NESA No.: .....

SCIENCE

2024

Year 12 Assessment Task 4

Trial Examination – Question Booklet

Earth and Environmental Science

General Instructions

- Write using black pen.
- Write your NESA student number at the top of this page.

Section 1 – 20 marks
Attempt questions 1-20
Use the multiple-choice sheet in the Answer Booklet for this section.
Allow 30 minutes for this section.

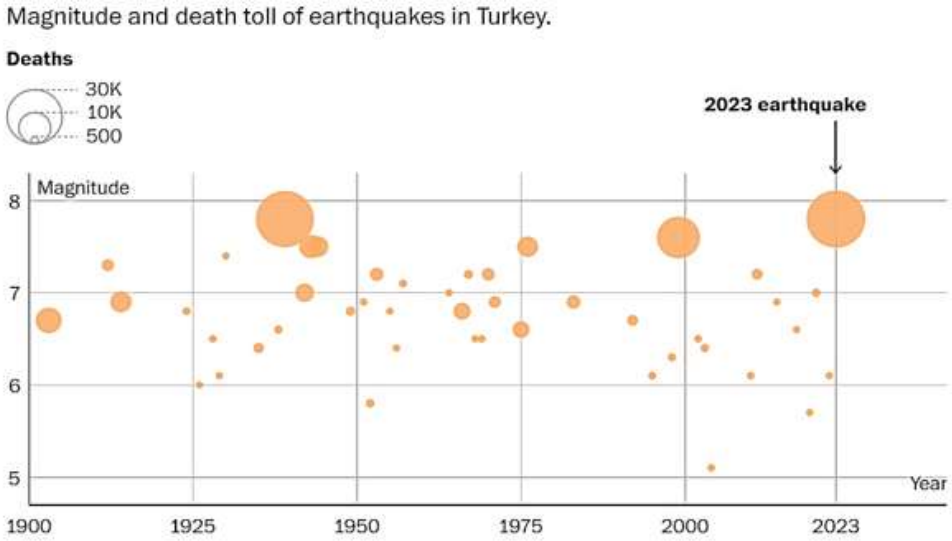
1 Organic waste is a common solid waste category. Which row of the table best identifies the components of organic waste and the most acceptable management practice?

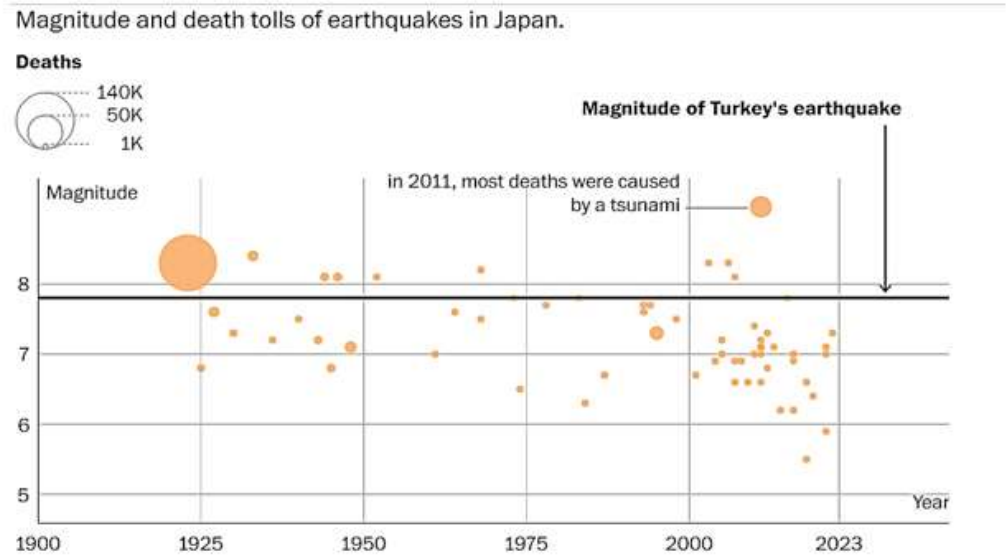
	Components of Waste	Management Practice
(A)	Cardboard and hard plastic	Recycling
(B)	Fruit and vegetable scraps	Compost
(C)	Glass and plastic bottles	Recycling
(D)	Grass clippings and animal waste	Landfill

2 The Australian Government has a campaign called Remade in Australia, which is designed to increase the amount of waste that actually is recycled. An advantage of this campaign is to

(A) increase the amount of waste material sent to landfill.
(B) reduce the amount of material goods made in Australia.
(C) increase the number of recycled materials purchased by consumers.
(D) encourage people to increase the goods they consume to provide more waste for recycling.

3 Observe the following graphs that represent the magnitude and death tolls of earthquakes in Turkey and Japan from 1900 to 2023.





During this time the death toll from earthquakes in Turkey has been much higher than the death toll in Japan.

What would be the most plausible explanation of this difference?

(A) There are more earthquakes in Japan than in Turkey.

(B) There are more earthquakes with a 7.8 magnitude and above in Turkey than in Japan.

(C) Many of the structures in Turkey have not been built using building codes that require structures to resist earthquake shaking.

(D) Turkey has a higher population that is more concentrated in cities than Japan.

4 Read the information below about Orange Roughy fish.

> Orange Roughy is a species of fish that are typically found in deeper water on the edge of continental shelves, sea mounts and ocean ridges. They are a slow-growing fish that can live over 140 years and are susceptible to overharvesting as they do not reach breeding age until 30-70 years old.
>
> Due to overfishing in the 1980s and 1990s, they are currently listed as Conservation Dependent under the EPBC Act, which means that while overharvesting is still an issue, they can still be fished within a certain limit. As such, Orange Roughy populations are not expected to return to sustainable levels until 2070.

Which one of the following would be the most sustainable way to manage the Orange Roughy populations to allow the fish population to recover?

(A) Use bird, turtle and seal excluding devices when fishing for Orange Roughy to reduce by-catch.
(B) Fishing boats should only keep Orange Roughy fish that are of a certain size, determined by scientists to be older than 30 years.
(C) Discard all other organisms caught in the nets when fishing for Orange Roughy.
(D) Continue to fish Orange Roughy at current levels in south-eastern Australia, regardless of size.

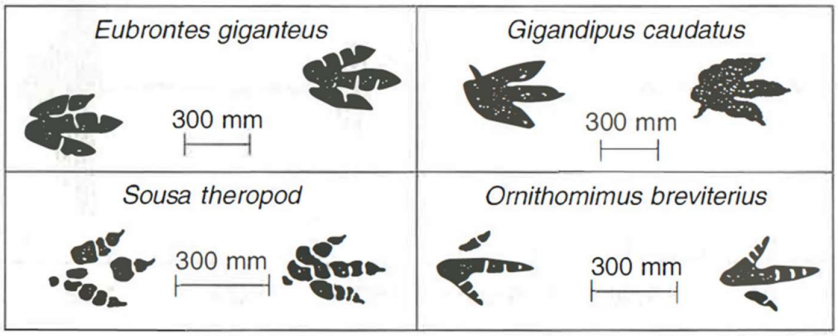
5 What natural event is most LEAST likely to trigger the formation of a tsunami?
(A) Cyclone.
(B) Earthquake.
(C) Landslide.
(D) Volcanic eruption.

6 What is a probable consequence of the continual loss of sea ice in the Arctic?



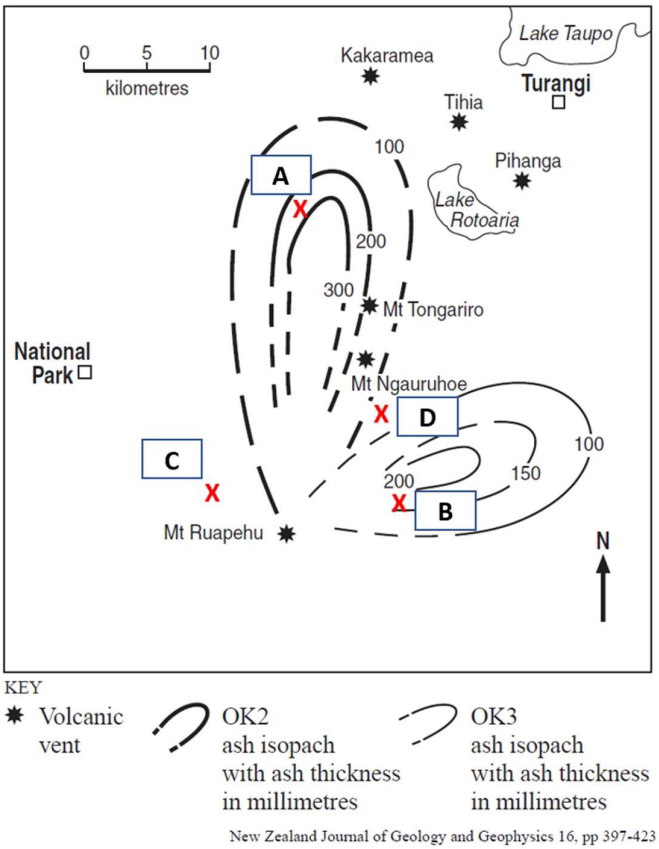
(A) Sea levels will rise.
(B) The global ocean conveyor will stop.
(C) More solar radiation will be absorbed by the oceans.
(D) A large portion of the world's population will lose a major source of drinking water.

7 The diagram shows the tracks of four dinosaurs. The length of a dinosaur's step is related to the length of its legs.



Which of these dinosaurs had the longest legs?
(A) *Eubrontes giganteus*
(B) *Gigandipus caudatus*
(C) *Sousa therapod*
(D) *Ornithomimus breviterius*

8 The diagram shows several vents in the Tongariro volcanic zone, New Zealand, and isopachs for two ash units, OK2 and OK3. Isopachs are lines of equal ash thickness. The Tongariro volcanic zone is related to a subduction zone.

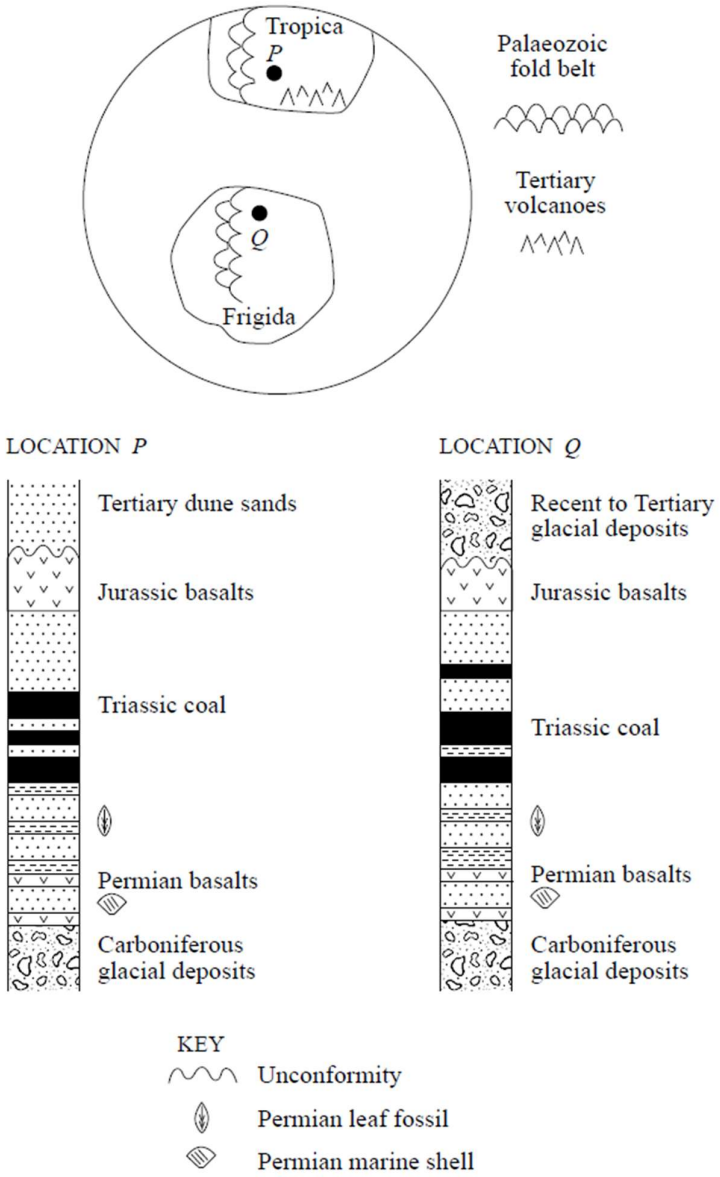


New Zealand Journal of Geology and Geophysics 16, pp 397-423

At which point would the ash cloud be the thickest?

(A) A
(B) B
(C) C
(D) D

9 The map below shows the present positions of two continents known as Tropicana and Frigida. Stratigraphic columns for location *P* on Tropicana and location *Q* on Frigida are also shown. Palaeomagnetic studies of the Permian basalts from location *P* on Tropicana indicated that the Earth's magnetic field was vertical in the locality at the time.

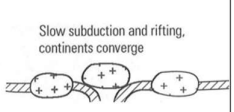
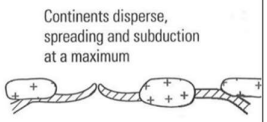
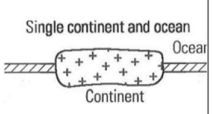
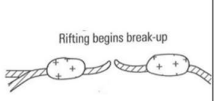


NOTE: On the Geological Time Scale, periods Neogene and Paleogene are often collectively called "Tertiary".

Based on the evidence given, these two continents split apart during which period?

(A) Tertiary.
(B) Jurassic.
(C) Triassic.
(D) Carboniferous.

10 The table below shows stages of the plate tectonic supercycle in random order.

Q	R	S	U
			

The correct sequence for the plate tectonic supercycle is

(A) S Q R U
(B) S R U Q
(C) Q S R U
(D) S U R Q

11 Which of the following activities would result in carbon sequestration?

(A) Burning forests, leading to increased atmospheric carbon dioxide levels.
(B) Replanting native vegetation in a previously-cleared area during mine rehabilitation.
(C) Reducing hydrocarbon emissions by banning the use of aerosol spray cans.
(D) Building a seawater desalination plant to mitigate the effects of drought.

12 The table below shows the amount of sulphur dioxide released by two volcanoes in recent eruptive episodes, Sinabung in Indonesia and Kilauea in Hawai'i.

Volcano	Sinabung	Kilauea
Eruption style	Explosive	Effusive
Amount of sulphur dioxide released in recent eruptions (kt = kilotons)	• 17.8 kt on 19 Feb 2018 • 10.6 kt on 20 Feb 2018 • 0.4 kt on 7 May 2019 • 4.5 kt on 25 May 2019	• 6 kt on 3 July 1983 • 46 kt on 19 Aug 1984 • 18 kt on 26 July 1985 • 5 kt on 22 Mar 1986 • 37 kt on 26 June 1986

Info source: AusEarthEd

Based on the information in the table, it would be true to say that

(A) on average, explosive eruptions produce more sulphur dioxide than effusive eruptions.
(B) the first eruption always produces the most sulphur dioxide.
(C) effusive eruptions always produce more sulphur dioxide than explosive eruptions.
(D) the amount of sulphur dioxide released in an eruption is quite unpredictable.

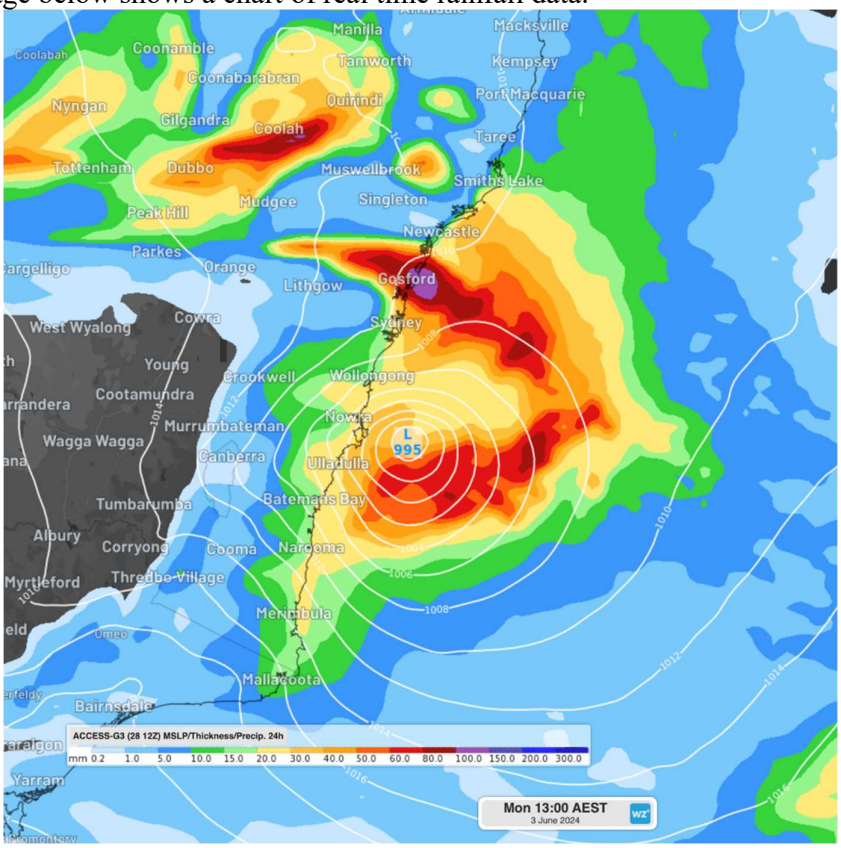
13 It is important for mining companies to use the topsoil removed during mining in the rehabilitation process because

(A) it preserves the burrows of native animals.
(B) it contains valuable mineral ore.
(C) the topsoil contains seeds of native plant species.
(D) it is cheaper than importing topsoil.

14 Which of the following is the most likely impact of a water pollution event in which hot wastewater used for cooling machinery in a factory, enters a natural waterway?

(A) Increased salinity.
(B) Increased nutrients.
(C) Decreased turbidity.
(D) Decreased oxygen levels.

15 The image below shows a chart of real time rainfall data.



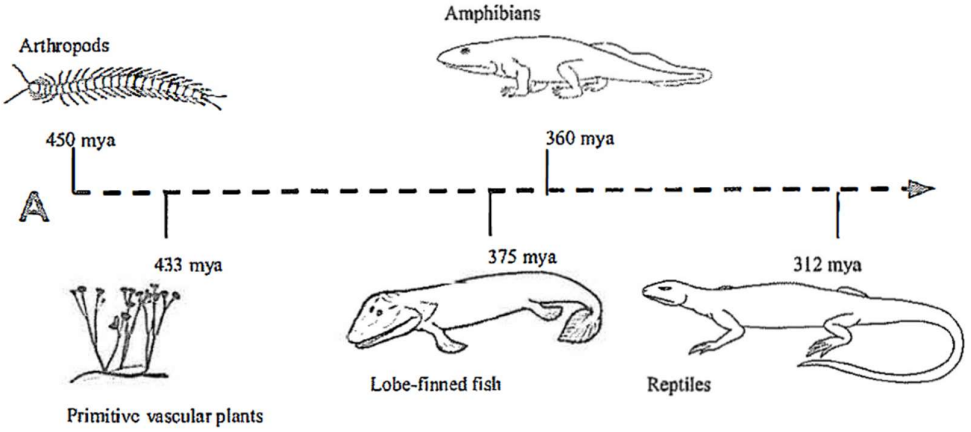
What type of weather hazard is shown in the chart?

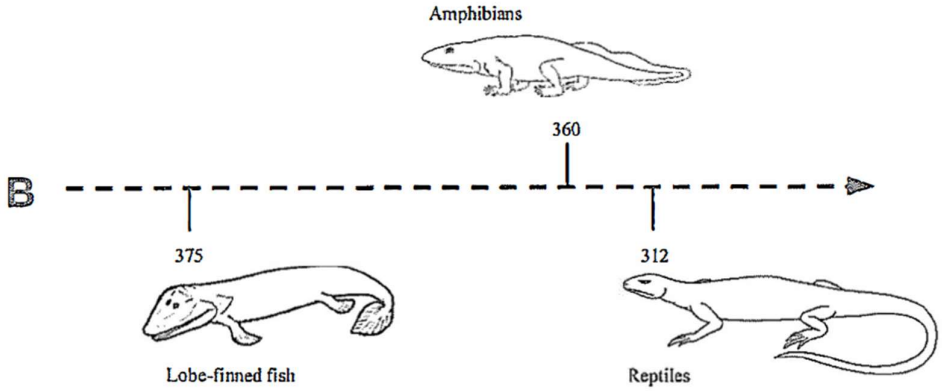
(A) East Coast Low.
(B) Hailstorm.
(C) Cyclone.
(D) Bushfire.

16 Which of the following identifies the technology likely used to obtain this data and a limitation of this technology?

	Technology used	Limitation
(A)	Weather radar	Radar can be fooled by swarms of insects.
(B)	Satellite image	Images care only taken once a day.
(C)	Weather stations	Stations often not permanently staffed by people are rely on technology.
(D)	Synoptic charts	Synoptic charts cannot be used to predict wind direction.

17 Students were asked to undertake a secondary investigation about the conquest of land by tetrapod animals. They were asked to present their information as a scaled timeline. Two samples are presented below:

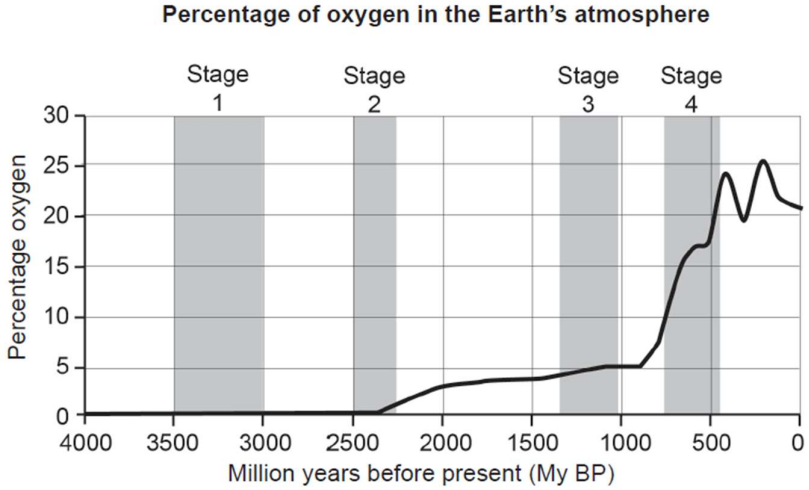




Which of the following statements is NOT correct about the timelines?

(A) Timeline A is more accurate.
(B) Timeline B is more relevant.
(C) The information presented in the timelines is consistent.
(D) The information presented in the timelines is equally as valid.

18 The graph below shows an estimate of the percentage of oxygen in the Earth's atmosphere over time.



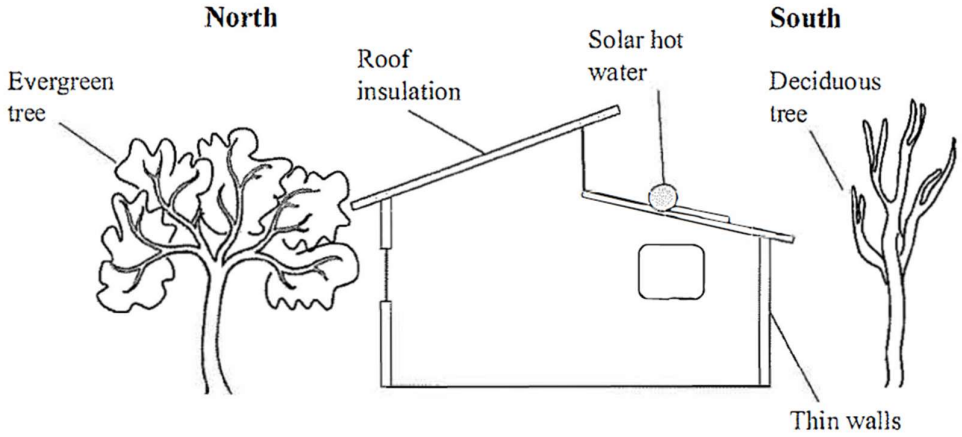
The majority of Australia's iron ore deposits were formed from banded iron formations.
During which stage were most of the Australian banded iron formations produced?

(A) Stage 1
(B) Stage 2
(C) Stage 3
(D) Stage 4

19 For over 50,000 years, Australia's Indigenous communities have used fire to manage the land and encourage biodiversity. It was once used extensively, especially in Northern Australia. Contemporary adoption of this practice requires a sound understanding of local conditions, climate and native plants and animals.
Scientists are advocating for this type of fire control to be applied to the management of public land, national parks and larger pastoral lands.
What is the main benefit of Fire and Emergency Services working with Indigenous resource managers to integrate cultural traditions?

(A) It would prevent fires in significant areas in the north of Australia.
(B) Indigenous resource managers would be able to manage all the bushfire prevention practices.
(C) It allows for liaison between Indigenous groups and government authorities to improve biodiversity of national parks.
(D) It provides an opportunity to manage and protect significant areas and private property around Australia from bushfires more effectively.

20 Electricity derived from the grid in NSW is supplied predominantly from coal-fired power stations. Heating and cooling a house using appliances can use large amounts of electricity.
The diagram below is a cross-section of a possible house design. Accompanying the design is some contextual information about the design and location.



- The house is located in Central NSW where summer temperatures can be very high and winter temperatures can reach below freezing.
- The sun moves through the northern part of the sky during the day.
- Evergreen trees hold their leaves all year, while deciduous trees drop their leaves in winter.

Which strategy shown above would best reduce the carbon footprint of the house year-round?

(A) Installation of the solar hot water system, facing south, to heat water.
(B) Quality roof insulation will assist in maintaining a constant internal temperature.
(C) Evergreen trees on the northern side of the house will stop the sun from heating the house all year round.
(D) Deciduous trees on the southern side of the house, adjacent to thin walls will allow heat into the house in winter.

NESA No.: .....

Fort Street High School

SCIENCE

2024

Year 12 Assessment Task 4

Trial Examination – Answer Booklet

Earth and Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 180 minutes
- NESA approved calculators may be used.
- Write using black pen.
- Draw diagrams using pencil.
- Write your NESA student number at the top of this page.
- A Geological Time Scale is provided at the back of this paper

Weighting – 30%

Total marks – 100

Section 1:

- Question 1-20
- Multiple choice (20 marks)

Section 2:

- Questions 21-34
- Extended response (80 marks)

Attempt All Questions (1-31)

Blank Page

Multiple-choice answer sheet

Place a cross in the circle that corresponds to the most correct answer.

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 ○

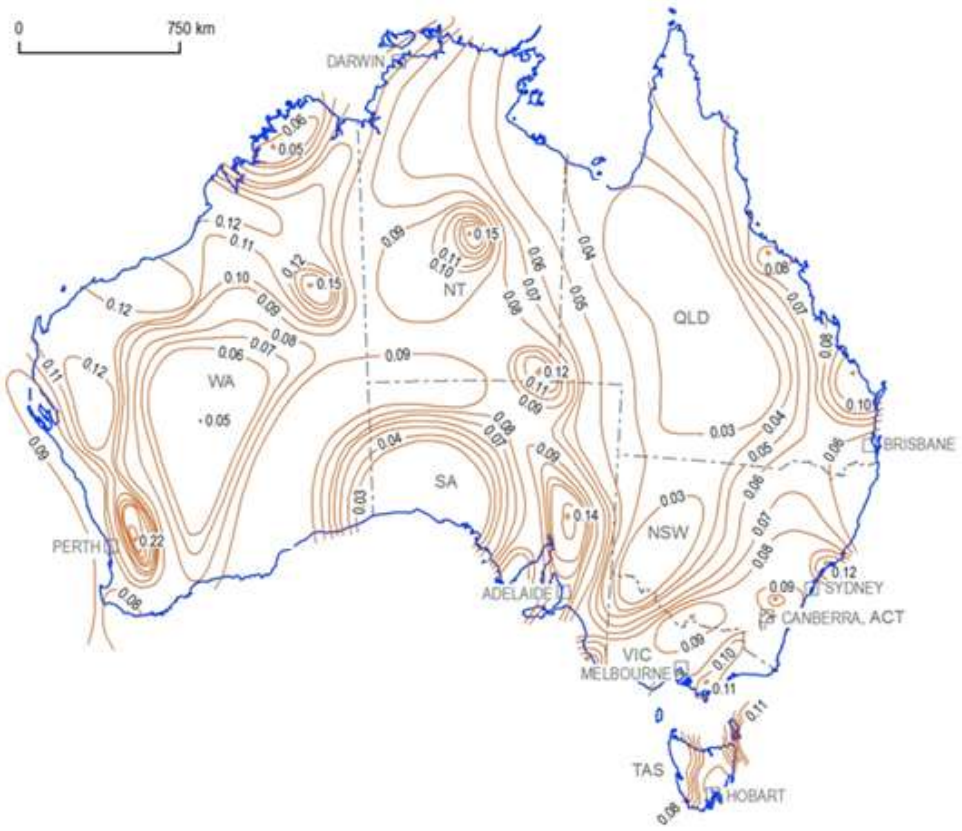
Attempt questions 21 - 31

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

Allow 150 minutes for this section.

Question 21 (8 marks)

The diagram below shows the current earthquake hazard map for Australia. The numbers in the map shows the risk of significant earthquake event in a year. Higher numbers mean greater risk.



(a) On the map, circle or highlight the region that has the highest earthquake hazard risk on the Australian continent. **1**

Question 21 continued.

(b) Explain how the focus of an earthquake is located. Use an annotated diagram to support your answer. **4**

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(c) Assess a named technology that could be used to minimise the effect of natural disasters associated with earthquakes in Australia. **3**

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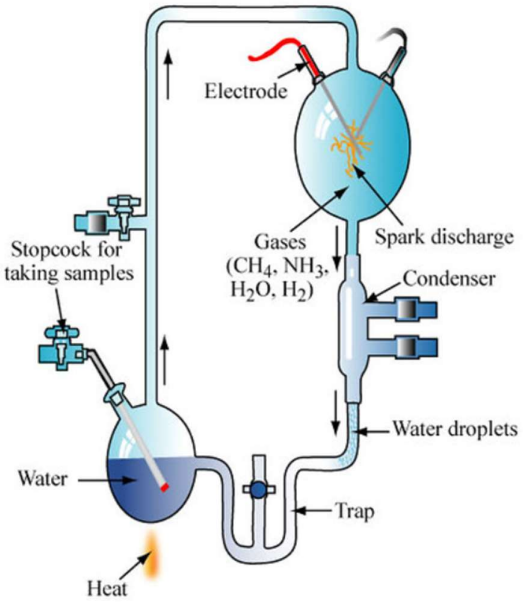
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Question 22 (5 marks)

In 1968 scientists at the Jet Propulsion Laboratory compared the analysis of a meteorite with the results of the Miller and Urey (Discharge Experiment). Their findings are in the table below which lists the relative quantity of the amino acids they discovered.



Amino Acid	Murchison Meteorite	Discharge Experiment
Glycine	●●●●	●●●●
Alanine	●●●●	●●●●
α–Amino-*N*-Butyric Acid	●●●	●●●●
α–Aminoisobutyric Acid	●●●●	●●
Valine	●●●	●●
Norvaline	●●●	●●●
Isovaline	●●	●●
Proline	●●●	●
Pipecolic Acid	●	●
Aspartic Acid	●●●	●●●
Glutamic Acid	●●●	●●
β–Alanine	●●	●●
β–Amino-*N*-Butyric Acid	●	●
β–Aminoisobutyric Acid	●	●
γ–Aminobutyric Acid	●	●●
Sarcosine	●●	●●●
N-Ethylglycine	●●	●●●

Evaluate the importance of meteorites in developing our understanding of the development of the early biosphere. **5**

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Question 23 (4 marks)

Explain how changing Aboriginal and Torres Strait Islander land management practices can adapt to the effects of anthropogenic climate change. Use an example in your answer.

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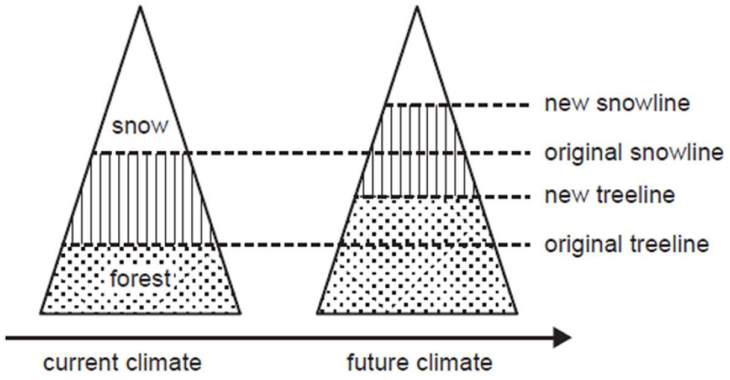
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Question 24 (10 marks)

The Victorian Alps have historically had reliable snow cover, which is vital for the survival of a range of species endemic to the region. The snow also provides a water source for both commercial and domestic use. Climate modelling in this region predicts the following:

- a reduction in snow cover and depth
- higher snowlines
- less rainfall
- higher temperatures

Predicted impact of climate change in the Victorian Alps



Source: adapted from SFJ De Wekker, M Kossmann, JC Knievel et al.,

(a) Based on these predictions, explain one impact on the alpine ecological system resulting from climate change. **3**

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(b) On many mountains, artificial snow-making technologies are used to increase snow cover for recreational skiers and to support the survival of snow-dependent species. However, snow-making uses large amounts of water. **3**

Justify a method for sourcing water sustainably so that snow-making can continue without contributing to further water scarcity.

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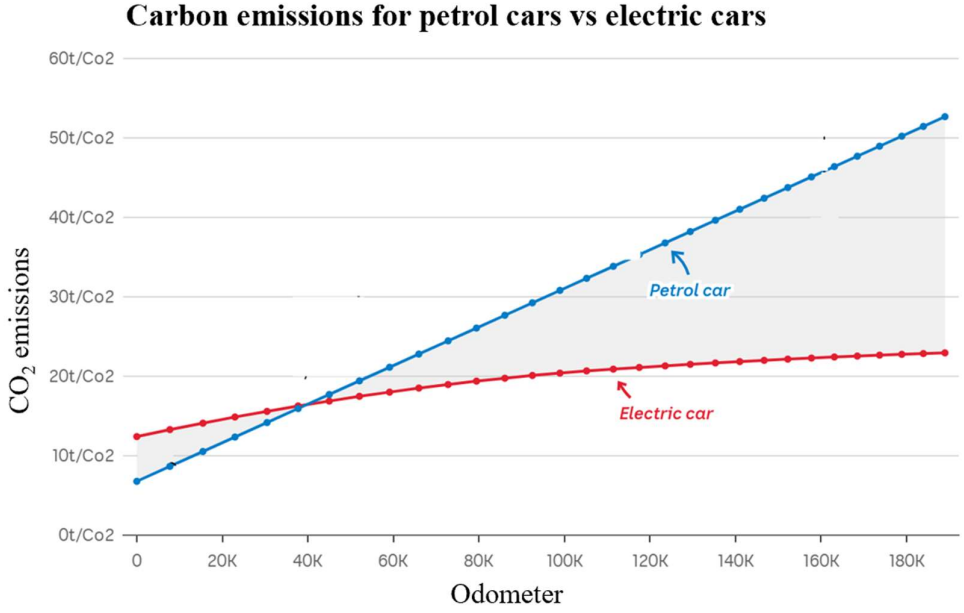
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Question 24 continued.

(c) To slow the rate of climate change, a local shire provides incentives for residents to purchase electric cars rather than petrol-fuelled cars. **4**



Assess the efficiency of electric car usage as a climate mitigation strategy. Refer to the data from Part (c) in your response.

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Question 25 (6 marks)

Cyanobacteria were one of the earliest forms of life on Earth. Stromatolites are preserved structures, which whilst rarely including bacterial fossils, are evidence of cyanobacteria colonies.

(a) Contrast cyanobacteria with stromatolites. **3**

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(b) Why are preserved stromatolites, even without bacterial imprints, considered a fossil? **3**

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Question 26 (7 marks)

a) Account for the explosivity of volcanic eruptions at convergent and divergent tectonic plate boundaries. **4**

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b) The 1991 eruption of Mt Pinatubo occurred due to tectonic interactions at a subduction zone. **3**
Explain the effect of these tectonic settings on the atmosphere.

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Question 27 (8 marks)

The following sources provide information about plastic waste recycling.

Source 1 – How does plastic impact wildlife?

There have been many documented incidents of the impact of plastic on ecosystems and wildlife. There are three key pathways by which plastic debris can affect wildlife:

Entanglement – the entrapping, encircling or constricting of marine animals by plastic debris.
Ingestion – (easting) of plastic can occur unintentionally, intentionally, or indirectly through the ingestion of prey species containing plastic.
Interaction – interaction includes collisions, obstructions, abrasions or use as a substrate.

Source 2 – Exporting recyclable plastics

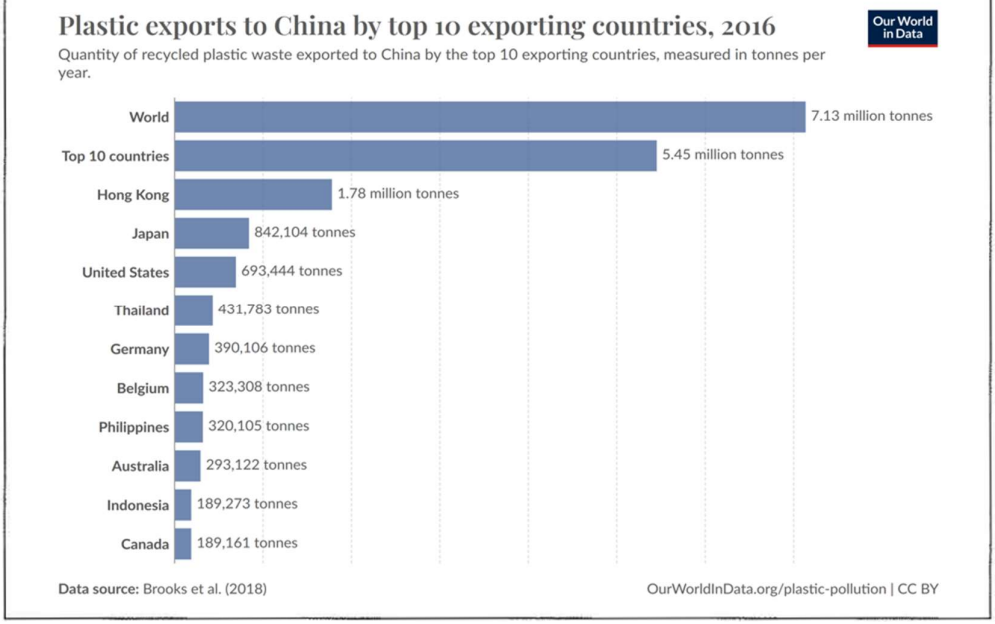
Recycled plastic waste is now sold and traded across the world. Plastics can be challenging to recycle, particularly if they contain additives and different plastic blends. In many cases it is convenient for countries to export their recycled plastic waste to another country to be processed for recycling (meaning they don't have to handle it domestically).

For importing countries, this plastic is often discarded if it doesn't meet the requirements for recycling or if it is contaminated by non-recyclable plastic. As such, traded plastic waste could eventually enter the ocean through poor waste management systems.

Source 3 – The impact of China's trade ban

In 2017 **China introduced a complete ban** on the imports of non-industrial plastic waste, meaning that all countries that had previously exported their recyclable waste to China, now had to find a way to deal with their waste domestically. Many of these countries did not have the facilities needed to recycle their own waste and were thus forced to find ways to either store their waste for future recycling or to dispose of the waste in landfill.

The following graph shows the quantity of plastic waste that was exported to China for recycling in 2016:



Question 27 continued.

Evaluate the sustainability of Australia exporting recyclable plastics as a method of managing plastic waste using the THREE sources provided to support your answer. **8**

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Question 28 (10 marks)

A student was investigating ocean acidification and decided to complete a first-hand investigation about the damage acids cause on carbonate-based shells.
The student decided to test the hypothesis:

"The decrease in levels of pH of water will decrease the mass of a shell over time"

The student gathered the following materials and equipment:

- shells (of the same species), vinegar, distilled water, small glass beakers, electronic balance, pH probe, data logger.

a) Using any of the equipment above, or other identified equipment, design a safe and valid procedure to test the above hypothesis. **7**
Include an annotated scientific diagram of the apparatus in your response.

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Question 28 continued.

b) Explain how changing atmospheric conditions affect the chemistry of ocean water. **3**

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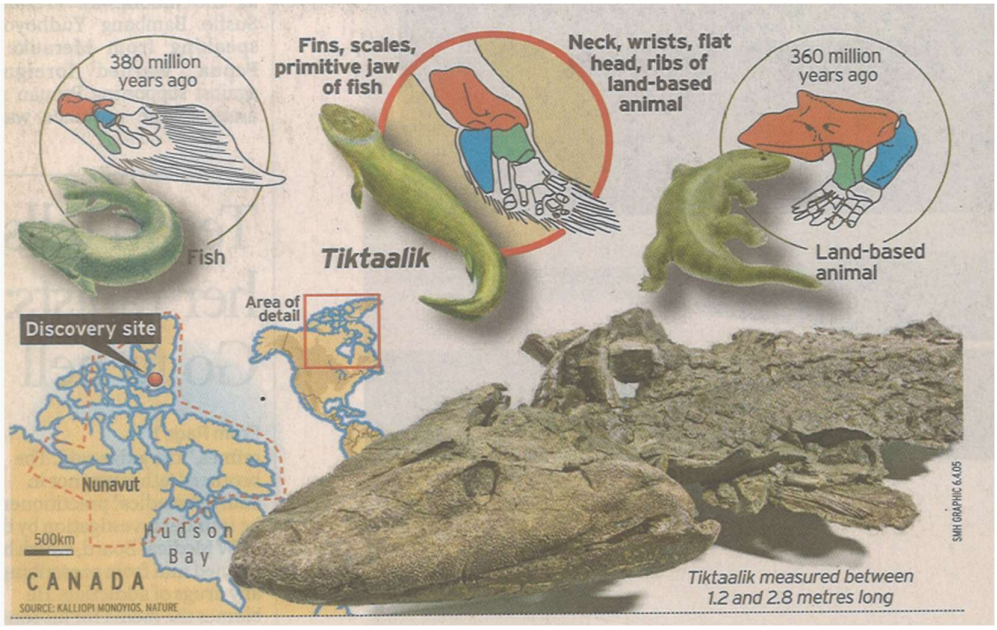
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Question 29 (6 marks)

The diagram below shows an image from the *Sydney Morning Herald* article (6 April 2006, p. 3) announcing the discovery of *Tiktaalik,* an important fossil in the record of life on Earth.
Tiktaalik was dated at 375 Ma.



Analyse the conquest of land by both plants and animals. Use examples to support your answer. **6**

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Question 30 (10 marks)

A mining company has identified a large mineral deposit containing high grades of copper and zinc. It is now carrying out further investigations and planning to evaluate whether it would be economically viable to develop a mine on the site. In the course of these investigations, a population of woylies ‑ a small marsupial listed as critically endangered by the International Union for the Conservation of Nature ‑ has been identified in the area.

(a) Describe two ways that mining might affect the woylies living in this area. **4**

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(b) As part of the company's application for a mining licence, you have been asked to prepare a policy for minimising the impact of mining on the woylie population. **6**
Describe the steps that you would recommend the company take at the following stages of the project:
(i) before the start of mining

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(ii) during mining

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(iii) at the conclusion of mining

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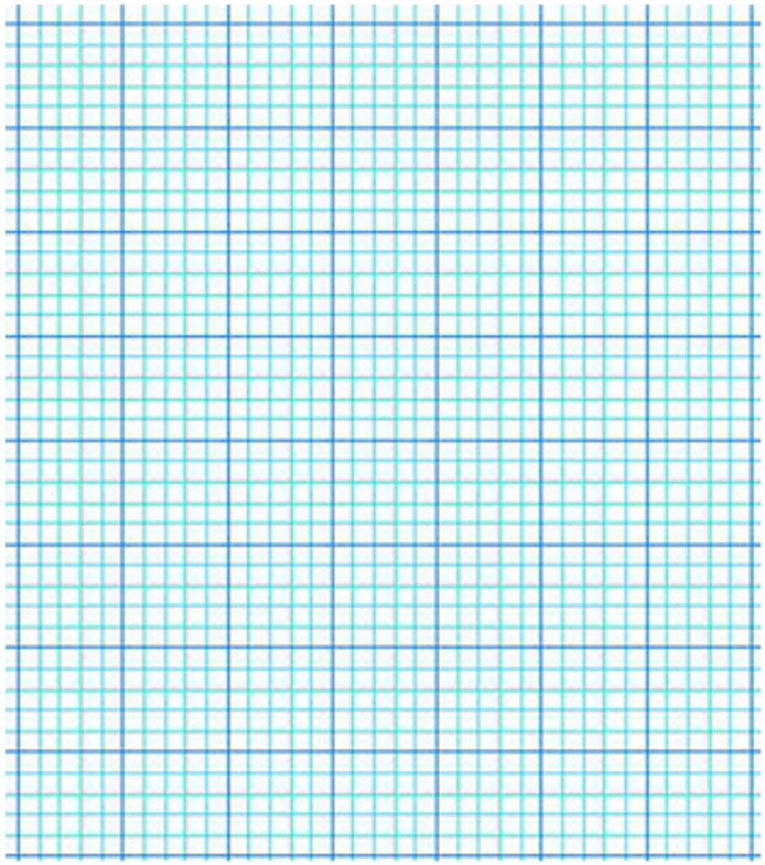
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Question 31 (6 marks)

The table below shows travel time and speed of a lahar from the summit of a volcano past two warning stations before it reaches the township of Guyton after an eruption through an early warning system.

Station	Distance (km)	Time (min)	Average speed (km/hr)
Summit warning centre	0	0	—
1	1	1.6	36
2	4	12	20
Township	7	28	15

a) Graph the distance of each station from the summit vs the time for the lahar to arrive and the average speed of the lahar on the grid provided. Label each station on your graph. **4**



Question 31 continued.

b) Justify a conclusion about how effective an early warning system would be in mitigating the impacts of a lahar eruption. **2**

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End of Test

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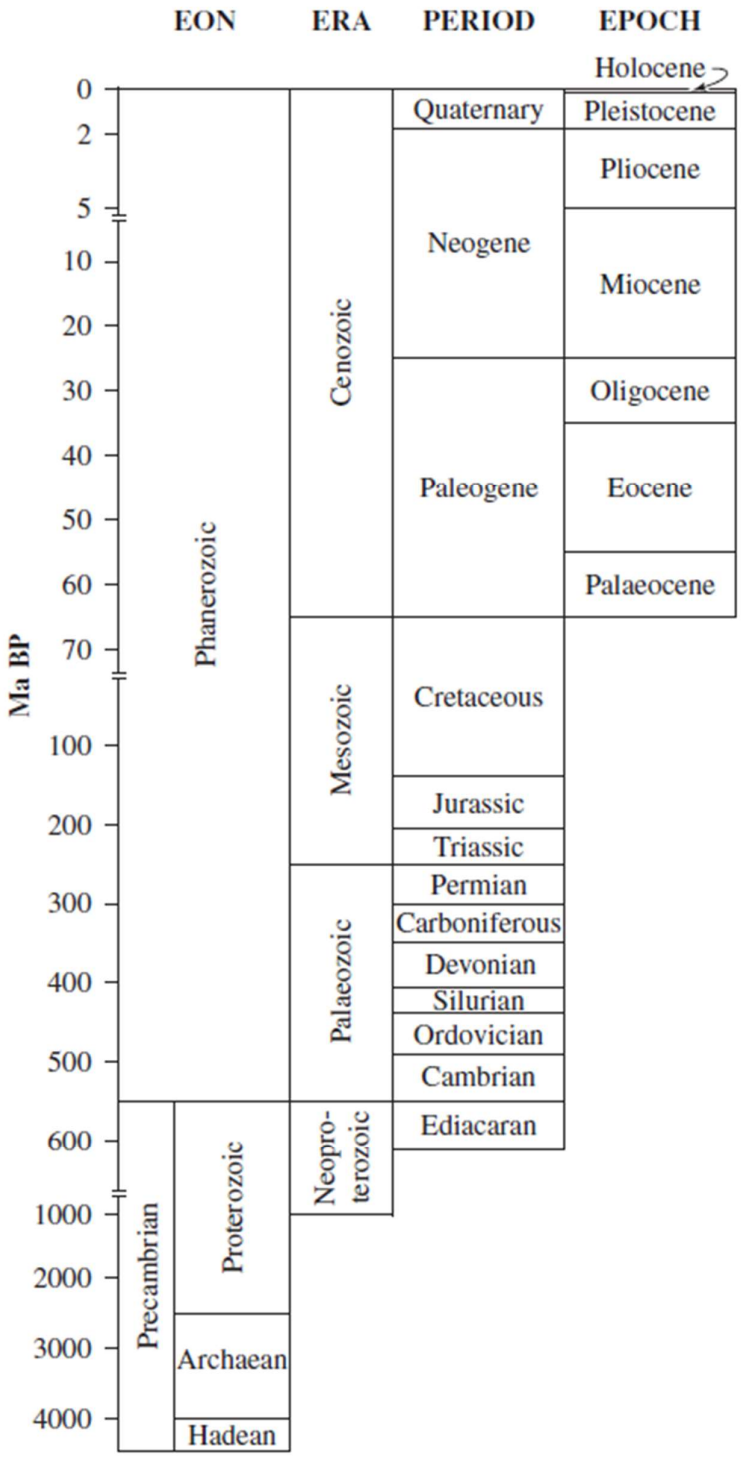
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Earth and Environmental Science

Geological Time Scale



EES Trial HSC 2024 Marking Criteria

Skills = 17 marks Q 7, 8, 12, 17, 27, 28a) & 31

KU = 83 marks All others

Section I

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

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

Question	Outcome
1	**EES12-15**
2	**EES12-15**
3	**EES12-13**
4	**EES12-15**
5	**EES12-13**
6	**EES12-14**
7	**EES12-12; EES11/12-6**
8	**EES12-13; EES11/12-5**
9	**EES12-12**
10	**EES12-12**
11	**EES12-14**
12	**EES12-13; EES11/12-5**
13	**EES12-15**
14	**EES12-15**
15	**EES12-13**
16	**EES12-13**
17	**EES12-12; EES11/12-5**
18	**EES12-12**
19	**EES12-15**
20	**EES12-14**

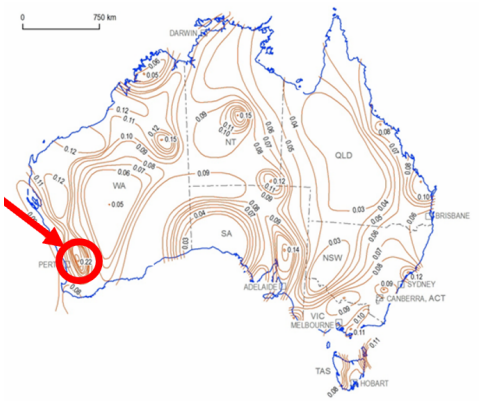
Section II

Question 21

a) **EES12-13**

Criteria	Marks
• Correctly identifies point 0.22 east of Perth	1

Suggested Response:

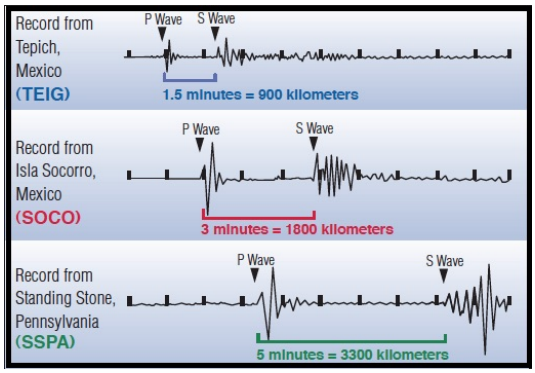


b) **EES12-13**

Criteria	Marks
• Explains how triangulation and differences in P & S wave velocities can be used to identify a location of an earthquake focus. • Uses appropriate and clear annotated diagram in response.	4
• Describes features of triangulation and P & S waves. • Uses appropriate diagram in response.	3
• Describes a feature of triangulation and P & S waves.	2
• Provides some relevant information.	1

Suggested Response:

P & S waves travel at different velocities. Seismologists know the speed of the waves and so the difference between the time of arrival at a seismometer station provides the distance from the focus. Using three stations, seismologists are then able to triangulate their data to pinpoint the location of the focus.





c) **EES12-13**

Criteria	Marks
• Describes a technology that could be used to minimise the effect of earthquakes or tsunamis. • Makes a judgement about the impact of the technology.	3
• Outlines a technology that could be used to minimise the effect of earthquakes or tsunamis. • OR • Infers a judgement about the impact of the technology.	2
• Provides some relevant information.	1

Suggested Response:

Seismographs are used to detect an earthquake event. This can send warnings to surrounding populated areas before the wavefronts arrive, providing vital seconds to allow people to reach shelter. This makes seismometers effective at minimising the impact natural disasters associated with earthquakes in Australia.

Answers could also include: ground movement detectors, anomalous animal behaviour, strain meters.

Question 22

EES12-12

Criteria	Marks
• Provides detailed descriptions of our understanding of the development of the early biosphere. • Identifies explicit criteria for the evaluation of meteorites in the development of the early biosphere. • Provides a well-supported judgement.	5
• Provides in some detailed a description of our understanding of the development of the early biosphere. • Identifies relevant criteria for the evaluation of meteorites in the development of the early biosphere. • Provides a judgement.	4
• Describes features of the early biosphere. • Identifies or infers criteria for the evaluation of meteorites in the development of the early biosphere. • Infers a judgement.	3
• Describes features of the early biosphere. OR • Identifies or infers criteria for the evaluation of meteorites in the development of the early biosphere.	2
• Provides some relevant information.	1

Suggested Response:

Meteorites provide the basic chemistry and raw ingredients that build the planets, including Earth; they provide the raw materials from which the biosphere was formed. This provides a framework for developing our understanding of the development of the early biosphere.

The theory of panspermia states that the organic molecules responsible for the development of the biosphere arrived on meteorites to the early Earth. The Murchison Meteorite was found to have many of the same organic molecules formed by the Urey-Miller experiment, an experiment designed to produce organic molecules from early Earth conditions.

This makes meteorites highly useful in developing our understanding of the development of the early biosphere.

Question 23

EES12-15

Criteria	Marks
• Explains using cause-and-effect how Aboriginal and Torres Strait Islander land management practices have changed in response to the effects of anthropogenic climate change. • Uses an appropriate example to support answer.	4
• Describes how some Aboriginal and Torres Strait Islander land management practices have changed in response to the effects of anthropogenic climate change. • Uses an example.	3
• Describes a relevant Aboriginal or Torres Strait Islander land management practice.	2
• Provides some relevant information.	1

Suggested Response:

Anthropogenic climate change has caused shifts in weather patterns and seasonal changes in northern Australia. As a result, some Aboriginal and Torres Strait Islander peoples have had to change traditional customs that are based on hunting and fishing practices. For example, the Yawuru people near Broom in WA have had to change their traditional calendar organisation, which has been based on the appearance of different (mostly) sea life.

Answers could include:

- Place boundaries revised as a result of rising sea levels in Torres Strait.
- changes in controlled burning practices as weather, drought and rainfall patterns shift.

Question 24

a) **EES12-14**

Criteria	Marks
• Explains one relevant impact on the alpine ecological system resulting from climate change.	3
• Describes an impact of climate change.	2
• Provides some relevant information.	1

Suggested Response:

The average temperatures increase as a result of anthropogenic climate change in the Victorian Alps. This causes the minimum altitude at which snow will settle to rise higher up the mountain, and the frozen soil minimum altitude will also be found higher up the mountain. This means that the tree line will creep higher up the mountain as the tree roots can take hold of the loose soil.

b) **EES12-15**

Criteria	Marks
• Justifies an appropriate method for sustainable sourcing water.	3
• Describes a method of sourcing water in general terms.	2
• Provides some relevant information.	1

Suggested Response:

Extracting water from a local water source can be sustainable if the melt water from the artificial snow is either collected or drained back into the original source. This method would allow for water to be used and sustainably return to the original source as it melts.

c) **EES12-14**

Criteria	Marks
• Describes how electric cars can mitigate the effects of climate change. • Refers explicitly to features of data. • Makes a judgement about the efficiency of electric car usage as a climate mitigation strategy.	4
• Outlines the effect of cars on climate change. • Makes some link to data. • Infers judgement statement about the efficiency of electric car usage.	2-3
• Provides some relevant information.	1

Suggested Response:

Although electric cars produce more carbon emissions than petrol cars to begin with (approx. 12t/CO_2 compared to 10t/CO_2 respectively), in the long run, petrol cars show a linear increase to over 50t/CO_2 after 180K reading on the odometer, while electric cars only increase to a little over 20t/CO_2 over the same odometer reading.

This suggests that using electric cars is an effective means of mitigating the effects of anthropogenic climate change. However, it is unlikely that the offset produced by a single shire in regional Victoria is likely to reverse the rising snowline of these mountains.

Question 25

a) **EES12-12**

Criteria	Marks
• Clearly outlines differences between cyanobacteria and stromatolites.	3
• Outlines features of cyanobacteria OR stromatolites.	2
• Provides some relevant information.	1

Suggested Response:

Cyanobacteria are a photosynthetic, prokaryotic microorganism, while stromatolites are the structures composed of cyanobacteria colonies and finely laminated sediments.

b) **EES12-12**

Criteria	Marks
• Outlines relevant features of trace fossils and clearly links them to the formation of stromatolites.	3
• Identifies preserved stromatolites as trace fossils. • Describes how stromatolites are formed through the actions of cyanobacteria.	2
• Provides some relevant information.	1

Suggested Response:

Stromatolites preserved in rock layers are considered to be a trace fossil. This means they are indirect evidence of past life and is not an imprint, mould or remineralisation of the organism's structures or form.

Stromatolites are formed in shallow marine or aquatic environments where cyanobacteria colonies are left to grow undisturbed in thin mats. As they grow and produce oxygen, the mats of microbes accrete settle sediments in the water, to form layer after layer.

The cyanobacteria grow through the sediment as it grows forming layered mounds. As the organism is required for the mounds to grow, their fossilisation is an indication of their presence.

Question 26

a) **EES12-13**

Criteria	Marks
• Accounts for the explosivity at each boundary by linking to relevant features of magma.	4
• Accounts for the explosivity at subduction zones or divergent boundaries.	3
• Outlines reasons for explosivity in general terms.	2
• Provides some relevant information.	1

Suggested Response:

Volcanic eruptions at convergent boundaries typically have felsic high-viscus magma; this thick magma requires high pressures of gas to burst through the high-viscus properties, resulting in an explosive eruption.

Volcanic eruptions at divergent boundaries typically have mafic low-viscus magma; the low-viscosity of this magma allows gasses and other fluid to flow more easily and be released with minimal energy, resulting in effusive eruptions.

b) **EES12-13**

Criteria	Marks
• Explains the effect on climate of explosive volcanic eruptions based on tectonic features of subduction zones.	3
• Describes relevant features of subduction zones and changes to the climate or atmosphere.	2
• Provides some relevant information.	1

Suggested Response:

Subduction zones result in partial melting of the subducted oceanic plate. This causes water and particular dissolved minerals to vaporise and be released in volcanic eruptions, such as the 1991 eruption of Mount Pinatubo. This releases a concentration of volcanic gases to the atmosphere, changing the local atmospheric chemistry and potentially shifting the temperature of the global climate.

Question 27

EES11/12-7

Criteria	Marks
• Describes in detail the sustainability of plastic exports. • Identifies explicit criteria for the evaluation of the sustainability of plastic exports. • Explicitly links to all three sources. • Provides a well-supported judgement.	8
• Describes in some detail the sustainability of plastic exports. • Identifies relevant criteria for the evaluation of the sustainability of plastic exports. • Refers to all three sources. • Provides a judgement.	7-6
• Describes the sustainability of plastic exports. • Identifies or infers criteria for the evaluation of the sustainability of plastic exports. • Refers to some of the sources. • Infers a judgement.	4-5
• Outlines the sustainability of plastic exports. AND/OR • Identifies or infers criteria for the evaluation of the sustainability of plastic exports.	2-3
• Provides some relevant information.	1

Suggested Response:

Until 2017, Australia was able to expo1i much of its plastic recyclable waste to China for processing. While this eliminated the need for plastic recycling plants in Australia, this was really just relocating the problem elsewhere. There would also have been fill expectation in Australia that filly plastics we disposed of in our recycling bins would in fact, be recycled, however Source 2 highlights that this plastic waste is often discarded in landfill or even worse, can end up in the environment if the plastic waste doesn't meet the requirements for recycling or if it is contaminated.

Source 1 highlights some of the dangers of plastics that end up in the environment such as animals becoming entangled in plastic waste, potentially eating plastics, or even being injured by it. This is clearly unsustainable as it is negatively impacting wildlife species. What's worse, is that without us even realising, the plastics we thought we were recycling in a sustainable way, could very well be the sold plastics that are causing such problems for wildlife because they are not in fact being recycled.

Source 3 also highlights the dangers of simply expo1iing our plastic waste to fil1other country that is willing to take it. Australia is in the top 10 countries that exported plastic waste to China prior to 2017, however it was by no means the largest exporter, so there are many other countries now also in the same position as us - looking for another solution to their plastics problem. It is unlikely that any other country would be able to take on the plastics waste from all of these countries, even if it tried, we would have no guarantee that the same thing would happen again - what's to say that any country that takes our plastic export is wouldn't suddenly impose a ban itself or just begin disposing of the waste in landfill?

Australia's use of export is as a method of dealing with our recyclable plastics is unsustainable. We have no guarantees that plastics sent to be recycled will in fact be recycled, we even have evidence to say that this waste ends up in the environment where it can negatively impact wildlife and

ecosystems. There is no guarantee that any other country we export to, wouldn't have the same issues.

Therefore, it seems that Australia's most sustainable option for dealing with plastics would be to recycle them domestically as we would at least be able to know what is happening to the waste once it goes into recycling bins.

Question 28

a) **EES11/12-1**; **EES11/12-2; EES11/12-3; EES11/12-4; EES11/12-7**

Criteria	Marks
• Identifies variables explicitly or implicitly. • Describes all of the requirements for a valid procedure. • Identifies safety precautions required. • Includes detailed and well annotated diagram of relevant apparatus. • Provides a clear and logical sequence.	7
• Outlines most of the requirements for a valid procedure. • Identifies some risks involved. • Includes labelled relevant diagram. • Provides a clear and logical sequence.	5-6
• Outlines some of the requirements for a valid procedure. • Identifies a relevant risk. • Includes relevant diagram.	3-4
• Identifies some aspects of relevant experimental procedure.	2
• Identifies one aspect of relevant experimental procedure.	1

Suggested Response:

Response should include a method for changing the independent variable, measurement of independent and dependent variables, management of controlled variables, use of a control and appropriate safe work practices.

b) **EES12-14**

Criteria	Marks
• Explains how increase in atmospheric CO_2 levels cause a reduction in oceanic pH.	
• Describes relevant features of atmospheric conditions or oceanic pH levels.	
• Provides some relevant information.	

Suggested Response:

An increase in atmospheric CO_2 causes more CO_2 to be dissolved by the upper ocean, which results in the formation of carbonic acid in ocean water and a reduced oceanic pH.

Question 29

EES12-12

Criteria	Marks
• Provides a detailed description of the conquest of land by both plants and animals. • Identifies relevant factors and clearly links them to the conquest of land by both plants and animals. • Integrates relevant examples into the response. • Provides a logical, coherent and concise progression of ideas.	6
• Describes the conquest of land by both plants and animals. • Identifies relevant factors and links them to the conquest of land by both plants and animals. • Uses examples to support the response. • Provides a logical and coherent progression of ideas.	4-5
• Outlines the conquest of land. • Identifies a relevant factor and links it to the conquest of land by plants OR animals.	3
• Outlines the conquest of land and identifies an example OR • Outlines a relevant factor	2
• Provides some relevant information.	1

Suggested Response:

Responses can include:

- Evolution of various body structures EG: skeletal structures, lungs (animals).
- Abundant resources (animals).
- Lack of predators (animals).
- Reduced competition for space (plants and animals).
- Formation of ozone layer to reduce UV radiation (link to previous evolution of photosynthesis) (plants or animals).

Question 30

a) **EES12-15**

Criteria	Marks
• Describes TWO ways mining might affect the population.	4
• Describes ONE way mining might affect the population.	3
• Outlines TWO ways mining might affect the population.	2
• Provides some relevant information.	1

Suggested Response:

The land clearing to make room for the mine is likely to reduce the population of woylies. However, the rehabilitation and ongoing maintenance post-mining may help conserve the woylie population into the future.

b) **EES12-15**

Criteria	Marks
• Describes appropriate steps for all 3 stages.	6
• 2 marks per description, 1 mark per outline.	2-5
• Provides some relevant information.	1

Suggested Response:

(i) before the start of mining

Woylie populations recorded & prepare reserve for population for duration of mine. Seeds and plants from their habitat stored, ready for reclamation after conclusion of mine.

(ii) during mining

Ongoing maintenance and monitoring of woylie population & stored plants/seeds.

(iii) at the conclusion of mining

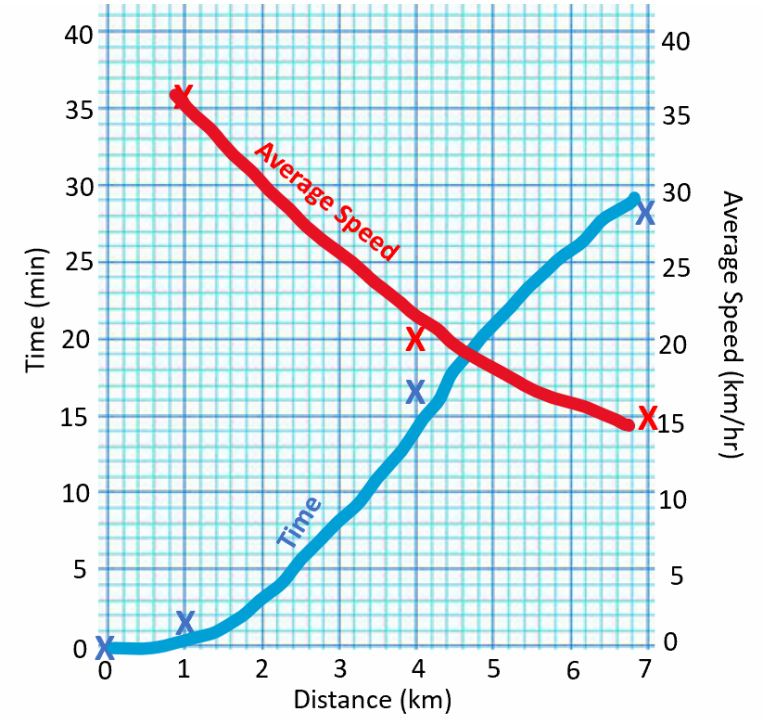
Topsoil and seedlings returned in place to rejuvenate environment. Woylies returned to environment. Populations monitored for years/decades after conclusion of mining.

Question 31

a) **EES11/12-4**

Criteria	Marks
• 2 x line graphs drawn, including line of best fit. • Graph labelled appropriately. • Appropriate scaling used. • Each station labelled.	4
• Missing one criterion.	3
• Missing two criteria.	2
• Displays some relevant data.	1

Suggested Response:



b) **EES11/12-5**

Criteria	Marks
• Provides appropriate conclusion. • Makes suitable justification based on data provided.	2
• Provides some relevant information.	1

Suggested Response:

An early warning system released from the summit warning centre would be somewhat effective at mitigating the impacts of a lahar eruption as it would provide approximately 28 minutes for the town's population to take precautions; which is enough time to save lives if people are prepared.