
Student Number

Abbotsleigh

2020

HIGHER SCHOOL CERTIFICATE
TRIAL HSC

Earth and Environmental Science

This PAPER does not necessarily reflect the content or format of the Higher School Certificate Examination for this subject.

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen only.
- Draw diagrams using pencil.
- NESA approved calculators may be used.
- Write your student number at the top of this page and the multiple choice answer sheet.
- The multiple choice answer sheet may be detached from the back of this exam.
- Use the extra writing space provided on page 32

Total marks – 100

Section I –20 marks (pages 2-12)

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

Section II – 80 marks (pages 13-31)

- Attempt Questions 21-28
- Allow about 2 hours and 25 minutes for this section.

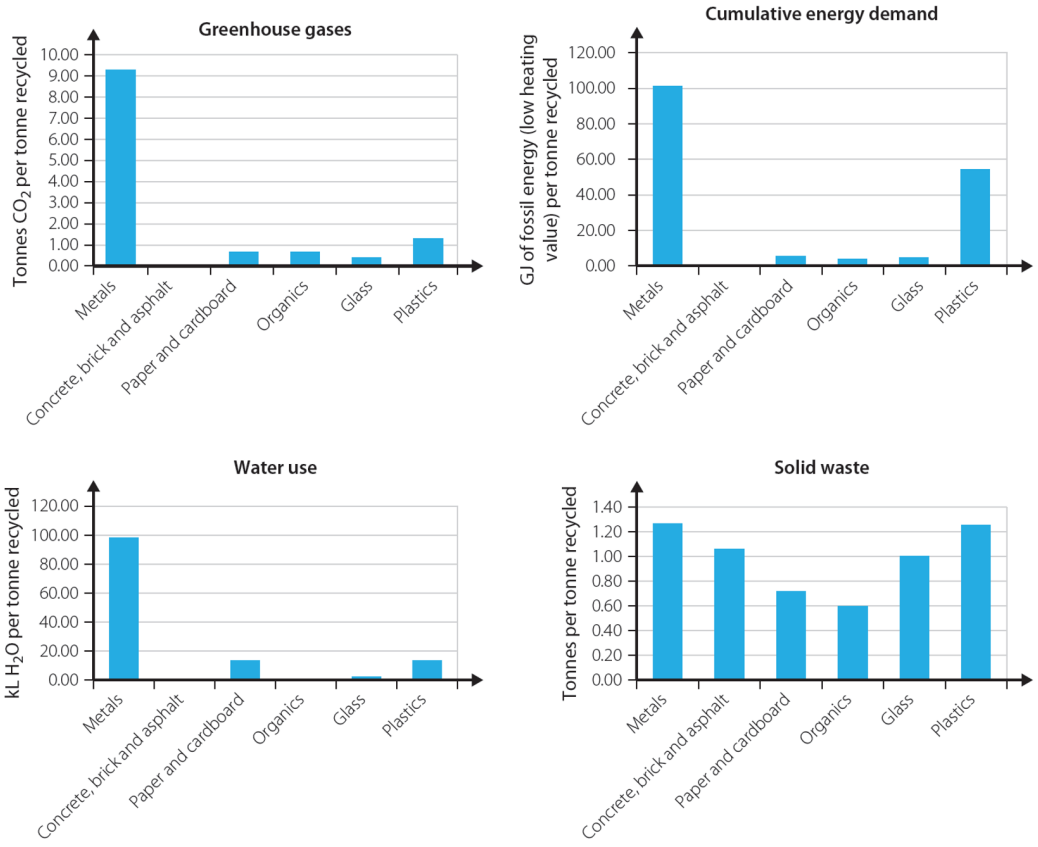
Section I Multiple Choice	20
Section II Written Responses	80
Total	**100**

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

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

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1 The diagrams below illustrate the average net benefit of recycling 1 tonne of waste by category.



Which is of the following statements is supported by this data?

(A) The greatest environmental benefit comes from recycling metals. Plastics also contribute significantly to the waste stream however there is no benefit to recycling plastics in regard to its contribute to greenhouse gases.

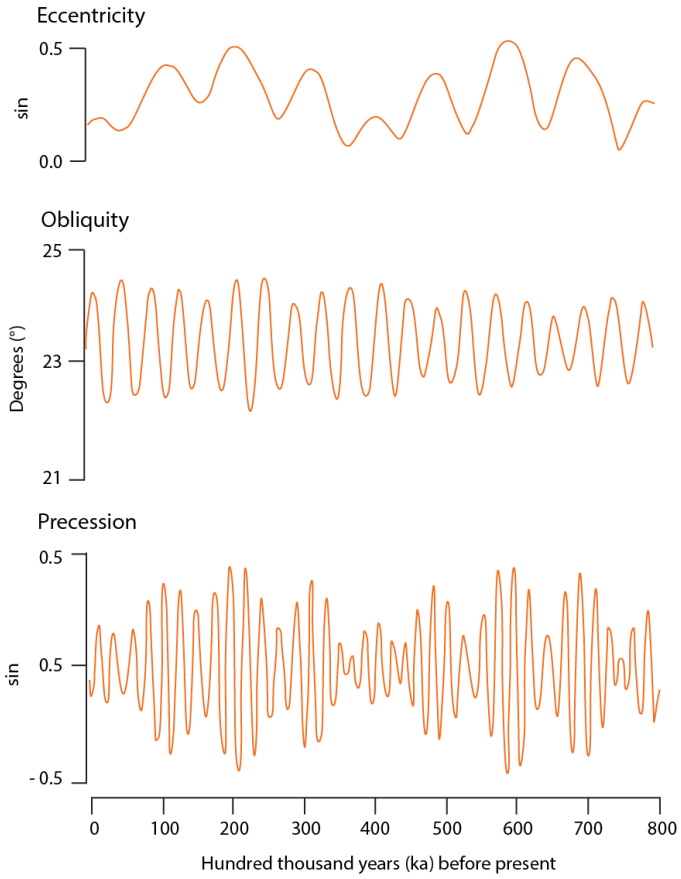
(B) The greatest environmental benefit comes from recycling plastics. Concrete, brick and asphalt have little benefit in terms of greenhouse gases, energy and water but great benefit in terms of avoiding landfill.

(C) The greatest environmental benefit comes from recycling metals. Concrete, brick and asphalt have little benefit in terms of greenhouse gases, energy and water but great benefit in terms of avoiding landfill.

(D) The greatest environmental benefit comes from recycling organics, they contribute the most significantly to landfill.

2 The diagram below shows the Milankovich cycles.

On what timescale do these variations occur?



(A) Hundreds of years

(B) Thousands of years

(C) Millions of years

(D) Billions of years

3 Which of the following statements accurately describes hydrothermal vent communities?

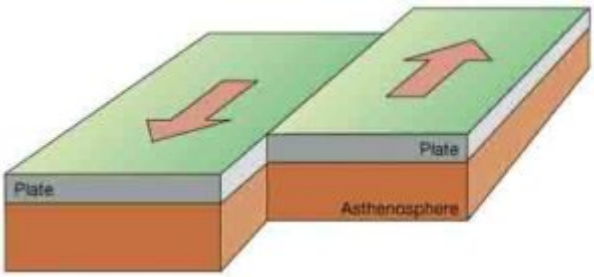
(A) The photosynthetic microbes generate carbohydrates. This supports a range of species who are adapted to survive in high H_2S concentrations.

(B) The chemosynthetic microbes generate carbohydrates. This supports a range of species who are adapted to survive in high H_2S concentrations.

(C) The photosynthetic microbes generate carbohydrates. This supports a range of species who are adapted to survive in low H_2S concentrations.

(D) The chemosynthetic microbes generate proteins. This supports a range of species who are adapted to survive in high H_2S concentrations.

4 Identify the activity which occurs at the plate boundary illustrated in the following diagram.



(A) Strike - slip fault

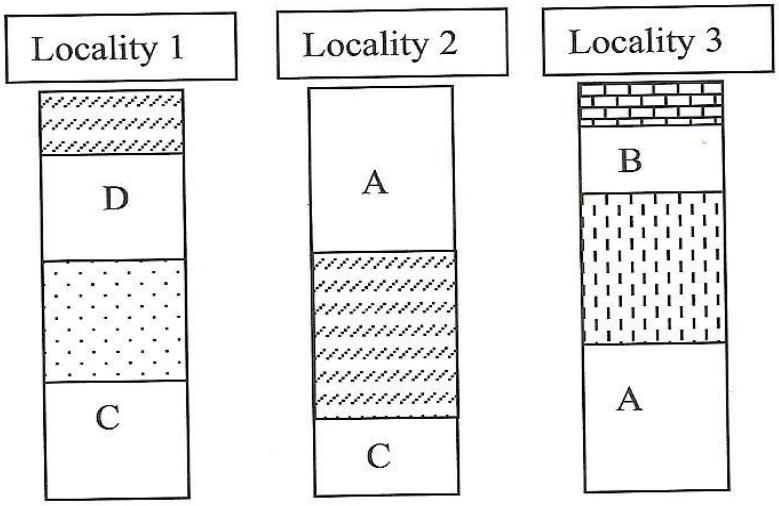
(B) Reverse fault

(C) Hanging fault

(D) Normal fault

5 The following diagram shows four fossils of short-lived organisms (A, B, C, D) present in geological sequences from three localities.

What is the correct sequence of fossils from oldest to youngest?



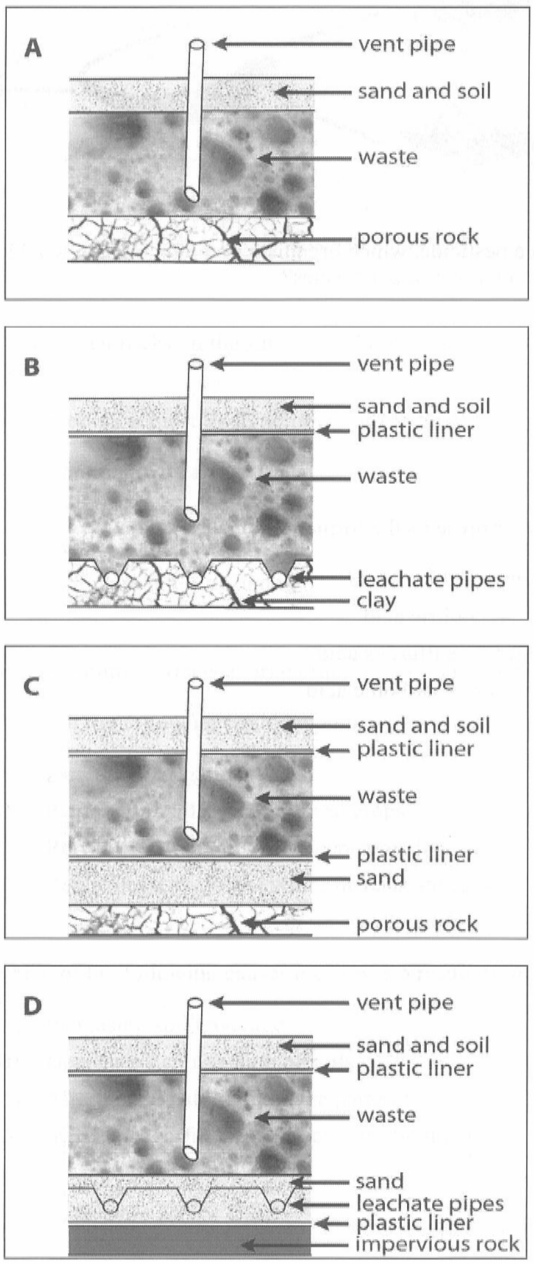
(A) C, A, D, B

(B) D, C, A, B

(C) C, D, A, B

(D) D, C, B, A

6 Which of the following models would best satisfy the requirements for waste storage in landfill?



7 Which of the following mining methods would be the most appropriate to evacuate ore which is located close to the surface?

(A) Strip/open cast mining

(B) Room and pillar mining

(C) Longwall mining

(D) Onshore drilling

8 What is meant by the term fault creep?

(A) The sideways and downward movement of a plate into the mantle beneath another plate.

(B) The movement of two plates that are locked together to move past one another in the absence of earthquake activity but can show displacement on the fault's surface.

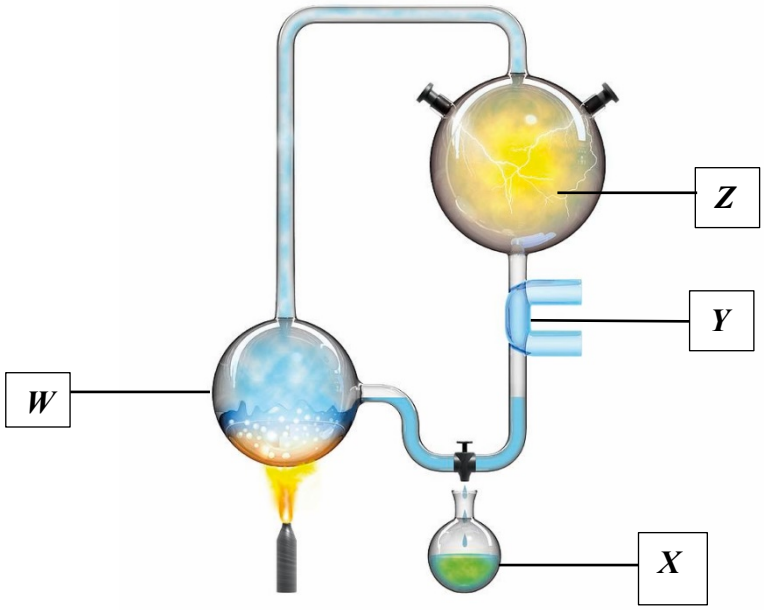
(C) The movement of two plates that are not locked together to move past one another in the absence of earthquake activity but can show displacement on the fault's surface.

(D) The movement of two plates that are not locked together to move past one another in the presence of earthquake activity but can show displacement on the fault's surface.

9 Consider the summary table below. Which row correctly summarises the methods used to study past climates?

	Method	*Measurement*	*Indicator*	*Time span*
(A)	Tree rings	Ring colour	Darker colours indicate warm weather conditions and more precipitation	Hundreds to thousands of years
(B)	Thermometers	Temperature	Temperature records at specific locations	Past 150 years
(C)	Ice cores	Concentration of gases in ice and ocean water	Higher O-18 levels indicate a colder climate	Past 150 years
(D)	Ocean sediments/fossils	Concentration of oxygen isotope O-18 in shell of microorganisms	Lower O-18 levels indicate a colder climate	Hundreds of thousands to millions of years

10 The apparatus below was used by Urey and Miller in their famous experiment.



Which row of the table correctly labels each portion of the apparatus?

	W	*X*	*Y*	*Z*
(A)	Boiling oceans	Amino acids	Cooling atmosphere	Lightning
(B)	Heated atmosphere	Excess fluid	Water diversion	Hydrogen gas
(C)	Elemental solution	Simple life	Condensation	UV radiation
(D)	Oxygenated water	Proteins	Gas addition tubes	Neon gas

11 What are cyanobacteria?

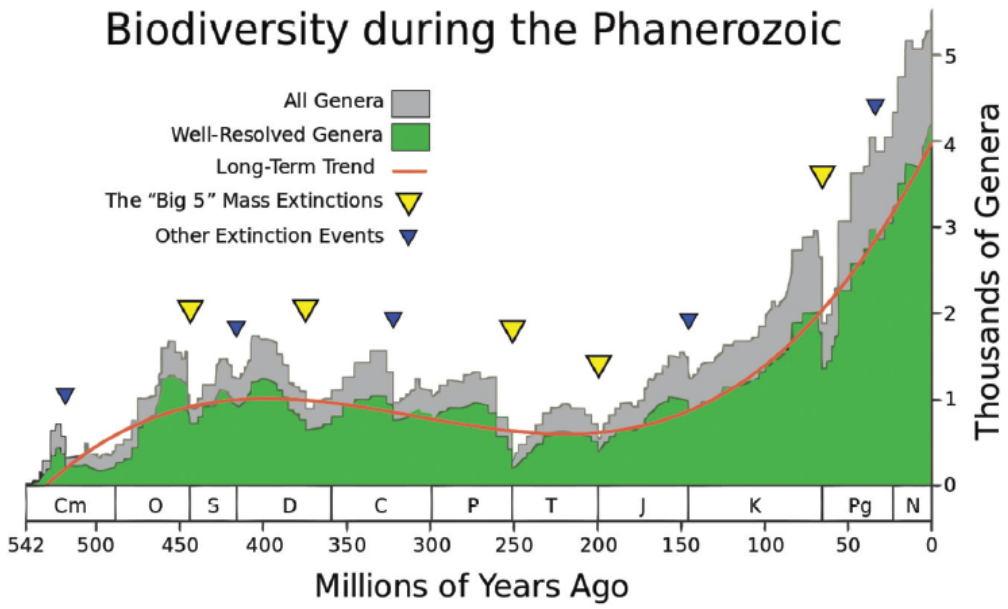
(A) Complex single-celled organisms that derive energy from photolysis

(B) Simple single-celled organisms that derive energy from photosynthesis

(C) Complex multi-cellular organisms that derive energy from fermentation

(D) Simple single-celled organisms that derive energy from chemosynthesis

12 Which of the following statements is supported by the data illustrated in the graph below?



(A) Increasing variation during the phanerozoic period was uninterrupted by extinction events.

(B) Decreasing variation during the phanerozoic period was punctuated by extinction events.

(C) Increasing variation during the phanerozoic period was punctuated by extinction events.

(D) Increasing variation during the phanerozoic period was caused by extinction events.

13 How does the process of ocean acidification affect marine organisms with hard shells?

(A) The nitrous oxide absorbed by our oceans reacts with water to produce hydrogen ions. The hydrogen ions remove the carbonate ions marine organisms require to build their hard shells.

(B) The carbon dioxide absorbed by our oceans reacts with water to produce carbonate ions. These are used by marine organisms to build their hard shells.

(C) The carbon dioxide absorbed by our oceans reacts with water to produce hydrogen ions. The hydrogen ions are toxic to marine organisms and result in their death.

(D) The carbon dioxide absorbed by our oceans reacts with water to produce hydrogen ions. The hydrogen ions remove the carbonate ions marine organisms require to build their hard shells.

14 Which plate boundaries are associated with ONLY shallow focus earthquakes?

(A) Divergent plate and transform boundaries

(B) Divergent and convergent plate boundaries

(C) Convergent and transform plate boundaries

(D) Convergent and collision plate boundaries

15 Which of the following sequences correctly illustrates the waste hierarchy wherein the options are listed from MOST preferable to LEAST preferable?

(A) Reuse waste → treat waste → recover energy → dispose of waste

(B) Reuse waste → recover energy → treat waste → dispose of waste

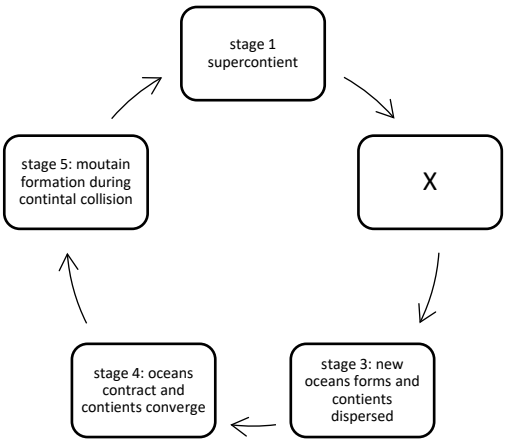
(C) Reuse waste → treat waste → dispose of waste → recover energy

(D) Treat waste → Reuse waste → dispose of waste → recover energy

16 Consider the summary table below. Which row correctly describes the greenhouse gases?

	Greenhouse gas	*Forcing*	*Natural processes*	*Human processes*
(A)	Methane	Negative	Wetlands	Ruminant digestion
(B)	Water vapour	Positive and negative	Water cycle	Fossil fuel combustion
(C)	Carbon dioxide	Positive	Photosynthesis	Deforestation
(D)	Nitrous oxide	Positive and negative	Nitrogen cycle	Agriculture and soil management

17 The flowchart illustrates the stages of the plate tectonic super cycle. Identify the missing stage X.



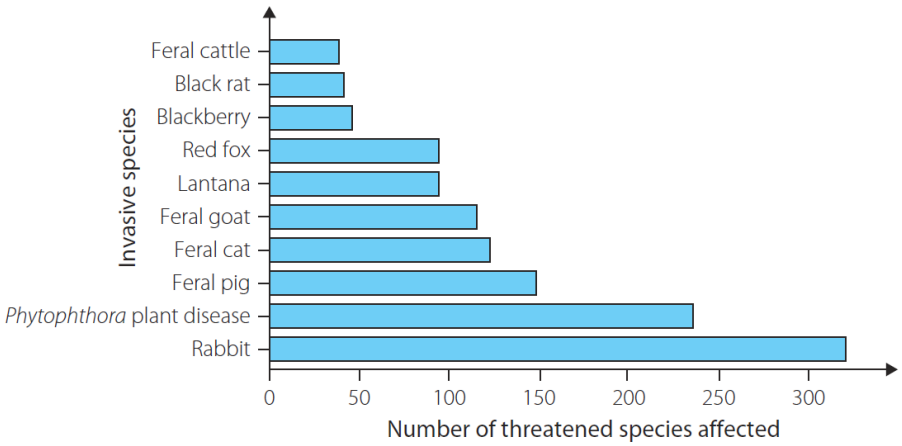
(A) Transgression

(B) Subduction

(C) Convergence

(D) Rifting

18 The graph below illustrates the top 10 invasive species in Australia and the number of threatened species they affect.



Which statement is NOT supported by the data shown?

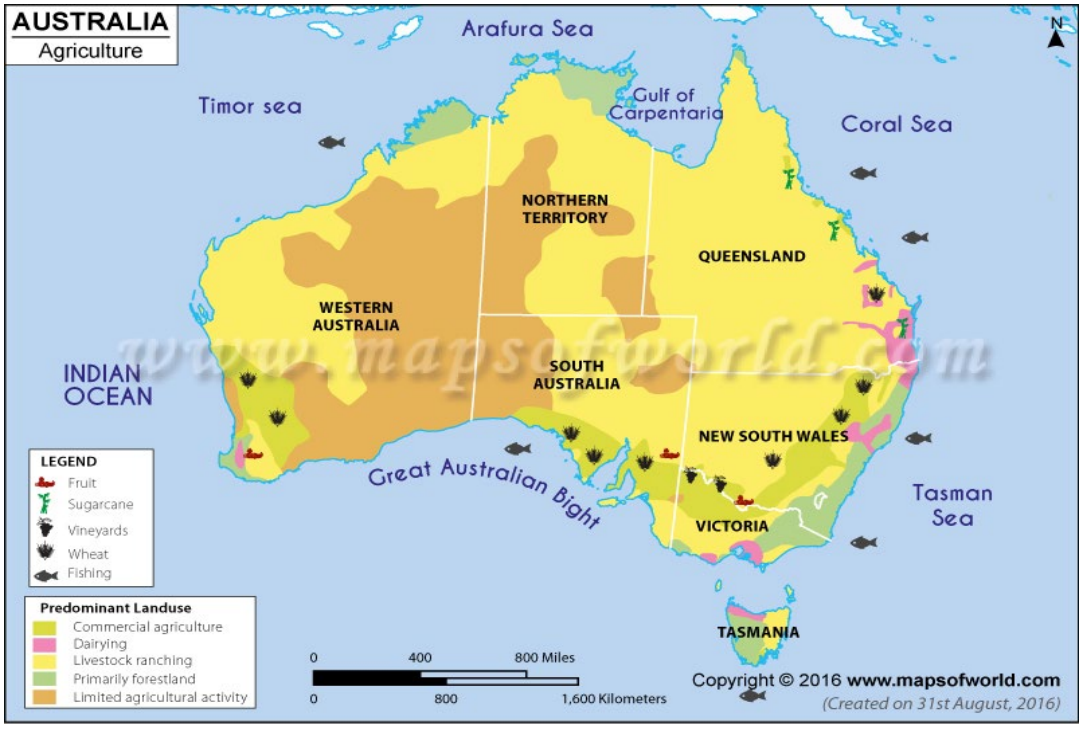
(A) Rabbits present the greatest threat to native species; they threaten approximately twice as many species as the black rat.

(B) Rabbits present the greatest threat to native species; they threaten more than 300 native species.

(C) Feral cattle present the weakest threat to native species.

(D) Feral pigs present a reasonable threat to native species, they threaten less species than rabbits however more than black rats.

19 The map below provides an overview of Australian agriculture. Which of the following statements is supported by the map?



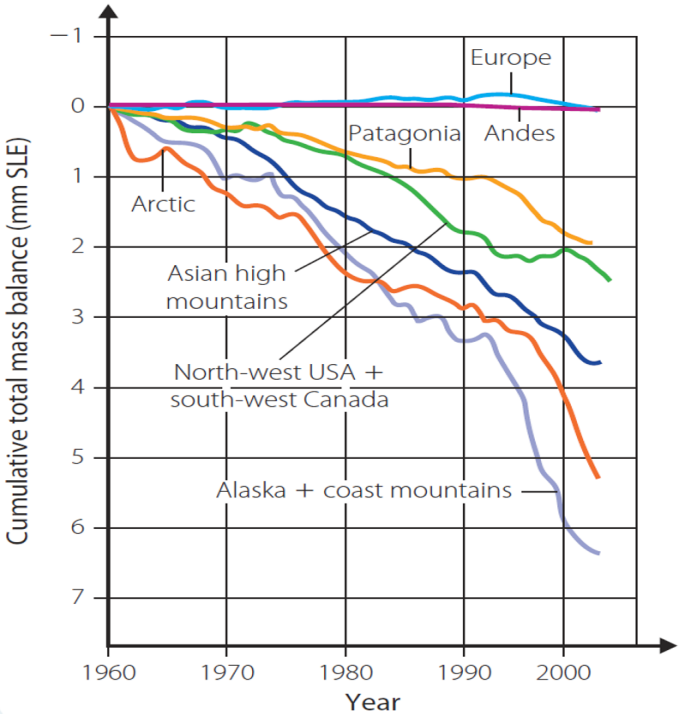
(A) Tasmania has the greatest potential for timber industry.

(B) East coast fisheries provide most of the fish eaten in Australia.

(C) New South Wales has the greatest variety of agriculture in Australia.

(D) Livestock ranching is the most profitable agriculture in Western Australia.

20 The graph below illustrates mass balance changes for selected glaciers and ice caps. Which of the following statement is NOT supported by the data?



(A) All glaciers and ice caps have decreased in mass between 1960 and 2000.

(B) The Alaska and coast mountains glacier have shown the greatest decrease in mass.

(C) There has been little change in the Andes ice cap.

(D) A greater mass decline can be seen with the Asian high mountains compared to Patagonia.

End of section I

Student Number

Section II – 80 marks
Attempt Questions 21-28
Allow about 2 hours and 25 minutes for this section

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

Question 21 (11 marks)

The image below illustrates the process of mountain top removal. This mining method requires explosives to blast debris off mountain tops in order to reach coal seams deep inside the earth, sometimes 122 meters below the surface.



(a) Describe the potential damaging impacts associated with this process. **3**

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(b) Outline the multiple challenges associated with mining rehabilitation methods and describe how these challenges are overcome. **4**

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(c) Discuss best practice for involvement of traditional owners in the mining process, using named examples. **4**

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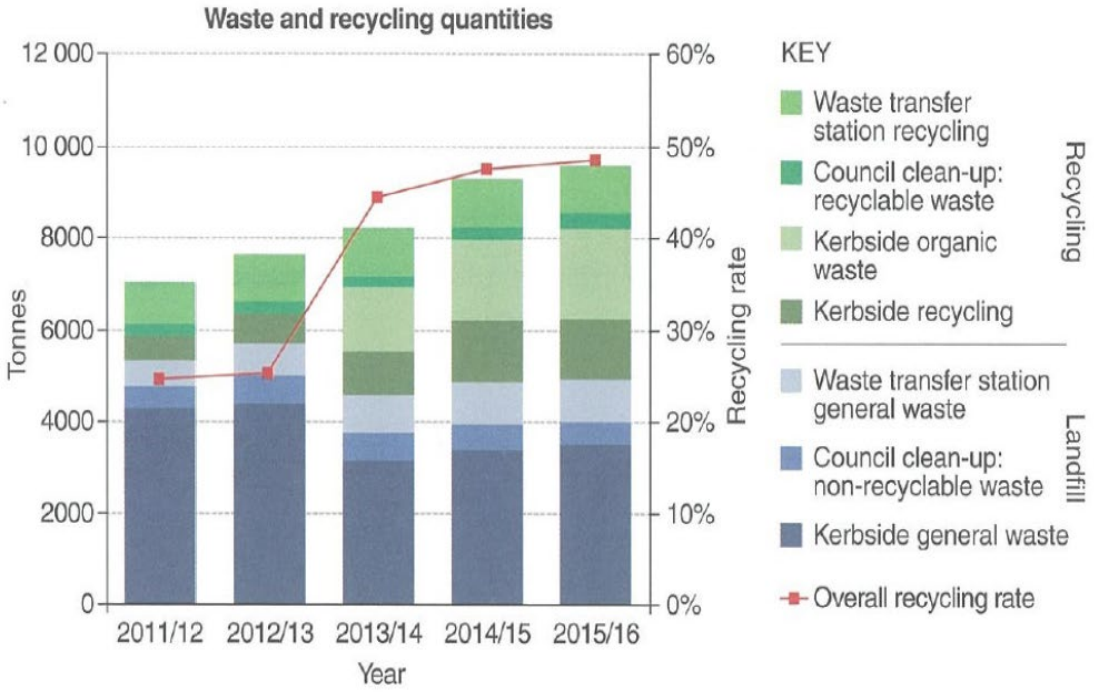
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End of question 21

Question 22 (12 marks)

The graph shows the breakdown of recycled versus landfill quantities from 2011 to 2016 for a town in NSW.



Use the graph to answer the following questions.

(a) Based on the graph, which measure has the greatest influence on the overall recycling rate between 2011/12 to 2015/2016? Justify your answer. **2**

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(b) Outline the environmental concerns associated with landfills as a means of solid waste disposal AND explain how modern engineered landfills are designed to prevent these problems. **3**

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(c) According to the waste hierarchy: **Resus or recycling methods are favourable to landfill as solid waste disposal management method.** **7**

Using examples which illustrate Australia's approach to waste management, evaluate this statement.

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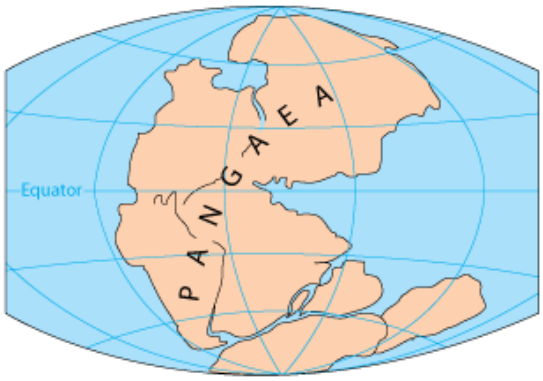
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End of Question 22

Question 23 (8 marks)

A supercontinent is a single continental landmass made of all or most of the continental lithosphere at the time. The image below illustrates Pangaea, a supercontinent that existed during the late Paleozoic and early Mesozoic era.

Supercontinent formation is a repeating, cyclic process. The plate tectonic supercycle affects climate and evolution.



PERMIAN
250 million years ago

(a) In the space below create a flowchart to illustrate how increased weathering after supercontinent formation leads to icehouse climate conditions. **4**

(b) Analyse the role of the plate tectonic supercycle on evolution. Use named examples of supercontinents and species. **4**

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End of Question 23

Question 24 (13 marks)

The map below shows the Islands of Japan.



(a) Draw a labelled cross-sectional diagram of the Section A. **4**

(b) Explain the nature of earthquakes at the type of plate boundary illustrated in part (a) **2**

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(c) Describe ground shaking as a potential hazard of earthquakes and outline ONE method which could be implemented to reduce the impact of this hazard. **3**

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(d) In reference to fault type and plate interaction compare the resultant seismic activity. **4**

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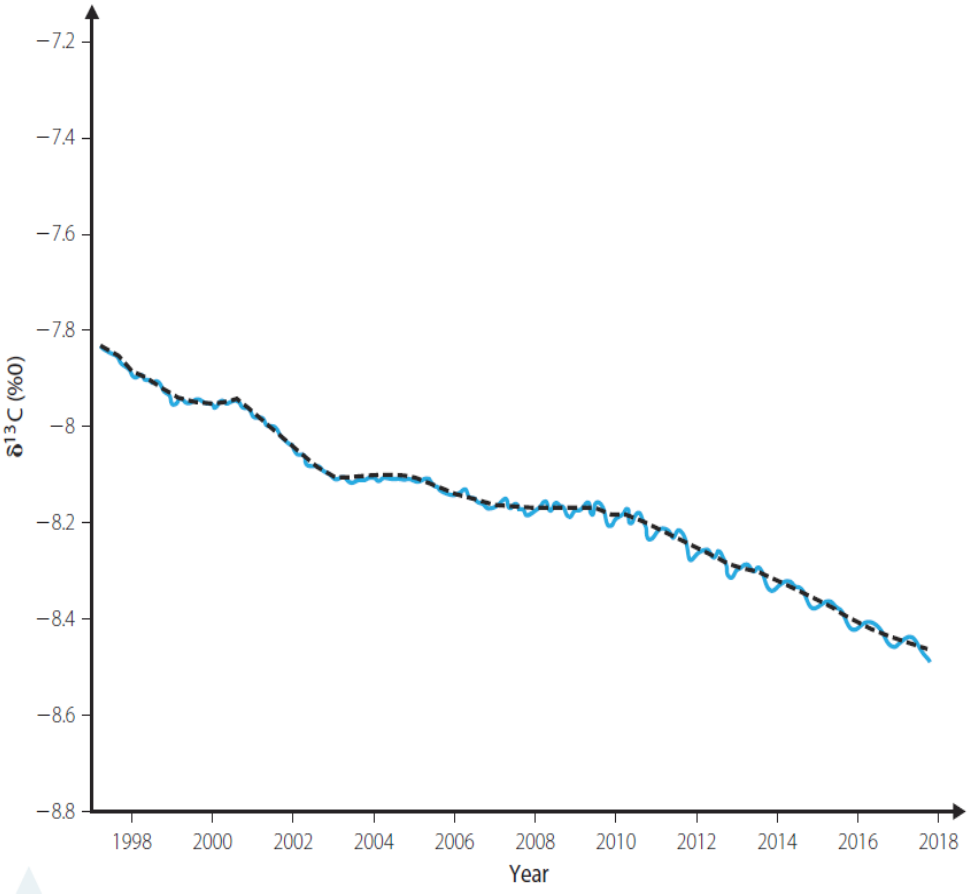
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End of question 24

Question 25 (11 marks)

Climatologists study how long it takes for the climate to change and what causes these changes to occur.

The data presented below illustrates the change in the ratio of carbon -13 to carbon -12 in atmospheric CO_2 ($\delta^{13}C$) over time. The data comes from Baring Head in New Zealand. Continuous measurements there have been occurring since the 1970s.



(a) With reference to the data shown, describe the trend in the ratio of carbon -13 to carbon -12 in atmospheric CO_2 ($\delta^{13}C$) over time. **2**

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(b) Explain how the data shown can be used to attribute climate changes to human activity. **2**

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(c) Compare the natural and anthropogenic greenhouse effect. **3**

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(d) Assess changes in the Earth's orbit around the Sun as causes of natural climate variation and the timescales in which changes occur. **4**

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End of question 25

Question 26 (7 marks)

The fossil below is *Redlichia rex*, a trilobite from the Early Cambrian which was extracted from Emu Bay Shale deposits in South Australia.



(a) Draw a flow chart to show major steps in the formation of the *Redlichia* fossil. **3**

(b) Explain how stratigraphic principles, fossils and absolute dating can be used to date the Cambrian event. **4**

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End of question 26

Question 27 (7 marks)

The evolutionary history of life on earth traces the processes by which living, and fossil organisms evolved from the earliest emergence of life to the present. The image below depicts the Murchison meteorite.



(a) Outline the panspermia hypothesis and explain how the Murchison meteorite provided evidentiary support for this theory. **3**

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(b) Harold Urey and Stanley Miller, at the University of Chicago in the early 1950s investigated the general idea that the atmospheric and physical conditions of early Earth enabled life to develop. **4**

Outline the methodology of their investigation and explain the implication of their work on our understanding of the development of life on earth.

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End of question 27

Question 28 (11 marks)

Carbon dioxide levels today are higher than at any point in at least the past 800,000 years. The data table below shows the change in CO_2 in the atmosphere and annual emissions between 1750 -2020.

Year	1750	1780	1810	1840	1870	1900	1930	1960	1990	2020
Atmospheric CO_2 (parts per million)	280	282	283	283	288	300	312	320	360	404
CO_2 emissions (billons of tons)	260	264	264	266	266	268	270	290	340	400

(a) Draw a graph of the data using **TWO** lines on the grid below. **4**

(b) Describe the trend in the change in CO_2 in the atmosphere and annual emissions between 1750 -2020. **2**

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(c) Describe and discuss ancient evidence and more recent evidence of variations in global temperature. **5**

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End of question 28

End of section II

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Multiple Choice Answer Sheet Student Number

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 ◯

1	A ◯	B ◯	C ◯	D ◯
2	A ◯	B ◯	C ◯	D ◯
3	A ◯	B ◯	C ◯	D ◯
4	A ◯	B ◯	C ◯	D ◯
5	A ◯	B ◯	C ◯	D ◯
6	A ◯	B ◯	C ◯	D ◯
7	A ◯	B ◯	C ◯	D ◯
8	A ◯	B ◯	C ◯	D ◯
9	A ◯	B ◯	C ◯	D ◯
10	A ◯	B ◯	C ◯	D ◯
11	A ◯	B ◯	C ◯	D ◯
12	A ◯	B ◯	C ◯	D ◯
13	A ◯	B ◯	C ◯	D ◯
14	A ◯	B ◯	C ◯	D ◯
15	A ◯	B ◯	C ◯	D ◯
16	A ◯	B ◯	C ◯	D ◯
17	A ◯	B ◯	C ◯	D ◯
18	A ◯	B ◯	C ◯	D ◯
19	A ◯	B ◯	C ◯	D ◯
20	A ◯	B ◯	C ◯	D ◯

HSC Earth and Environmental Science

Assessment Task 4 Trial Examination

Marking Guidelines and Sample Responses

Section I: Part A

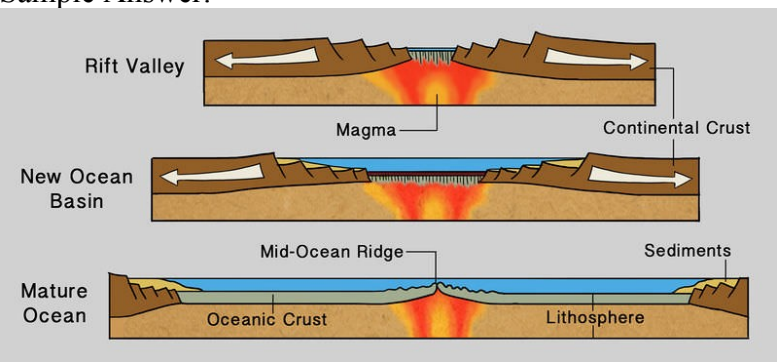
Multiple-choice Answer Key

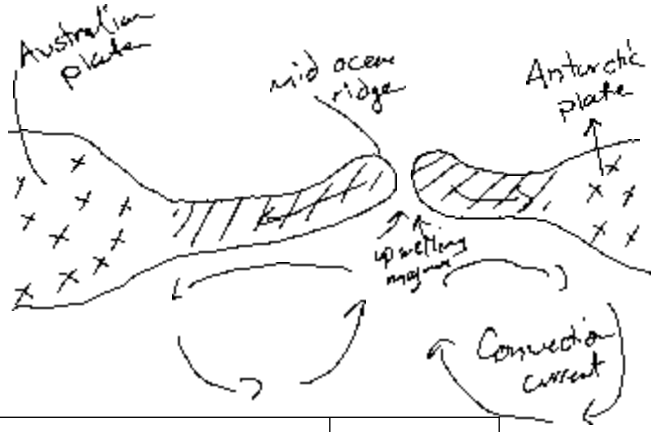
Q1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B	**A**	**C**	**D**	**A**	**C**	**B**	**C**	**C**	**C**	**C**	**D**	**C (B)**	**B**	**D**	**C**	**D**	**B**	**A**	**D**

Section II:
Question 21(a)

Criteria	Marks
• Well drawn diagram of correct boundary type with the following labelled (minimum): o Direction of plate movement o Mid-ocean ridge o Crust type OR name of plates	3
• Diagram not clearly showing divergent boundary type or missing key labels (see above	2
• Incorrect boundary type drawn	

Sample Answer:





Question 21(b)

Criteria	Marks
• Identifies the core as the source of heat for convection currents in mantle	1

Oceanic crust
Continental crust.

Question 21(c)

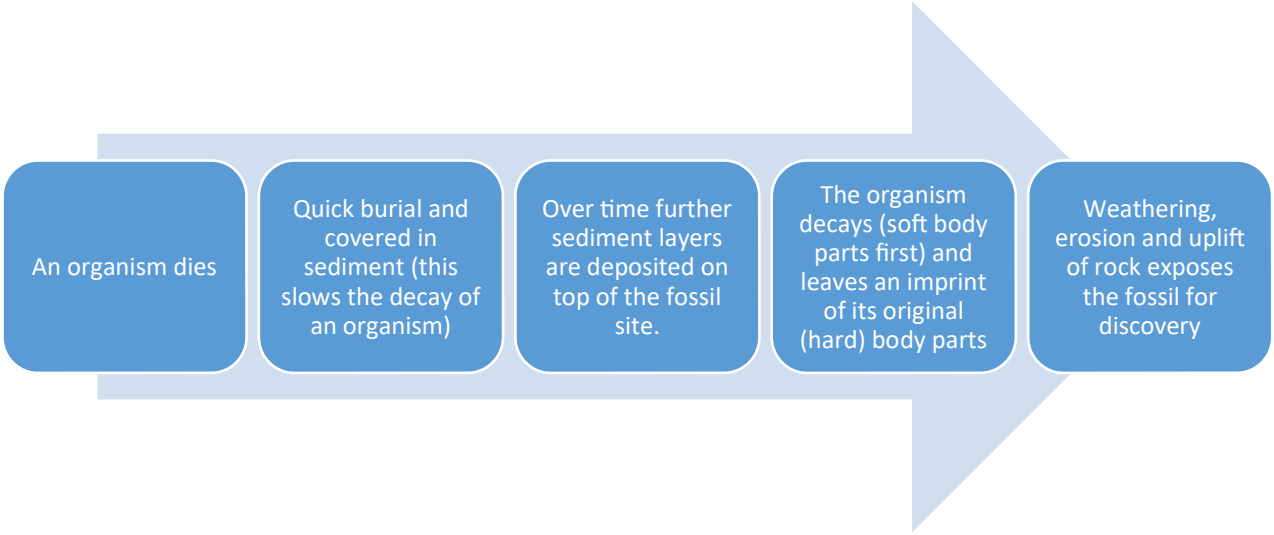
Criteria	Marks
• Provides significant details for the effect that the PTSS has on evolution	2
• Some relevant information provided	1

Sample answer:
The plate tectonic supercycle causes variations in the intensity of important global geological processes. Long-term variations in Earth's climate, the amount of continental weathering, the availability of nutrients in the oceans and the composition of the atmosphere combine to influence the evolution of life on Earth. For example, the movement of continents across the globe into differing climate regions causes animals and plants present on different continents to adapt to the differing climates.

Question 22(a)

Criteria	Marks
• Shows 3-4 key stages of fossil formation to create a mould fossil • Correctly formatted flow chart including some kind of progression (ultimately arrows leading to stages or numbered stages). Simply a series of diagrams does not achieve this.	3
• Significant detail lacking in the stages of the fossil formation which distinguishes the formation of a mould fossil to other types of fossils OR • Not shows as a flow chart	2
• Some relevant information provided	1

Sample answer:



Question 23

Criteria	Marks
• Provides an accurate and brief summary of the formation of BIFs with reference to the following points: o The origins of iron o The production of oxygen o The reaction to form iron oxide o Accounts for the bands in the formations	3
• Missing key aspects from above	2
• Some relevant information provided	1

Sample Answer:
Photosynthetic cyanobacteria in stromatolites were producing oxygen in the oceans, but it reacted with the iron (from black smokers) dissolved in seawater to form iron oxide minerals on the ocean floor, creating banded iron formations.
Fluctuating oxygen levels…
The dark layers in this boulder are mainly composed of magnetite (Fe3O4) while the red layers are formed by silica rich sediments (SiO2). Some geologists suggest that the layers formed annually with the changing seasons.

Question 24

Criteria	Marks
• Provides points for and/or against a hypothesis for the extinction event • Refers to the data and one other piece of evidence	4
• Provides points for and/or against a valid hypothesis but does not engage with the data or provide other evidence	2-3
• Some relevant information provided	1

Sample answer:
One of the most widely accepted hypotheses for the end-cretaceous extinction event is that it was caused by an asteroid impact may have triggered the extinction event by ejecting huge quantity of rock debris into the atmosphere causing a 'blockout' of all solar radiation. With no sunlight, no photosynthesis could occur causing the death of green plants and disrupting food chains to higher animals such as the reptiles.
The provided data shows an increase at this time of iridium (a very rare-earth element) only present in the Earth's mantle and in extra-terrestrial rocks (such as asteroids). There is a also a large crater, 180km in diameter dating to the end of the Cretaceous buried beneath sediments in the Yucatan Peninsula in Mexico.

Question 25

Criteria	Marks
Demonstrates extensive knowledge and understanding of the adaptations observed in early Silurian invertebrates that colonised the terrestrial environments	5
Demonstrates sound knowledge and understanding of the adaptations associated with the colonisation of early terrestrial invertebrates	4
Makes some key relevant points for the colonisation of early terrestrial invertebrate animals	2-3
Provides some relevant information	1

Sample answer:
Animals (and plants) that were invading the land in the Silurian Period faced all sorts of environmental challenges to which they had to adapt to. Without the buoyancy provided by a marine environment, animals needed to support their body against gravity. The animals that were best adapted to life on land were the arthropods. They were very strong for their size, and already had an almost waterproof outer skeleton that was resistant to damage by ultraviolet light. Numerous paired and jointed limbs with internal muscles helped overcome gravity and allow movement over uneven terrestrial surfaces.

- Spiracles allowing oxygen intake/gas exchange.

Question 26

• Demonstrates an extensive knowledge and understanding of the concept of how anomalous animal behaviour may be used to predict earthquakes along with the limitations of such a '*technology'* • Demonstrates a thorough knowledge and understanding of one other technology and how it is used in predicting earthquakes • Provides a judgement based on criteria of the effectiveness of both technologies (either together or separately)	5

• Demonstrates a sound understanding of the two technologies and how they may be used in predicting earthquakes • Provides a judgement of the two technologies	4
• Demonstrate a basic understanding of the two technologies in predicting earthquakes	2-3
• Provides some relevant information	1

Sample answer:

To be an effective technology in predicting earthquakes a technology must be able to provide information on three factors:

i) The date and time of the event;
ii) The location of the epicentre; and
iii) The magnitude of the earthquake.

Anomalous animal behaviour has been suggested in the quote above from the Max Planck Institute as a method from which to predict earthquake activity based on the idea that some animals behave abnormally in the lead up to an earthquake. This however, does not effectively predict the three factors listed above as an effective earthquake prediction method as animals cannot reliably indicate the time an earthquake is due to occur, the location or the magnitude of the quake. While there may be some truth to this area of research it cannot be considered and EFFECTIVE prediction method for communities to evacuate an area in the lead up to an earthquake.

A strain-meter is another technology used to predict earthquake activity. These instruments are buried in boreholes around 200m deep and measure the movement of the walls of the hole relative to the diameter of the borehole and monitor the 'strain in crustal rock near active faults and volcanoes for earthquake activity. They have a high precision of less than 1 part per billion. These devices are currently in place along the San Andreas Fault. While it is very difficult to predict and earthquake event, Strainmeters are much more effective in predicting earthquake activity in a specific region than anomalous animal behaviour, however, the effectiveness relies on a timely warning and so a great knowledge of the area and previous measurements leading up to an earthquake is required for it to act as a prior warning system.

Question 27

Criteria	Marks
• Details the physical impacts both positive and negative of bushfires in the Australian environment. • Provides a judgement based on criteria of the physical impact of bushfires on the Australian environment • Demonstrates an extensive knowledge and understanding of the key features of human activities and how they contribute to the frequency AND magnitude of bushfires referencing several examples of human activities and their effects.	8
• Provides a judgement, with reference to criteria, of the physical impact of bushfires on the Australian environment • Demonstrates a thorough knowledge and understanding of the effects of human activities and their contribution to the frequency and magnitude of bushfires	6-7
• Attempts to make a judgement on the physical impact of bushfires on the environment • Demonstrates a sound knowledge of how human activities may effect the frequency OR magnitude of bushfires	4-5
• Provides key information on the impact of bushfires on environments generally	2-3

• Links human activities to the frequency or severity of bushfires	
• Provides some relevant information	1

Answers may include:
Physical impacts:

- Positive: regeneration of Australian native plants, destruction and removal of introduced and pest species reduces competition for natives.
- Negative: destruction of habitat, disruption to natural food chains, native wildlife put at risk of burning and threatens populations of many species. Human infrastructure damage including housing and lives put a risk, smoke hazards from bushfires can travel long distances causing respiratory hazards.

Human Impacts: **big factor – climate change**.

- Scientists predict extreme bushfires in Australia to more frequent and severe without substantial and rapid action to reduce greenhouse gas emissions.
- *Frequency:* As a result of human induced climate change, the fire seasons in Australia have started earlier due to longer and hotter heatwaves occurring earlier in the bush fire season.
- More temperature record breaking days occurring throughout the bushfire season.
- *Magnitude:* Prolonged and more intense droughts due to burning of coal, oil and gas driving up global temperatures. Aus. Experienced a 15% decline in late autumn rainfall.
- Fewer opportunities for 'hazard reduction burns' (or bushfire fuel reduction burns).
- Drier vegetation being more flammable (both frequency and magnitude)

Good source: www.climatecouncil.org.au/not-normal-climate-change-bushfire-web/

Question 28a

Criteria	Marks
• Provides characteristics and features of both hazards AND outlines the impact on either the biosphere or atmosphere for both	4
• Some detail missing or incorrect in one of the four areas	3
• Two boxes completed successfully	2
• Some relevant information	1

Sample Answer:

Hazard	Description of Hazard	Impact on the Biosphere and/or atmosphere
Ash eruptions	Explosive eruptions generate ash. Ash particles are generally <10-30 um in diameter and form clouds which settle on the landscape for many km around eruption. Ash is easily carried on the wind for very long distances.	Can have devastating effects on other living things and can bury cars and buildings. Ash often blankets pastures and fields and other vegetation as well as blocking out solar radiation causing huge declines in the photosynthetic rates of plants which of course disrupts food chains.
Lava flows	Magma that rises to the surface and released as molten rock and pours or oozes from an erupting vent. Lava is erupted during either effusive activity or explosive lava fountains. Its velocity depends on its viscosity, but is generally fairly slow moving.	Deaths caused directly by lava flows are uncommon because most lava moves slowly enough that people can evacuated areas, however, vegetation and other living things which cannot quickly escape will be burned in the lava path. Long term increases soil fertility as solid lava weathers.

Question 28(b)

Criteria	Marks
• Distinguishes between a geological hazard and a disaster by referring to the impact on human life and civilisation	2
• Provides some relevant information	1

Sample Answer:
A geological disaster occurs when natural geological processes impact on our activities, either through loss of life or injury, or through economic loss. A geological hazard is a potential disaster.

From textbook:
A geological hazard becomes a disaster "when it exceeds a societies ability to cope with the impacts of the event" – rising death toll, economic, infrastructure damage. Pg 128

Question 29

Criteria	Marks
• Demonstrates extensive understanding about the use of models in Earth and Environmental Science • Makes a judgement on the value of modelling by weighing up the benefits and limitations • Refers to the Tsunami model pictured and one other named model from the course	6
• Demonstrate a sound knowledge of how models are used in Earth and Environmental Science • Makes a judgment • Refers to the provided model and one other	4-5
• Demonstrates a basic understanding on the use of models in EES	2-3
• Provides some relevant information	1

Sample Answer:
Modelling is used in Earth and Environmental Science in order to make understanding complex processes and other phenomena accessible to the general society. This however, often has its limitations. In simplifying certain processes we compromise on specific details of the process and this can lead to misunderstanding.
The model illustrated incorporates a range of prediction factors and helps society to understand the potential wave height of a 1-in-1000 year tsunami event and indicates that the West coast of Australia would expect a taller wave height (4.0m) than the south-east coast of Australia. However, this could be misread that it only has the possibility of occurring once every 1000 years when this is really only a risk factor.
Another helpful model is that of climate modelling which takes large amounts of data to graphically predict the possible rise in temperature under different carbon emission scenarios. These graphs are helpful in getting society to see the potential impacts of not changing behaviours vs. implementing different strategies.

Question 30

Criteria	Marks
• Demonstrates a thorough understanding of the ENSO cycles and how this is related to (or causes) various climatic events in Australia including flooding. o Identify change in sea temperautres between Aus and south America (pacific ocean) o Relate the change in sea temp to other aspects of the ENSO system (increased trade winds, warmer temps at east aus) o Relate the changes in ENSO conditions to increased rainfall and therefore flooding	3
• Describes ENSO in general terms and links the model to flood events in Australia	2
• Provides some relevant information	1

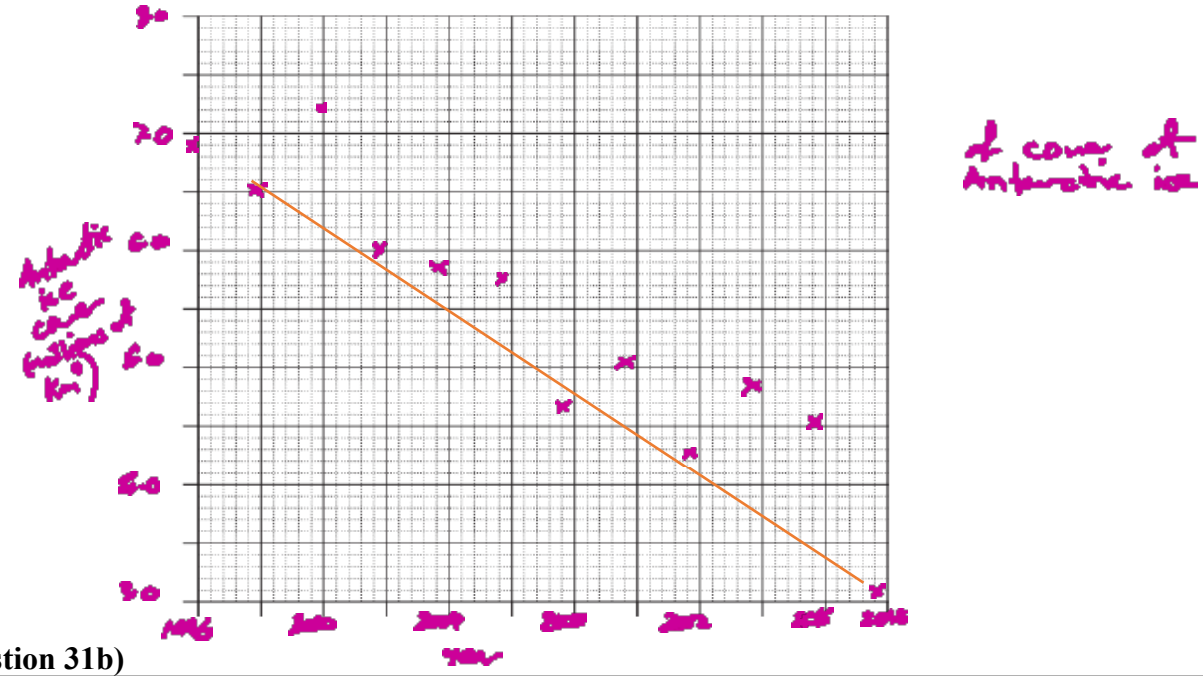
Sample answer:

Australia's weather is influenced by many climate drivers, El-Nino and La Nina are perhaps the strongest influence on year-to-year climate variations in Australia. They are part of a natural cycle known as the El Nino-Southern Oscillation (ENSO) and are associated with a sustained period of warming (El Nino) or cooling (La Nina). They are caused when sea surface temperatures warmer than usual causes a shift in atmospheric circulation. This can greatly affect Australia's rainfall patterns and cause increased rainfall and flood events as well as greatly reduced rainfall leading to drought events.

Question 31

Criteria	Marks
• Graph is a line graph and contains: o Title o Axis titles and units (where required) ▪ X-axis: Year ▪ Y-axis: Antarctic ice shelf (millions of km^2) o Consistent scale o Accurately plotted points o Line of best fit showing trend	**4**
• Lacking some of the above criteria	**3**
• Meeting criteria but drawn as a different type of graph • OR • Several of the above criteria missing	**2**
• Some of the elements above included	**1**

Sample answer:



Question 31b)

Criteria	Marks
• Relates the cause of the changes in the cryosphere to valid changes in climate • References to the reflective ability (aka Albedo) of ice and snow compared to land and oceans. Identifies a declining trend in the Antarctic ice cover over the past 20 years • Refers to data from the graph	3
• Makes some valid references to changes in the cryosphere affecting climate change.	2
• Provides some relevant information	1

Sample Answer:

The cryosphere consists of ice, snow and glaciers in all their form with in the Earth's systems. Ice and snow have a high albedo and therefore reflect a lot of the incoming solar radiation and have a cooling effect on the climate. When ice and snow are removed from the Earth's surface, as can be seen occurring in the graphed data over the past 20 years there has been a decline in the Antarctic ice cover, the darker land or ocean beneath reduce this cooling effect an amplifies climate change. Thawing permafrost also releases GHG causing further warming.

Question 32(a)

Criteria	Marks
• Provides valid hazards and precautions for performing a waste audit in a school setting	2
• Provides at least ONE valid hazard with ONE related precaution	1

Hazard	Precaution
Sharp glass, metals, plastics, etc may cut skin	• Wear PPE including gloves • Place broken glass, metal or other sharps into appropriate containers when sorting to avoid future injuries
Fine dust particles may irritate eyes and respiratory surfaces	• Wear safety glasses and cover all cuts and abrasions with appropriate first aid • Wear a mask
Toxic and harmful chemicals from decomposing	• Wear mask at all times when sorting waste • Dispose of harmful chemicals separately according to manufacturers instructions

organic matter, paint and aerosols harmful to respiratory system	• Wash hands and face after sorting.

Question 32 b)

Criteria	Marks
• Provides a complete, safe and valid method in a step wise account written in 3rd person • Identifies how much waste to be sorted (ie. A days worth or 1 week) • Clearly categorises waste types for valid sorting and steps to sort waste outlined • Includes clear steps to determine, calculate and compare the amount of waste in each category • Method for recording results presented	4
• Waste types are not clearly defined OR • Some step in method not easy to follow or missing	2-3
• Some relevant steps are presented	1

Question 32 ©i

Criteria	Marks
Identifies **July-August** as being the time when the strategies are likely to have been put in place	1

Question 32 ©ii

Criteria	Marks
• Suggests a suitable strategy that would have reduced the average waste per day down from ~516 – 332 • Explains how the strategy will effectively reduce the amount of general waste produced each day	3
•	2
• Identifies a suitable waste management strategy	1

Sample Answer:
By implementing an effective recycling program at the school where paper is separated out from the general waste the student would effectively reduce the amount of general waste as seen in the graph. The implementation would need to be followed with an effective and engaging advertising campaign to encourage students and staff to use the new system and recycle waste paper. While the cleaners within the school would need to be informed of the change.

Question 33

Criteria	Marks
• Demonstrates an extensive knowledge and understanding of how an example of both ancient and recent climate change evidence are both similar and different	4

• Demonstrate sound understanding of the similarities and/or differences between the two types of evidence for climate change	3
• Identifies an example of both types of evidence • OR • Demonstrates sound understanding of one type of evidence	
• Provides some relevant information	1

Sample Answer

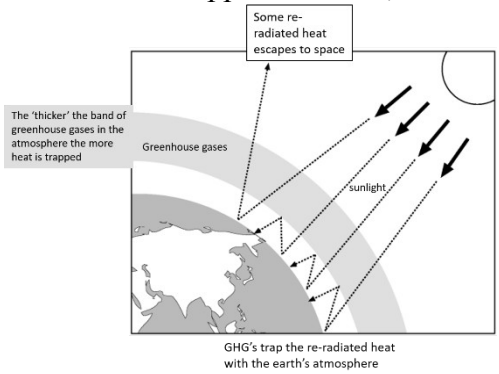
Ancient Climate evidence	**Recent Climate evidence**
Example: Pollen samples from ancient sediment (aka. *Palynology)*	Example: Dendrochronology (tree ring data)
When pollen is washed or blown into a lake it becomes part of the sediment and records the types of vegetation living in that ecosystem	Tree rings form cores of living trees are counted and analysed to obtain evidence of the climate during the life of the tree (or a record of trees of different ages from the same region).
The number and types of pollen is counted and a pollen diagram can be constructed	The distance between the tree rings is analysed to determine rainfall and climate data
Records can be obtained dating back hundreds of thousands of years, even back millions of years using this technique	Records can only be obtained dating back to the trees lifetime or a series of trees growing in the same area. (tens to hundreds of years)

Question 34a)

Criteria	**Marks**
• Demonstrate an extensive understanding of both the natural greenhouse and enhanced/anthropogenic greenhouse effect • Includes clearly labelled diagram showing the difference in the two phenomena	4
• Demonstrates sound understanding of the two concepts • Includes a clear diagram to illustrate the concepts	3
• Demonstrates a basic understanding of the two concepts OR • Attempts to include a diagram of the greenhouse effect	2
• Provides some relevant information	1

Sample Answer:

Greenhouse gases are gases in the atmosphere that allow sunlight to pass through and reach the Earth's surface, however, when this light is re-radiated back out through the atmosphere the same greenhouse gases trap the heat energy inside the atmosphere. When these gases are present in the right amounts, they maintain the Earth at a temperature warm enough for the survival of organisms and let excess heat back out into space. This phenomena is known as the **Greenhouse effect** and is both natural and necessary for life on Earth to survive. The rapid increase in greenhouse gas concentrations in the atmosphere has led to the enhanced greenhouse effect, which is when too much heat is trapped on Earth, resulting in an overall increase in global temperatures.



Question 34(b)

Criteria	Marks
• Demonstrates an understanding of how the oceans may become acidified (ie. A build up of carbon dioxide) • Shows how identified human activities can cause CO_2 to increase in the oceans.	3
• As above but lacking a coherent relationship between human activities and ocean acidification	2
• Some relevant information presented	1

Explain = relate cause and effect relationships

Sample Answer:

- Ocean acidification is mainly caused by carbon dioxide gas in the atmosphere dissolving into the ocean. ... Currently, human activities such as the burning of fossil fuels including coal, oil and gas for human industry is one of the major causes. In addition to this, deforestation results in fewer trees to absorb the gas which accumulates more CO_2 in the atmosphere. Carbonic acid

Question 34©

Criteria	Marks
• Identifies a marine ecosystem that is being affected by the oceans increasing in acidity • Describes Both the current and the expected future impacts of ocean acidification on the identified ecosystem	3
• Identifies an ecosystem the is being affected by ocean acidification • Describes either the current OR future impacts on the ecosystem	2
• Makes general statements about an ecosystem affected by ocean acidification	1

Sample Answer:

Many marine organisms that produce calcium carbonate shells or skeletons are negatively impacted by increasing CO_2 levels and decreasing pH (or increasing acidity) in the oceans. For example, increasing ocean acidification has already been shown to significantly reduce the ability of reef-building corals to produce their skeletons, this severely affects a coral reefs ability to rebuild and recover after disturbance events. It is expected that ocean acidification will cause coral reefs to erode faster than they can be naturally rebuilt over the next century which compromises the long-term survival of these ecosystems and impacts an estimated 1 million species that depend on coral reefs habitat.