BOSTES BOARD OF STUDIES TEACHING & EDUCATIONAL STANDARDS NSW

2015 HIGHER SCHOOL CERTIFICATE EXAMINATION

IMPORTANT:
This resource was developed to support a previous version of the syllabus.
It may contain content that differs from the current syllabus.

Earth and Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black 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 13, 17, 19, 21 and 23

Total marks – 100

Section I Pages 2–25

75 marks

This section has two parts, Part A and Part B

Part A – 20 marks

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

Part B – 55 marks

- Attempt Questions 21–30
- Allow about 1 hour and 40 minutes for this part

Section II Pages 27–37

25 marks

- Attempt ONE question from Questions 31–34
- Allow about 45 minutes for this section

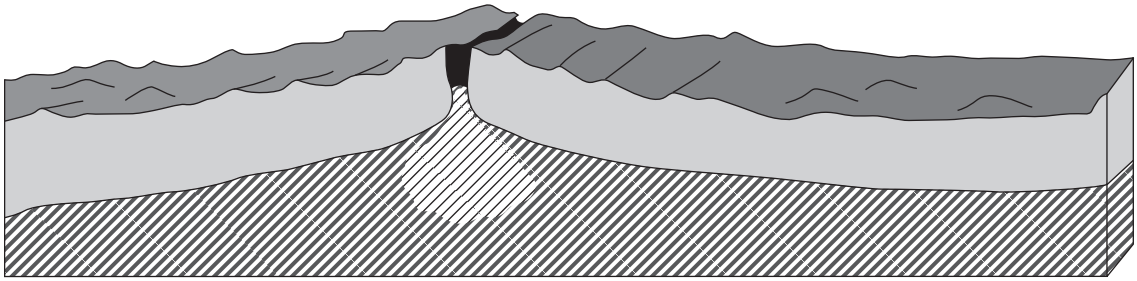
Section I
75 marks

Part A – 20 marks
Attempt Questions 1–20
Allow about 35 minutes for this part

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

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1 The diagram shows a plate boundary.



Which row in the table correctly describes this boundary?

	Type of plate boundary	*Rock type in the crust*
(A)	Convergent	Granite
(B)	Divergent	Basalt
(C)	Convergent	Basalt
(D)	Divergent	Granite

2 Which Eon lasted for the longest time?

(A) Hadean

(B) Archaean

(C) Proterozoic

(D) Phanerozoic

3 Which of the following CANNOT be used as direct evidence for the evolution of vertebrates?

(A) Fossils

(B) Embryology

(C) Carbon dating

(D) Cellular structures

4 What is the main long-term cause of low fertility in soils across most of the Australian continent?

(A) Low rainfall

(B) Tectonic stability

(C) Extensive erosion

(D) High temperatures

5 Where is a deep focus earthquake most likely to occur on the Australian–Indian Plate?

(A) At the centre of the Sydney Basin

(B) At the continental margin east of New South Wales

(C) At the subduction zone along the northern plate boundary

(D) At the mid-oceanic ridge along the southern plate boundary

6 Which of the following events is most likely to cause a tsunami?

(A) A volcanic eruption in Hawaii producing a lava flow

(B) An explosive volcanic eruption causing an earthquake in central Australia

(C) An outpouring of magma at the southern edge of the Australian–Indian Plate boundary

(D) A shallow focus earthquake along the northern edge of the Australian–Indian Plate boundary

7 Which row of the table shows both a human-induced and a natural cause of acid rain?

	Human-induced cause	*Natural cause*
(A)	Agricultural activity	Increased temperatures
(B)	Industrialisation	Tropical storms
(C)	Car emissions	Volcanic activity
(D)	Mine waste	Weathering

8 During the last 200 years, there has been an increase in the area of high salinity soils in Australia.

Which of the following processes has contributed most to this increase?

(A) Use of fertilisers

(B) Irrigation of crops

(C) Evaporation of inland seas

(D) Transportation of ocean salt by wind

9 The images show four different types of fossilisation.



Image 1



Image 2



Image 3



Image 4

Which row of the table matches each fossil image with its correct type of fossilisation?

	Image 1	*Image 2*	*Image 3*	*Image 4*
(A)	Original hard parts	Internal mould	Cast	Original organism
(B)	Cast	Internal mould	Original organism	Original hard parts
(C)	Original hard parts	Cast	Internal mould	Original organism
(D)	Cast	Original hard parts	Original organism	Internal mould

10 What was the main reason for phasing out halides, including CFCs, that were widely used in aerosols and refrigerants?

(A) They were a limited industrial resource.

(B) They were replaced by more modern technology.

(C) They were a contributor to greenhouse gases in Earth's atmosphere.

(D) They were a cause of the depletion of the ozone layer in Earth's atmosphere.

11 Which of the following occurred at the boundary between the Permian and Triassic Periods?

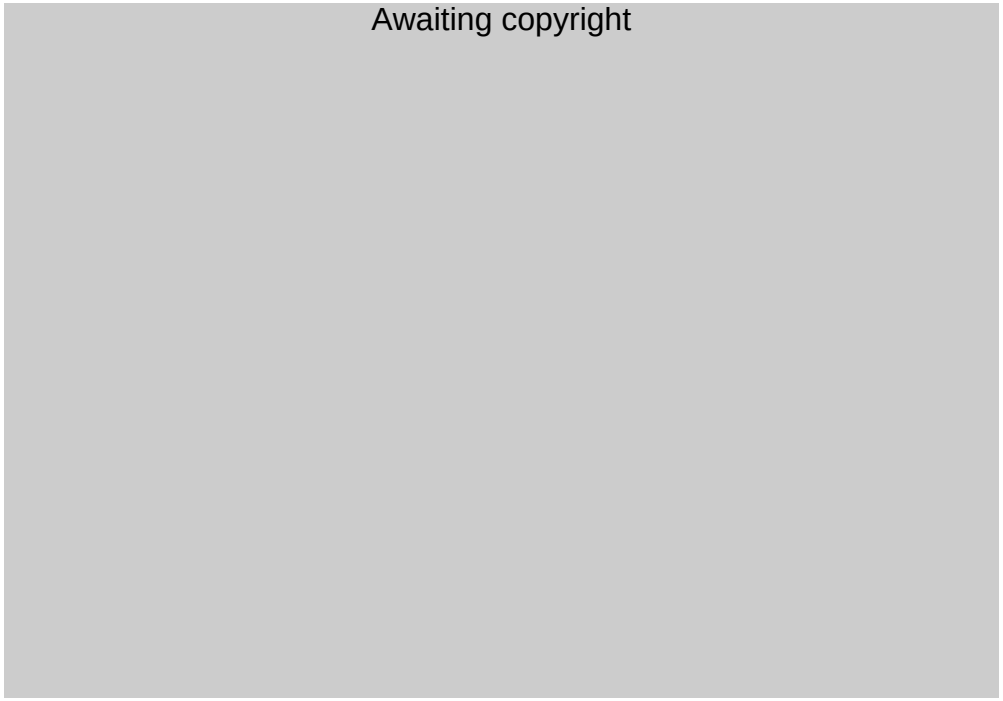
(A) The evolution of mammals

(B) The evolution of hard body parts

(C) The extinction of 95% of known species including the trilobites

(D) The extinction of 75% of known species including the dinosaurs

12 The diagram shows four stratigraphic columns.



Which of the columns in the diagram contains the youngest fossils?

(A) Column A

(B) Column B

(C) Column C

(D) Column D

13 Which example of climate change could be caused by a major explosive volcanic eruption?

(A) Small increases in global temperatures for up to three years caused by carbon dioxide emissions

(B) Small decreases in local temperatures for up to a month caused by hot gas clouds reflecting radiation from the sun

(C) Small increases in local temperatures for up to a month caused by lava flows heating the atmosphere near the volcano

(D) Small decreases in global temperatures for up to three years caused by sulfur dioxide aerosols reflecting radiation from the sun

14 The image shows a wheat growing region of Western Australia where a land use problem is being addressed.



With kind permission of Mr David McFall

Which problem is being addressed?

(A) Salinity

(B) Drought

(C) Pest infestation

(D) Soil compaction

15 Which of the following rocks are the oldest?

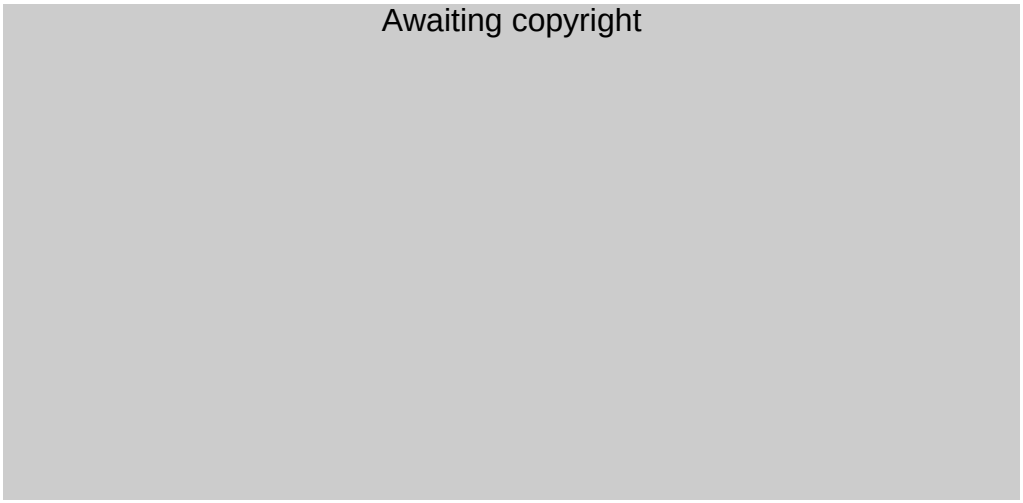
(A) Gneisses of the Gawler Craton in South Australia

(B) Basalts of the Older Volcanics in central Victoria

(C) Limestones of the Canning Basin in Western Australia

(D) Quartzites of the Lachlan Fold Belt in New South Wales

16 The graph shows Australia's carbon dioxide emissions by the type of industry.



Using the information in the graph, which statement is true if each industry reduces emissions by 5%?

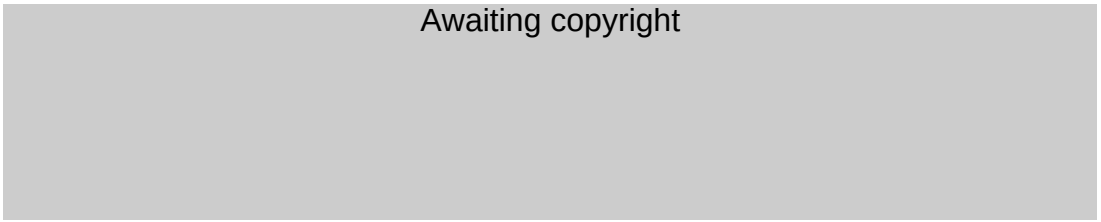
(A) CO_2 emissions would be the same for all industries.

(B) CO_2 emissions would be less for transport than for agriculture.

(C) CO_2 emissions would be greater for industrial processes than for waste.

(D) CO_2 emissions for power stations would be less than the combined total for all other industries.

17



DDT was a widely-used chemical to control insect pests in agriculture.

Why did the use of DDT cause problems for predatory birds?

(A) DDT is cumulative along food chains.

(B) DDT disperses widely when sprayed into the air.

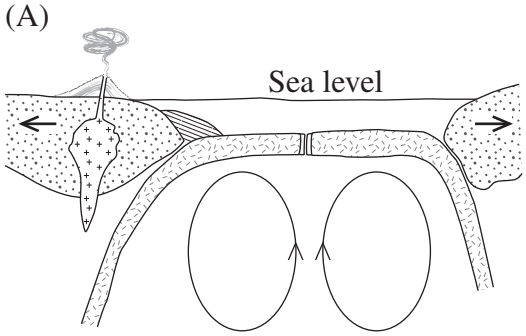
(C) DDT accumulates in the soil when sprayed on crops.

(D) DDT is washed into streams and rivers after heavy rain.

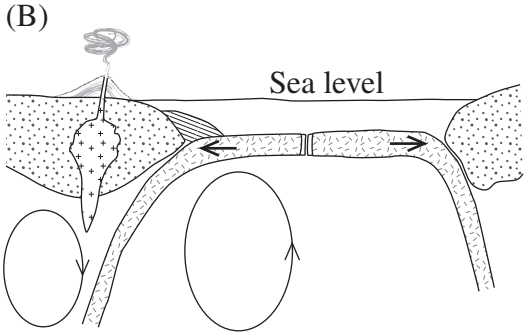
18 The diagrams show the directions of some mantle currents and plate movements in a section of Earth's crust.

Which diagram is correct?

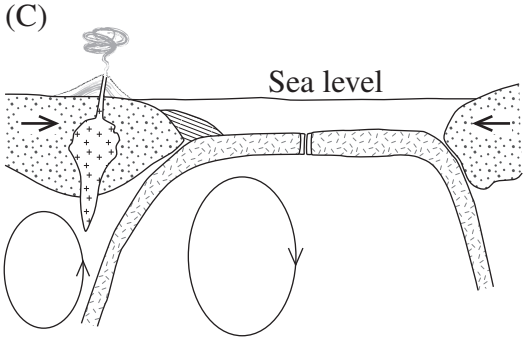
(A)



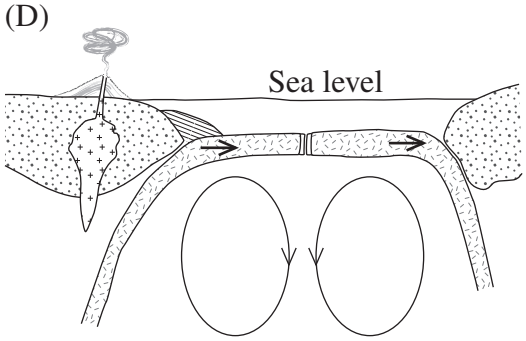
(B)



(C)



(D)



19 Photosynthetic cyanobacteria were the dominant life form 3200 million years ago.

What was the main consequence of photosynthesis at that time?

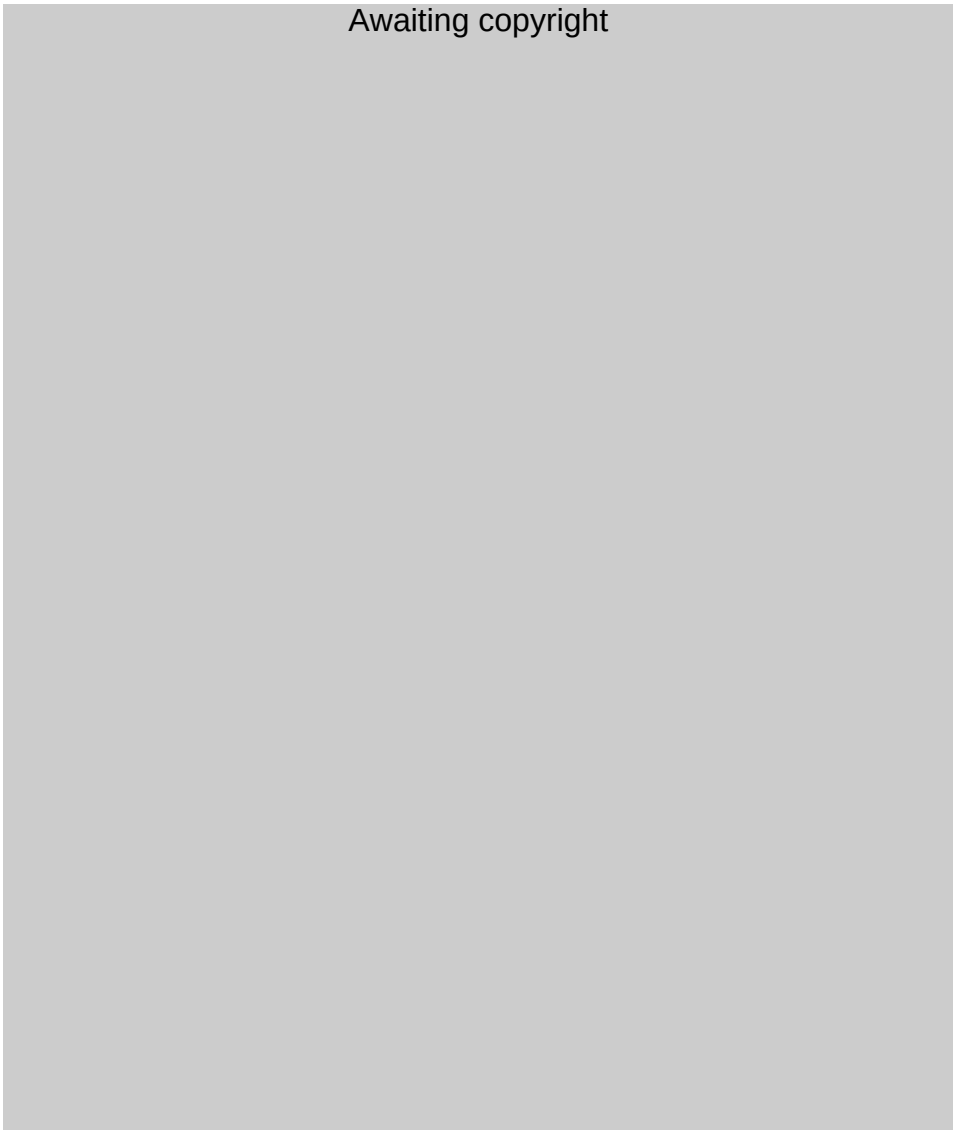
(A) The production of carbon dioxide led to an increase in dissolved carbonates in the ocean.

(B) The production of oxygen led to an increase in banded iron formations.

(C) The production of oxygen led to an increase in atmospheric oxygen and the formation of the ozone layer.

(D) The production of carbon dioxide led to an increase in atmospheric carbon dioxide and higher global temperatures.

20 The graphs show the changes in four measurable properties of the Mt St Helens volcano two months prior to, and just after, an eruption on 19 March 1982.



Based on the data, which measurable property was the best predictor of the eruption?

(A) Seismic energy release

(B) Dome expansion

(C) Change in tilt

(D) Sulfur dioxide emission

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Centre Number

Student Number

Section I (continued)

Part B – 55 marks
Attempt Questions 21–30
Allow about 1 hour and 40 minutes for this part

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Question 21 (4 marks)

(a) Outline ONE feature of a conservative plate boundary. **1**

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(b) Describe TWO features of an oceanic lithospheric plate. **3**

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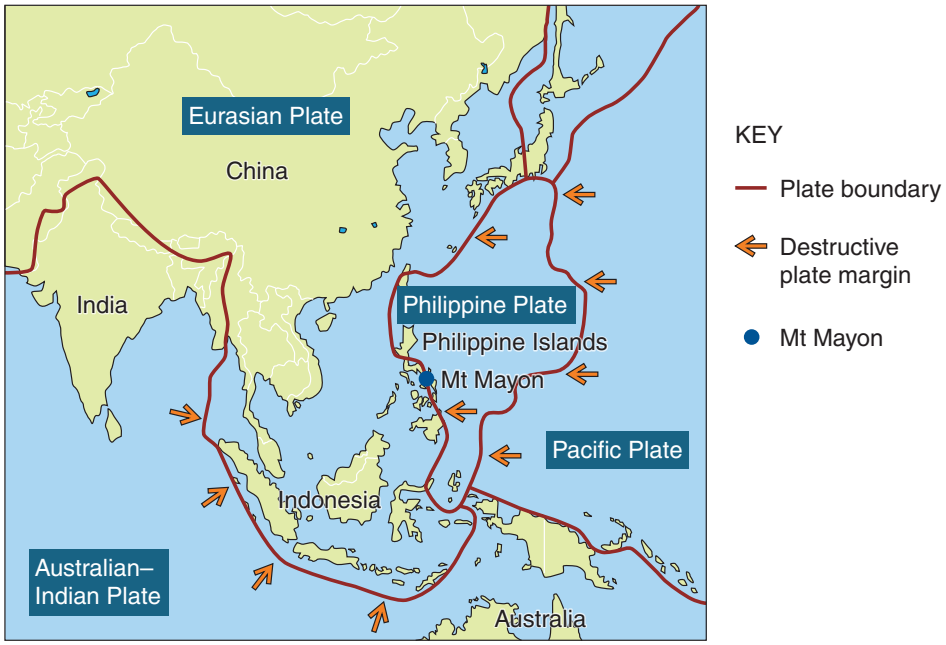
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Question 22 (8 marks)

The photograph shows Mt Mayon in the Philippine Islands and the map shows the location of Mt Mayon.





© Tomas Tam

(a) Describe ONE advantage and ONE disadvantage of living next to a mountain such as Mt Mayon. **3**

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Question 22 continues on page 15

(b) Explain why the Philippine Islands and Australia experience different types of tectonic activity. **5**

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End of Question 22

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Centre Number

Section I – Part B (continued)

Student Number

Question 23 (4 marks)

Draw a labelled diagram to show how a rift valley is formed. **4**

Question 24 (4 marks)

(a) Outline the steps in the formation of ozone in the stratosphere. **2**

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(b) Why is the ozone layer important to life on Earth? **2**

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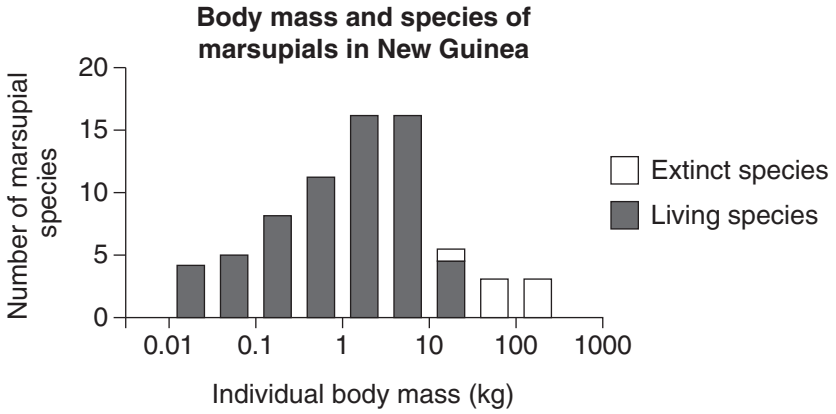
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Question 25 (4 marks)

The graph shows the relationship between the body mass and the number of species of a group of New Guinea marsupials that has existed over the past two million years. **4**



Chris Johnson, Australia's Mammal Extinctions, Cambridge University Press, 2007

Using data from the graph, propose possible reasons for this relationship.

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Question 26 (8 marks)

(a) It has been suggested that the evolution of eyes in animals was a major development during the Cambrian event. **3**

How could the development of eyes have given animals an evolutionary advantage?

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(b) Since the Cambrian Period, mosses, ferns, conifers and angiosperms have evolved.

(i) Identify ONE advantage the terrestrial environment offered the first land plants. **1**

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(ii) Using examples, explain how plants had to change to overcome environmental difficulties as they moved from aquatic to terrestrial habitats. **4**

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Question 27 (4 marks)

(a) Name a pest and outline a management practice for this pest that does not involve the use of pesticides. **2**

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(b) What are the benefits of using the management practice identified in part (a)? **2**

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Question 28 (4 marks)

Write an experimental method that could be used to investigate ONE effect of soil compaction. **4**

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Question 29 (8 marks)

(a) Describe the geological features that should be considered when selecting an area suitable for a waste dump. **3**

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(b) Assess the environmental effectiveness of current landfill practices. **5**

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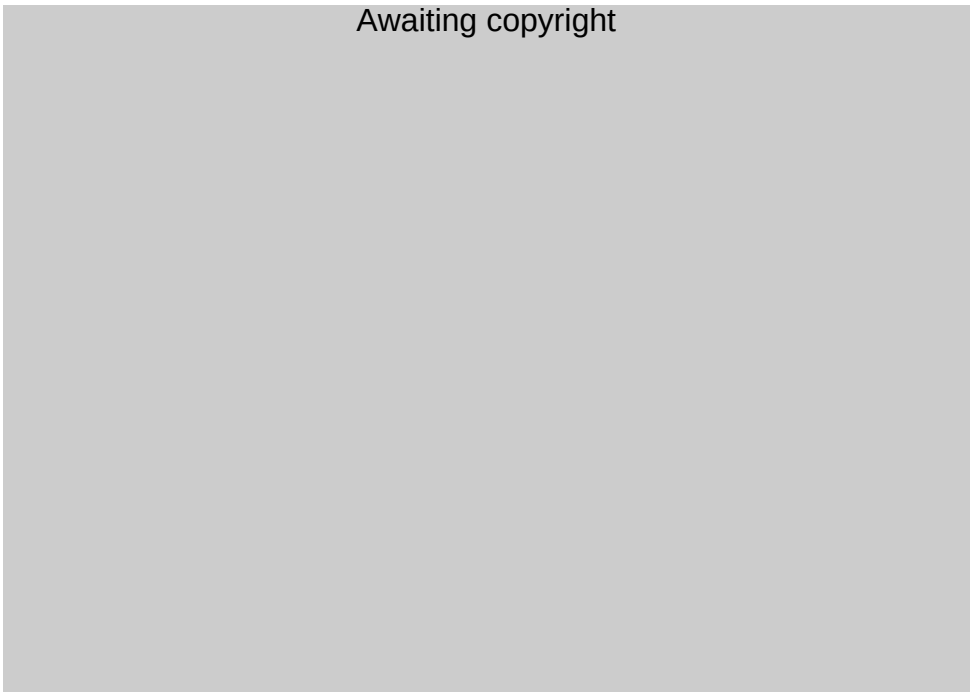
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Question 30 (7 marks)

The graph shows observed and modelled average global temperatures from 1900 to 2010. **7**



> 'Advances in our knowledge of natural and human-induced influences on global temperatures, which impact on global climate, have been used to develop strategies to prevent the trend shown in this graph from continuing.'

Evaluate this statement using data from the graph to support your answer.

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Question 30 continues on page 25

Question 30 (continued)

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End of Question 30

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Earth and Environmental Science

Section II

25 marks
Attempt ONE question from Questions 31–34
Allow about 45 minutes for this section

Answer parts (a)–(c) of the question in Section II Answer Booklet 1.
Answer parts (d)–(e) of the question in Section II Answer Booklet 2.
Extra writing booklets are available.

Pages

Question 31 Introduced Species and the Australian Environment 28–29

Question 32 Organic Geology – a Non-renewable Resource 30–32

Question 33 Mining and the Australian Environment 33–35

Question 34 Oceanography 36–37

Question 31 — Introduced Species and the Australian Environment (25 marks)

Answer parts (a)–(c) in Section II Answer Booklet 1.

(a) (i) Outline a reason for ONE animal being deliberately introduced to Australia. **1**

(ii) Propose reasons to explain why rats became a successful pest on Macquarie Island, one of Australia's sub-Antarctic territories. **3**

(b) Explain how a named introduced plant and a named introduced animal altered the abiotic characteristics of their Australian environment. **4**

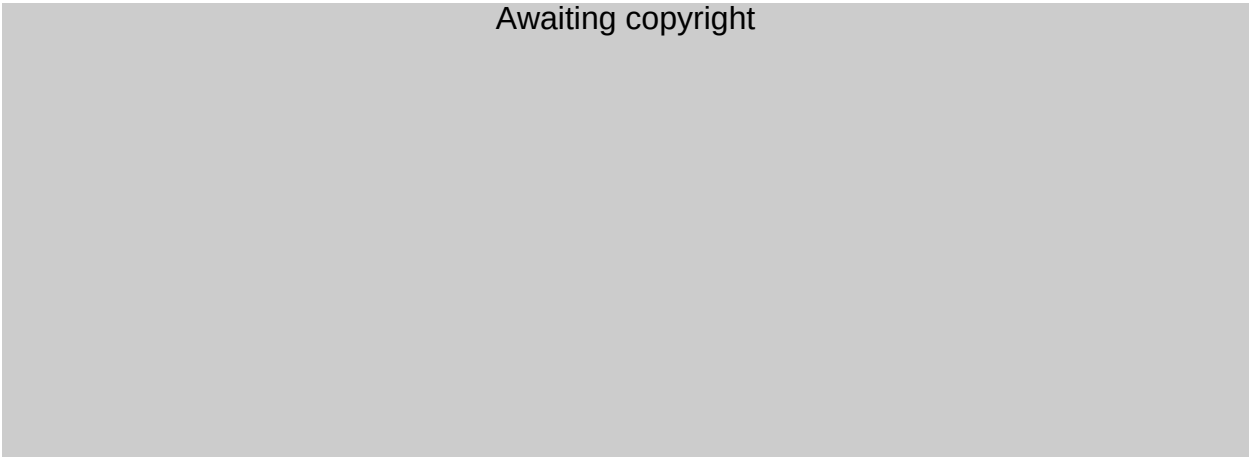
(c) (i) Why are quarantine procedures so important in Australia? **2**

(ii) Assess the effectiveness of TWO quarantine procedures used at Australian airports. **3**

Question 31 continues on page 29

Answer parts (d)–(e) in Section II Answer Booklet 2.

(d) The graph shows the effect of a biological control agent on a weed growing in a crop.



(i) Describe the relationship between the weed and the biological control agent. **2**

(ii) With reference to the graph, assess whether this biological control agent was successful. **4**

(e) Science is providing knowledge about management strategies to minimise the impact of introduced species. **6**

Assess how effectively this knowledge is being used to ensure a sustainable future for Australian ecosystems. Include examples in your answer.

End of Question 31

Question 32 — Organic Geology – a Non-renewable Resource (25 marks)

Answer parts (a)–(c) in Section II Answer Booklet 1.

(a) (i) How does the proportion of carbon in coal change as the rank increases? **1**

(ii) Explain why organic matter has been converted mostly to oil in Bass Strait, but mostly to gas in the North West Shelf of Western Australia. **3**

(b) Describe the similarities and differences in the geology of coal and oil deposits. **4**

(c) (i) Describe how a named technology can be used in the exploration for coal. **2**

(ii) Before coal is used, it is processed as shown in the flow chart. **3**



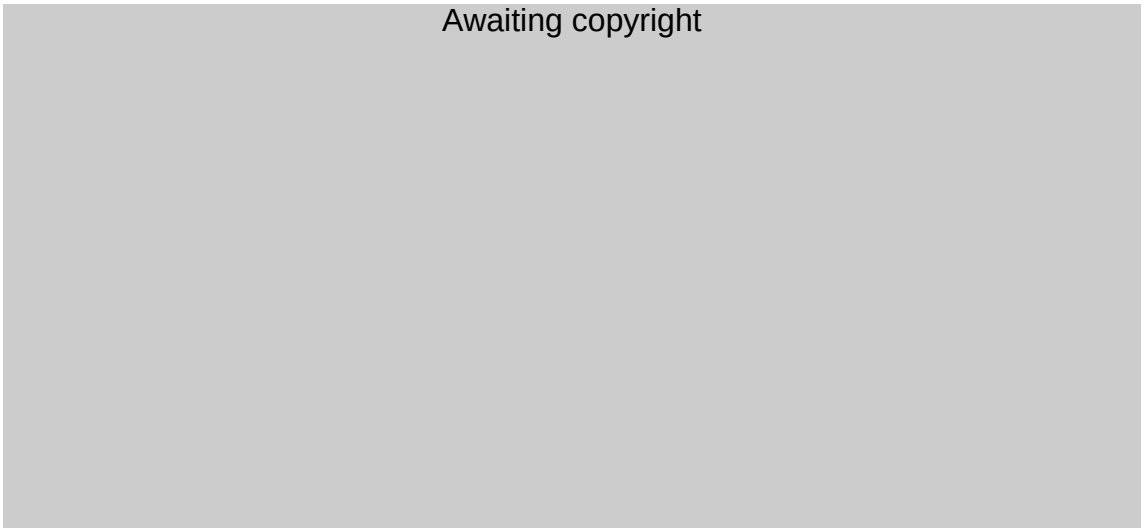
Explain why each of these processes is used.

Question 32 continues on page 31

Question 32 (continued)

Answer parts (d)–(e) in Section II Answer Booklet 2.

(d) (i) The graph shows the predicted and actual power outputs of a wind turbine over 24 hours. **2**

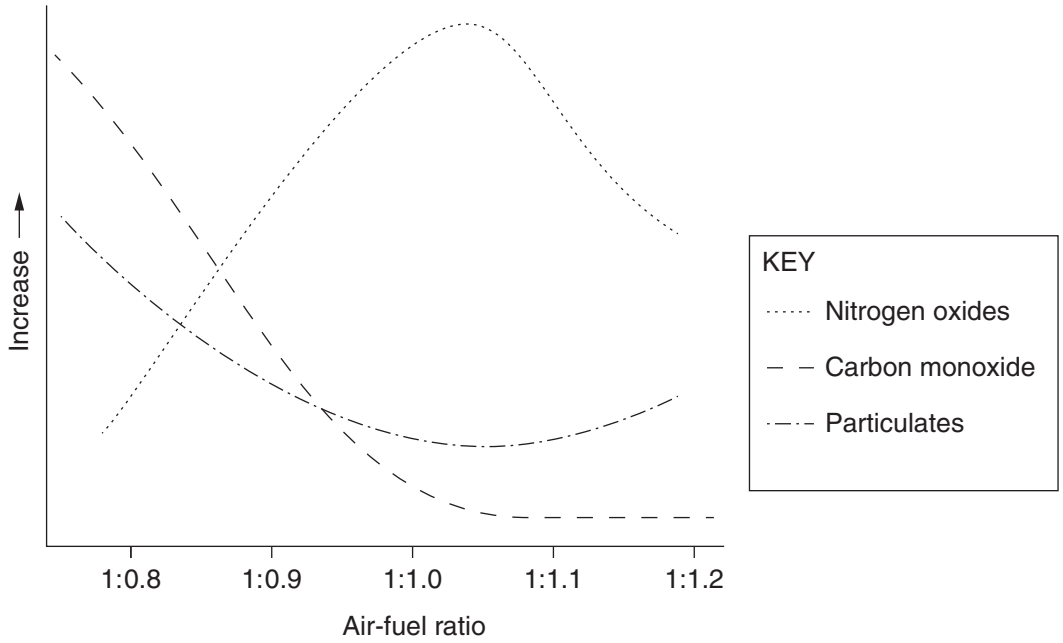


Describe the relationship between the predicted and actual power outputs.

Question 32 continues on page 32

Question 32 (continued)

(ii) The graph shows the emissions from an internal combustion engine. **4**



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Account for each of the THREE emission curves.

(e) Science is providing knowledge about Australia's renewable and non-renewable energy resources. **6**

Assess how effectively this knowledge is being used to ensure a sustainable future for Australia's energy needs. Include examples in your answer.

End of Question 32

Question 33 — Mining and the Australian Environment (25 marks)

Answer parts (a)–(c) in Section II Answer Booklet 1.

(a) (i) Name ONE Australian mineral province where a sedimentary metallic ore is mined. **1**

(ii) Explain how ONE named landmark decision has affected the operations of mining companies in Australia. **3**

(b) Explain why an Environmental Impact Statement (EIS) for the rehabilitation of a mine site has to take into account both the mining methods used and the features of the specific site. **4**

(c) (i) Outline how TWO non-geological factors may influence the economic viability of an ore body. **2**

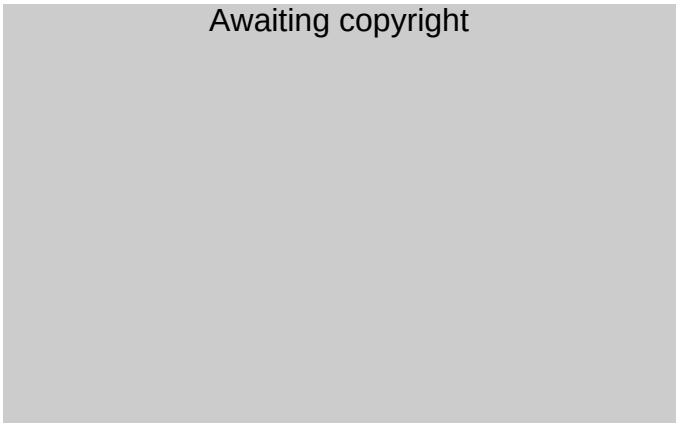
(ii) Explain the influence that TWO geological factors may have on the economic value of a mineral deposit. **3**

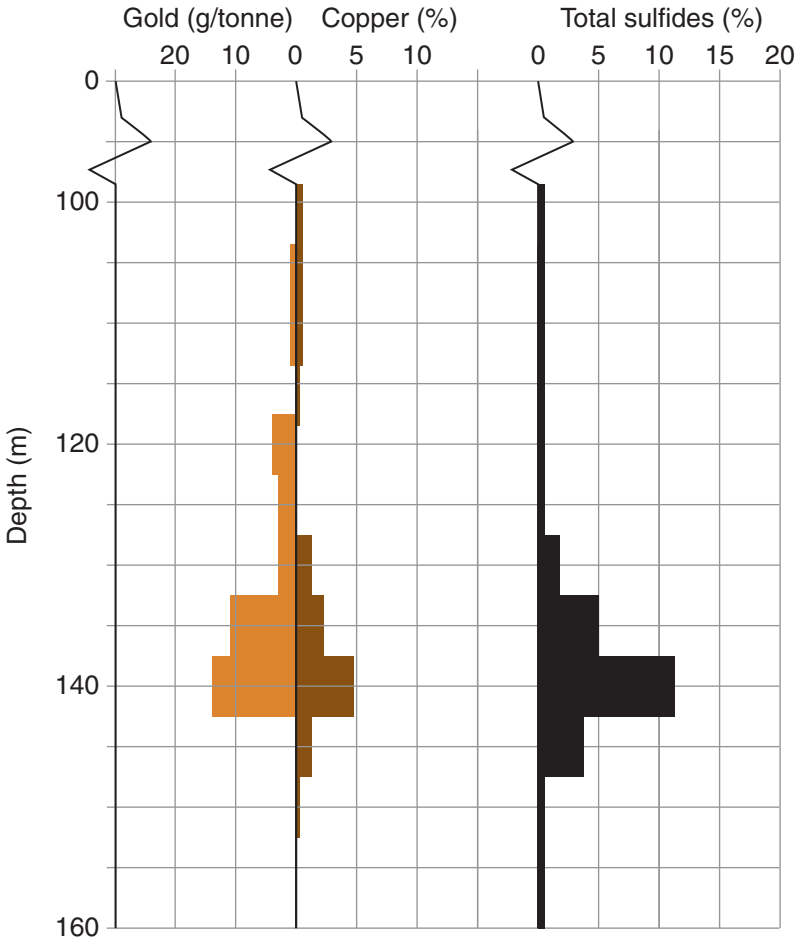
Question 33 continues on page 34

Question 33 (continued)

Answer parts (d)–(e) in Section II Answer Booklet 2.

(d) The photograph shows an abandoned gold-copper mine and the graph gives the assay results for a drill hole at Location X on the photograph.





Question 33 continues on page 35

(i) Describe the relationship between total sulfides and the grades for both gold and copper. **2**

(ii) Recommend an exploration program that includes both drilling AND one other exploration method that could determine whether there is a viable ore body below Location X. **4**

(e) Science is providing knowledge about Australia's renewable and non-renewable mineral resources. **6**

Assess how effectively this knowledge is being used to ensure a sustainable future for Australian mineral resources. Include examples in your answer.

End of Question 33

Question 34 — Oceanography (25 marks)

Answer parts (a)–(c) in Section II Answer Booklet 1.

(a) (i) Light availability is one physical feature of oceans. Identify TWO other physical features. **1**

(ii) Explain how light availability varies within Earth's oceans. **3**

(b) Describe the adaptations that organisms have evolved in response to the abiotic conditions around deep sea hydrothermal vents. **4**

(c) (i) Describe a process that renews the oxygen supply on the ocean floor. **2**

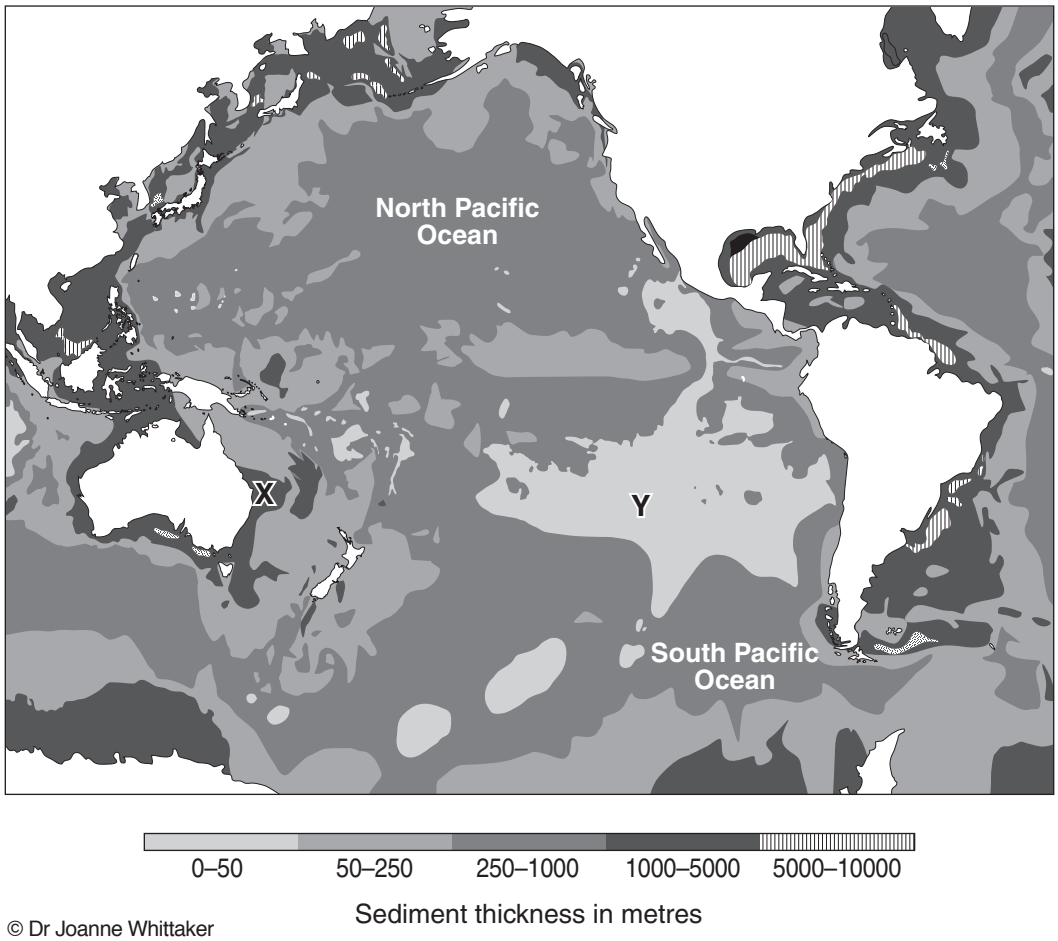
(ii) Draw a flow chart or labelled diagram showing the movement of carbon and oxygen between the oceans and the atmosphere. **3**

Question 34 continues on page 37

Question 34 (continued)

Answer parts (d)–(e) in Section II Answer Booklet 2.

(d) The map shows the variation in sediment thickness in the oceans.



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(i) Identify a typical sediment you would expect to find at each of the locations X and Y. **2**

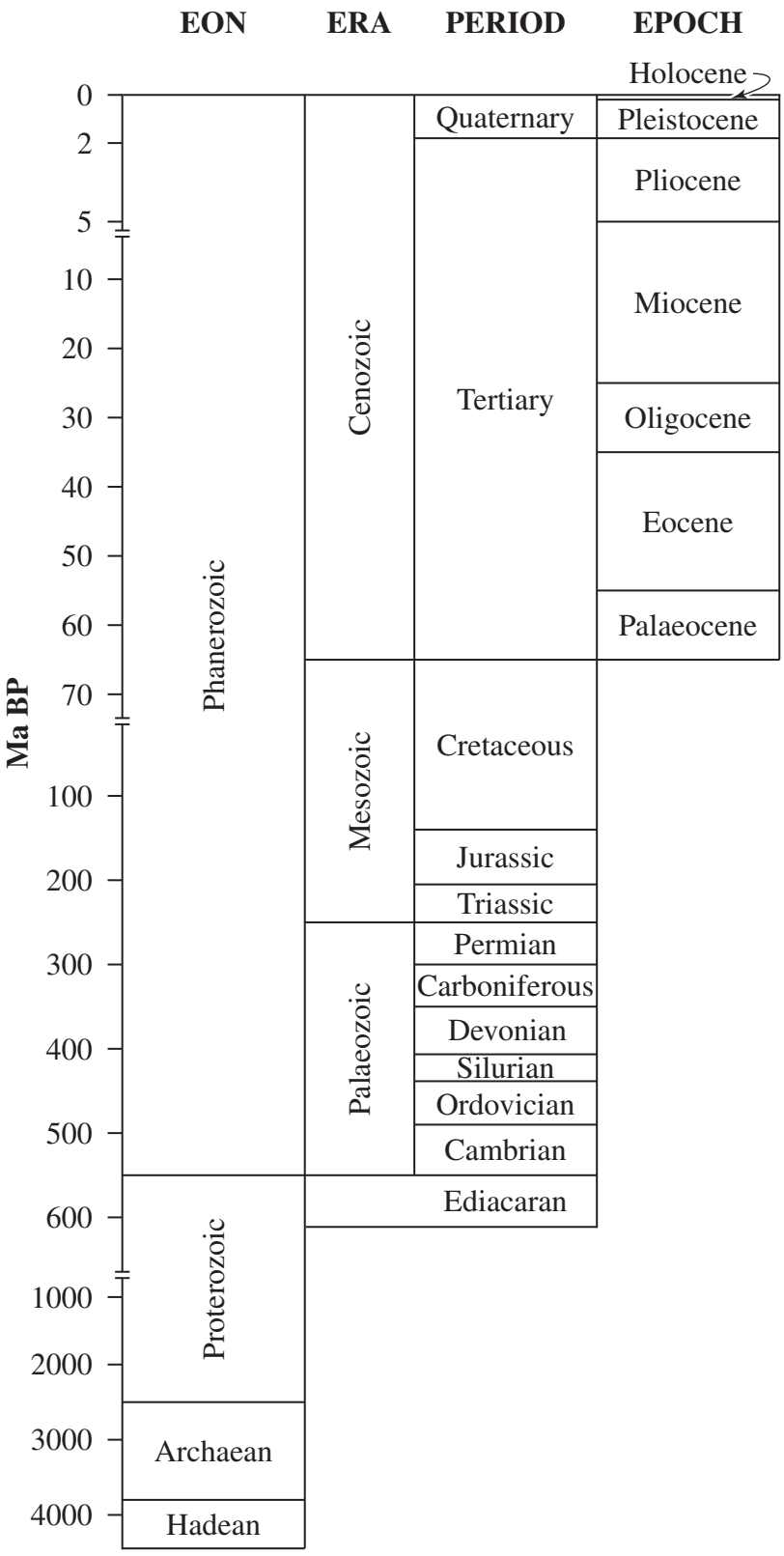
(ii) Use the map to account for the variations in sediment thickness in the Pacific Ocean. **4**

(e) Science is providing knowledge about the nature of the oceans and their resources. **6**

Assess how effectively this knowledge is being used to ensure a sustainable future for the oceans. Include examples in your answer.

End of paper

Geological Time Scale



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