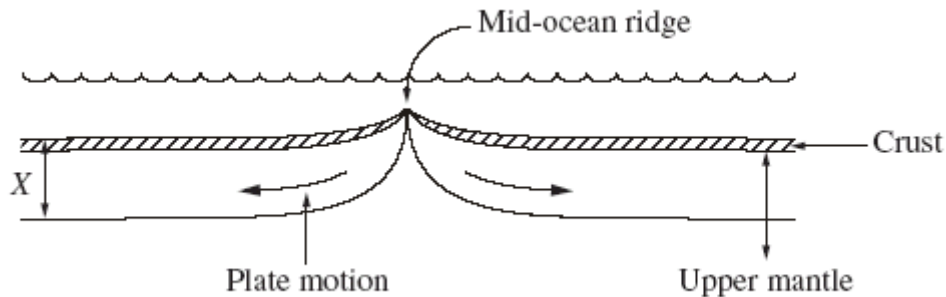
Attempt Questions 1–15

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.

1 The diagram shows a cross-section through a mid-ocean ridge. Features of the ridge system are labelled.



What is represented by the letter X?

- (A) Lithosphere.
- (B) Ocean trench.
- (C) Asthenosphere.
- (D) Subduction zone.

2 A plate boundary has a deep ocean trench and a chain of active volcanic islands.

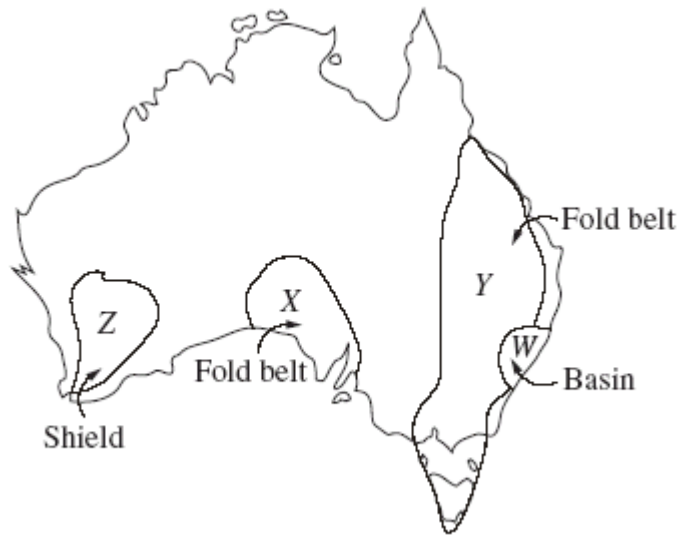
Which plate boundary and igneous rock typically characterise this type of boundary?

- (A) Oceanic divergent boundary and basalt.
- (B) Continental divergent boundary and andesite.
- (C) Ocean–ocean convergent boundary and andesite.
- (D) Ocean–continent convergent boundary and basalt.

3 Which of the following is a common short-term effect of major explosive volcanic eruptions?

- (A) Increased rates of weathering due to acid rain from Methane emissions.
- (B) Decreased agricultural production due to a reduction in available sunlight.
- (C) Decreased biodiversity due to the dispersion of toxic metals.
- (D) Increased plant growth due to carbon dioxide emissions.

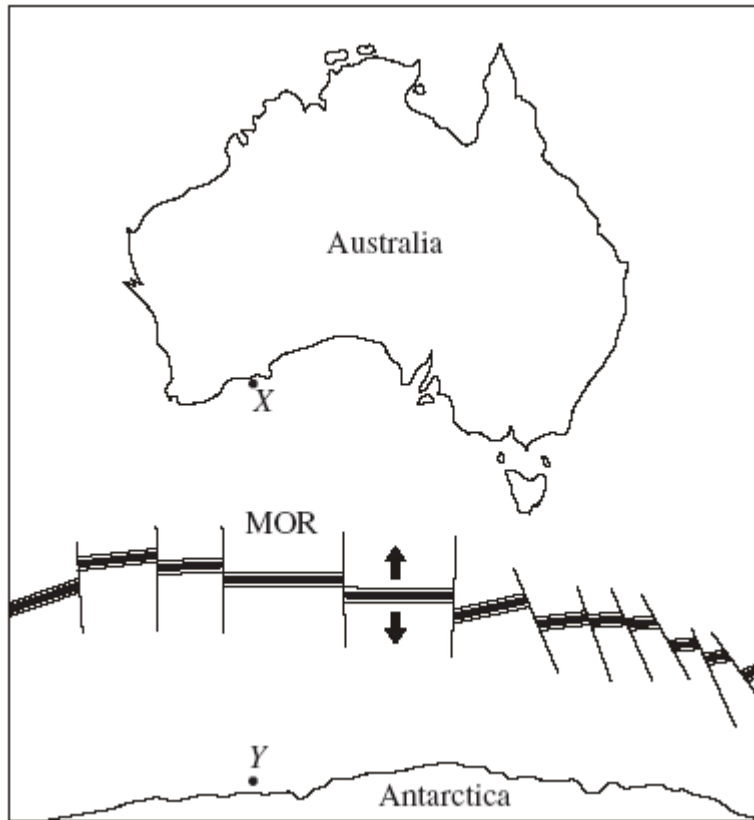
4 The map shows some geological regions in Australia.



What is the order of formation, from oldest to youngest, of these regions?

- (A) Z, X, Y, W.
- (B) X, Y, W, Z.
- (C) W, X, Y, Z.
- (D) X, Y, Z, W.

5 The map shows Australia, part of Antarctica and the mid-ocean ridge (MOR) between them. The age of oceanic crust at *X* and *Y* is approximately 80 Ma BP and the distance between these points is 5600 km.



Assuming the rate has remained constant, by how much is the distance between Australia and Antarctica increasing each year?

- (A) 70 cm.
- (B) 35 cm.
- (C) 7.0 cm.
- (D) 3.5 cm.

6 Which one of the following best describes stromatolites?

- (A) Rod-like structures produced by volcanic vents on the ocean floor.
- (B) Fossilised remains of animals that inhabit the deep ocean floor.
- (C) Structures produced by living organisms that trap sediment.
- (D) Chalk deposits precipitated by coral-like animals.

**7** All significant Banded Iron Formations (BIFs) were formed prior to 1800 Ma BP.

What does this indicate about conditions on Earth prior to 1800 Ma BP?

- (A) There was very little free oxygen in the atmosphere.
- (B) Weathering of iron-rich rocks had not commenced.
- (C) Photosynthetic organisms were abundant.
- (D) Deep ocean basins had not formed.

**8** What advantage for survival did hard-shelled animals have over soft-bodied metazoans like the Ediacara fauna?

- (A) Hard-shelled animals could exploit deeper marine environments.
- (B) Hard-shelled animals were more readily preserved as fossils.
- (C) Hard-shelled animals were better protected from predation.
- (D) Hard-shelled animals were less able to move more efficiently.

**9** Relative dating is based on which of the following?

- (A) Measuring radioactive isotopes.
- (B) Using carbon-14.
- (C) Establishing the complexity of fossils.
- (D) Determining stratigraphic sequence.

**10** A comparison of the Cambrian fossil record with that of the Late Proterozoic has resulted in the use of the term *explosion* when referring to the Cambrian Event.

Why is this expression used?

- (A) Most genera were destroyed by a bolide impact in the Cambrian.
- (B) There was an apparent increase in the diversity of animal life forms.
- (C) The first land-based vertebrate species appeared in the Cambrian.
- (D) An increase in volcanic activity led to rapid evolution.

**11** Which of the following has resulted in the majority of Australian soils being relatively low in fertility?

- (A) The excessive use of fertilisers and pesticides over the last two hundred years in Australia.
- (B) The lower rainfall experienced in Australia since it started moving towards the equator after the break-up of Gondwana.
- (C) The depletion of the majority of nutrients by dense forest that covered the whole Australian continent during the Carboniferous Period.
- (D) The great age, low topographic relief and geological stability of Australia.

**12** How do chlorofluorocarbons (CFCs) reduce the concentration of ozone in the atmosphere?

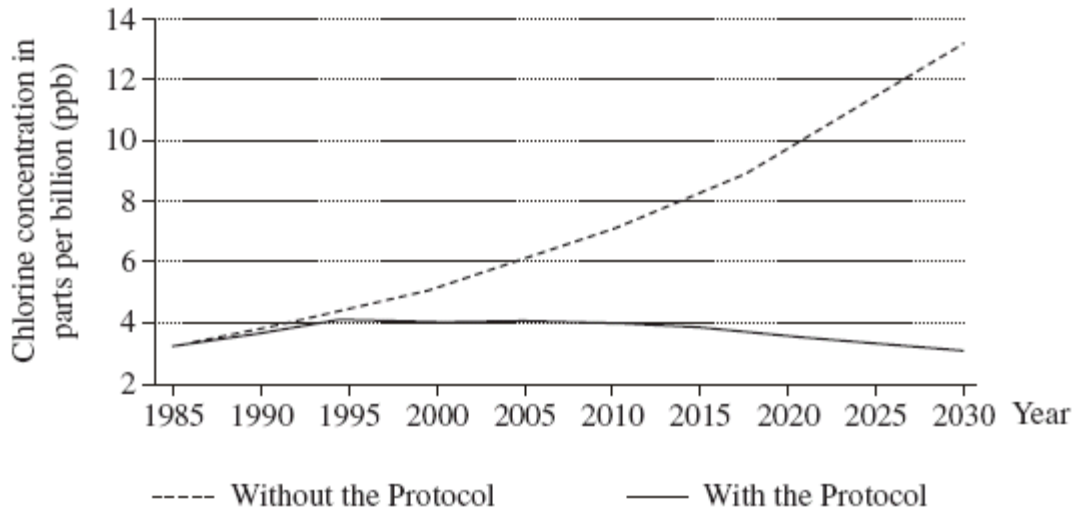
- (A) The CFCs combine with ozone to produce oxidised molecules.
- (B) In dark and cold conditions, CFCs combine with carbon dioxide to decrease ozone production.
- (C) CFCs split in the troposphere and oxidise, creating extra carbon dioxide molecules.
- (D) Radiation causes CFCs to release atoms that convert ozone to oxygen.

**13** Which of the following strategies would be the *most* effective in rehabilitating salt-affected land?

- (A) Changing the land use from crop growing to animal grazing.
- (B) Lowering the water table through revegetation.
- (C) Adding fertiliser to neutralise salts in the soil.
- (D) Using overhead irrigation to flush salt from the soil.

**14** The graph shows the predicted effects of implementing the Montreal Protocol controls on chlorine concentration in the stratosphere.

Which of the following statements is supported by the information in the graph?



- (A) Chlorine concentrations will increase by 13 ppb between 1985 and 2030 without the implementation of the Protocol.
- (B) Chlorine concentrations will decrease by 50% between 1995 and 2030 with the implementation of the Protocol.
- (C) Protocol implementation will result in chlorine concentrations returning to 1985 levels by the year 2005.
- (D) Implementing the Protocol will lead to chlorine concentrations in 2030 being 10 ppb lower than if the Protocol is not implemented.

**15** The effect of the excessive use of some pesticide can result in the problems of bioaccumulation and biomagnification.

Which statement correctly describes an effect on organisms.

- (a) biomagnification only occurs in plants.
- (b) biomagnification occurs at higher levels in the food chain.
- (c) bioaccumulation only effects non target species.
- (d) bioaccumulation effects all producer organisms.

# Earth and Environmental Science

## 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.

### Question 16 (5 marks)

(a) Identify ONE feature of a lithospheric plate. (1)

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(b) Outline briefly TWO hypotheses used to explain the movement of lithospheric plates. (2)

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(c) Use ONE of the hypotheses you outlined in part (b) to explain how divergent margins form. (2)

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**Question 17** (7 marks)

In your Earth and Environmental Science course you completed a case study of a recent natural disaster associated with tectonic activity.

Name the natural disaster you studied .....
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(a) Describe the tectonic movement involved in this disaster. (2)

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(b) Describe ONE type of technology that can assist in the prediction of disasters of this kind. (2)

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(c) Explain ONE method other than prediction that could be used to minimise the disastrous effects associated with this type of tectonic activity. (3)

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**Question 18** (6 marks)

Describe the features of a mountain range formed at an ocean-continent plate boundary.

Include in your description –

Rock types present

Types of geological structures present

The nature of plate tectonic processes forming the mountains

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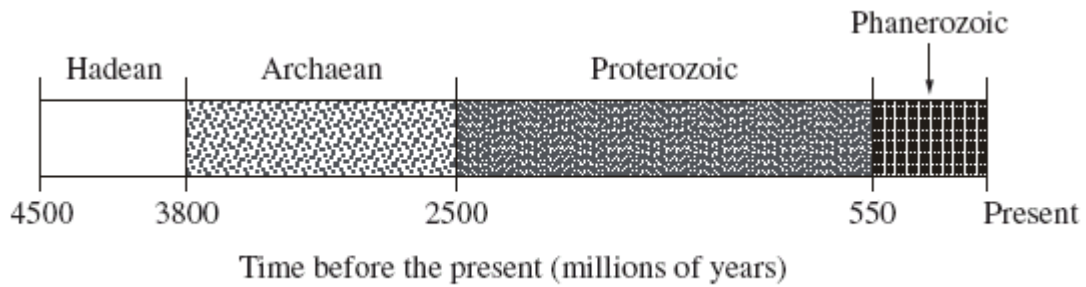
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**Question 19** (6 marks)

The diagram represents the eons of geological time.



(a) Recall the basis for the division of the geological timescale into eons. (2)

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(b) Outline why the Australian Banded Iron Formations (BIFs) formed prior to the Phanerozoic eon. (2)

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(c) Outline the stable isotope evidence to support the theory that life first appeared approximately 3800 million years ago. (2)

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**Question 20** (6 marks)

Structures called stromatolites are regarded as some of the oldest evidence of life on Earth.

(a) Briefly describe the structure of a fossil stromatolite. (2)

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(b) Compare the features of the ancient stromatolites with those still living today. (2)

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(c) Account for the distribution of fossil stromatolites compared to the distribution of modern stromatolites. (2)

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**Question 21** (4 marks)

(a) Identify TWO features that allow you to distinguish between a mass extinction event and a smaller extinction event such as the recent extinction of megafauna in Australia. (2)

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(b) Describe TWO different hypotheses to explain mass extinction events. (2)

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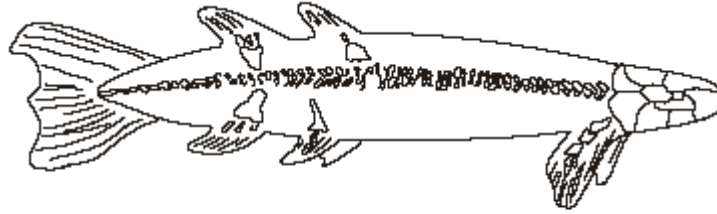
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**Question 22** (6 marks)

Crossopterygian fish are commonly regarded as a transition group because they provide a link between aquatic and terrestrial organisms.



Crossopterygian fish

(a) Complete the table provided to identify TWO problems encountered by the descendants of Crossopterygian fish and describe how each problem is overcome to allow them to survive in terrestrial environments. (4)

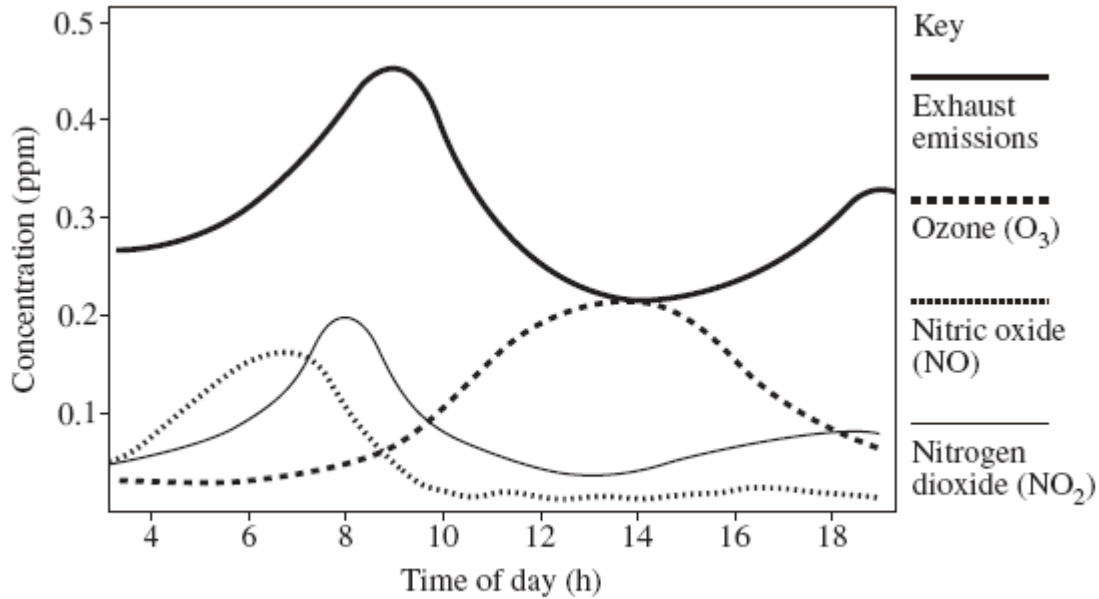
<i>Problem</i>	<i>Description of how this problem is overcome</i>
1. .... ..... .....	..... ..... .....
2. .... ..... .....	..... ..... .....

(b) Describe TWO methods that can be used to establish the age of fossils. (2)

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**Question 23** (6 marks)

The graphs show the concentration of compounds in the atmosphere in an urban area such as Sydney on a clear summer day. Ozone ( $O_3$ ) is a pollutant produced in the lower atmosphere in urban environments. Ozone is produced in a photochemical reaction.



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(a) Name TWO compounds found in vehicle emissions. (2)

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(b) Explain the trends in exhaust emissions shown on the graph. (2)

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(c) Propose a reason for the trend in ozone ( $O_3$ ) concentration. (2)

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**Question 24** (3 marks)

Briefly describe the effects of a named pesticide on human health.

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**Question 25** (4 Marks)

In 1999 it was estimated that in NSW between 120 000 and 174 000 hectares of land were affected by dryland salinity. If current practices continued the area affect is considered to increase to 4 000 000 hectares by 2050.

Outline ONE action which can be taken to minimise the problem of dryland salinity with reference to –

(a) Land clearing (2)

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(b) Irrigation (2)

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**Question 26** (3 marks)

(a) Identify one source of acid rain. (1)

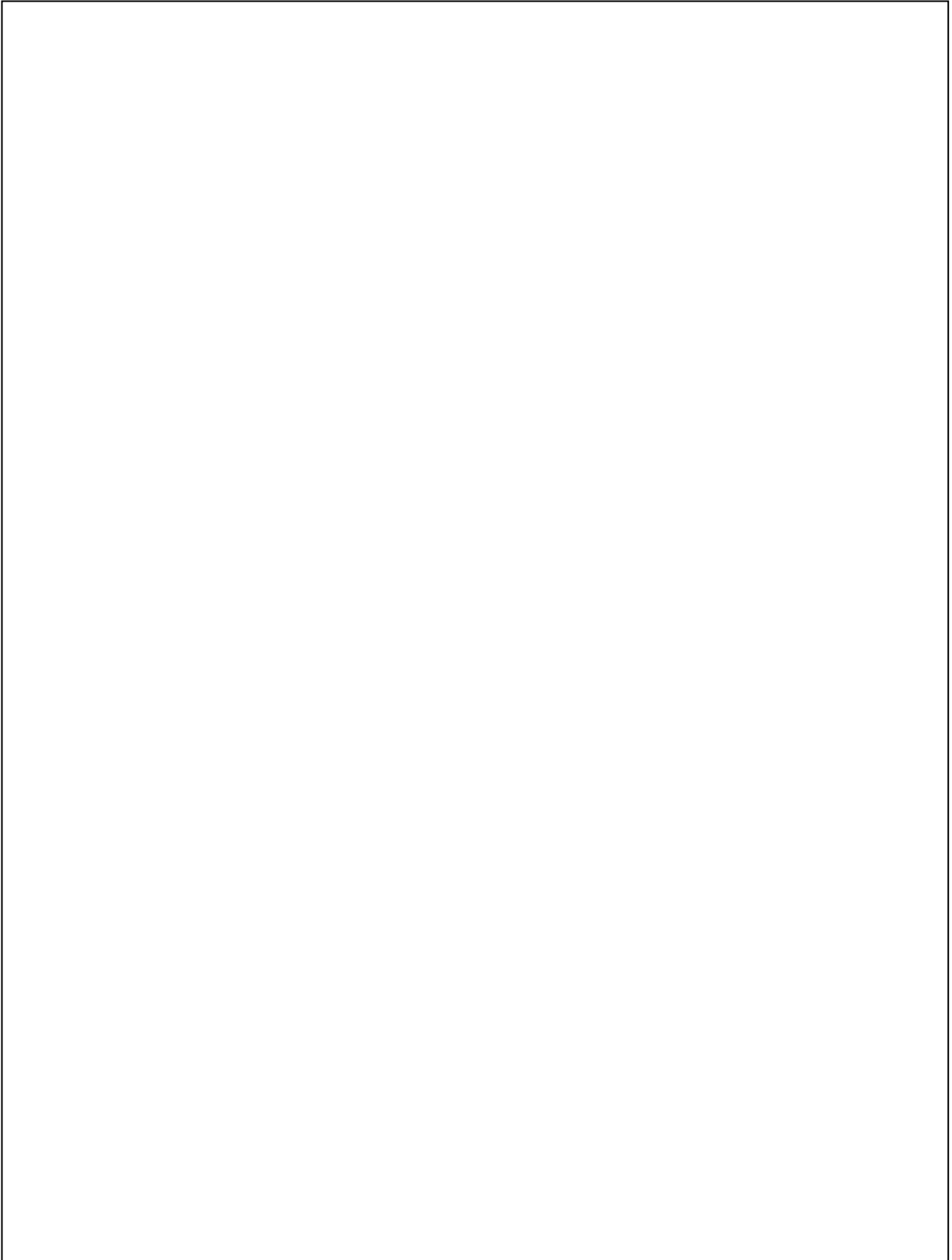
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(b) Describe an ecological effect of acid rain on ocean and lake ecosystems. (2)

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**Question 27** (4 marks)

Draw a flowchart to summarise the major processes and products involved in the treatment of sewage.

A large, empty rectangular box with a thin black border, intended for the student to draw a flowchart summarizing the major processes and products involved in the treatment of sewage.

# Earth and Environmental Science

## Section II

**25 marks**

**Attempt ONE question from Questions 28–31**

**Allow about 45 minutes for this section**

Answer the question on the paper provided.

Question 28 Introduced Species and the Australian Environment

Question 29 Organic Geology – A Non-renewable Resource

Question 30 Mining and the Australian Environment ..... 21–22

Question 31 Oceanography

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

(a) Identify the main geological features of an ancient continental area of sedimentary ore formation. (2 marks)

(b) Outline the effect of ONE state or federal government policy on mining operations in the context of sustainability. (2 marks)

(c) Identify 2 examples of renewable resources commonly used in society. (2 marks)

(d) In your study of Mining and the Australian Environment you performed a first-hand investigation to test for the presence of ore minerals and metals.

Justify how the plan that you developed for this investigation allowed you to make conclusions about the presence of ore minerals and metals. (3 marks)

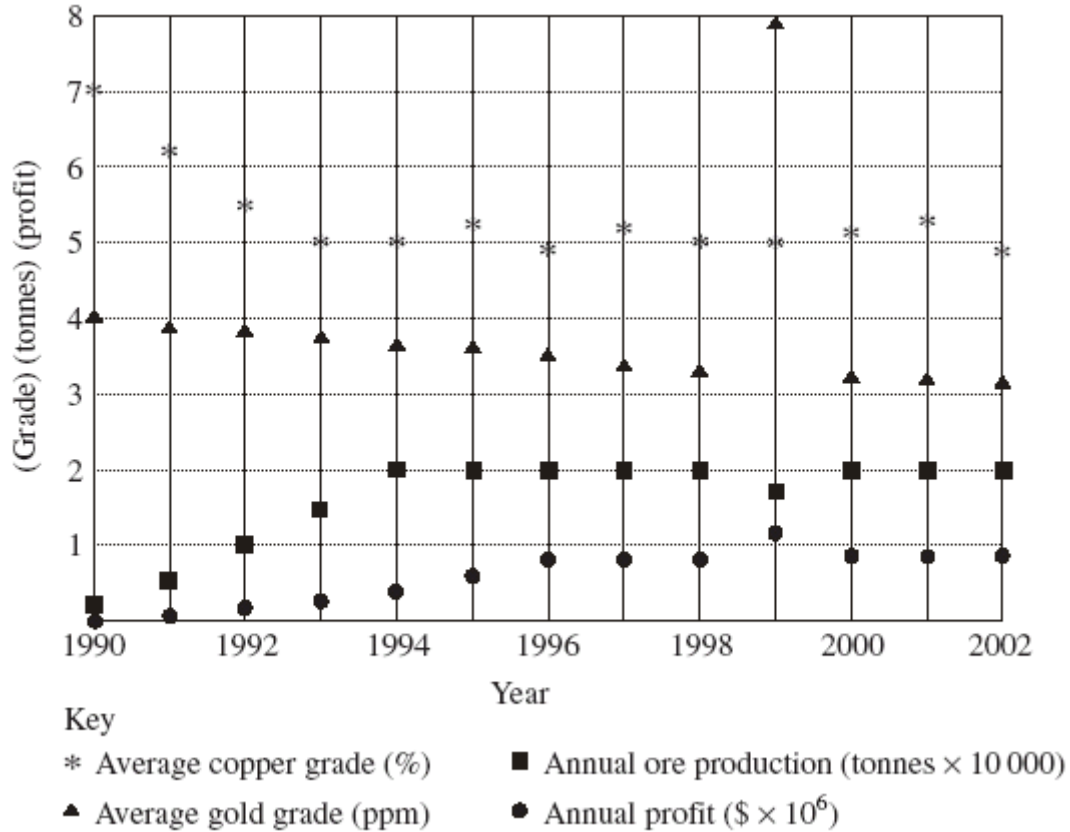
(e) Explain how changes to the market price of a metal affects the grade and tonnage of ore that can be mined profitably. (4 marks)

(f) Describe the role of drilling in determining the size and grade of the deposit you have studied. (2 marks)

(g) Assess the likely environmental effects of exploration, mining and processing methods for a named deposit. (6 marks)

*This question continues on the next page.*

(h) A copper and gold mine commenced production in 1990 with an expected life of 30 years. The graph shows the metal grades, annual ore production and profits from 1990 to 2002.



(i) Describe the trends for annual production and annual profits over the period shown. (2 marks)

(ii) Account for ONE of these trends. (2 marks)

## Geological Time Scale

