Singleton High School

Name: _____

2016
Higher School Certificate
Trial Examination

Earth and Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- Board approved calculators may be used
- A Geological Time Scale is provided
- Write your student number and/or name at the top of every page

Total marks – 100

Section I – Pages 2–17
75 marks
This section has two parts, Part A and Part B

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

Part B – 55 marks
Attempt Questions 21–31
Allow about 1 hour 40 minutes for this part

Section II – Pages 18–37
25 marks
Attempt ONE question from Questions 32–35
Allow about 45 minutes for this section

This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME: .....

STUDENT NUMBER/NAME: .....

1 Which of the following correctly matches the features to the type of plate boundary?

	Convergent boundary	*Divergent boundary*
(A)	Reverse faulting	Folding
(B)	Folding	Normal faulting
(C)	Strike-slip faulting	Reverse faulting
(D)	Normal faulting	Strike-slip faulting

2 Which rocks are generally associated with oceanic plates?

(A) Andesite and granite

(B) Basalt and granite

(C) Andesite and gabbro

(D) Basalt and gabbro

3 What type of plate motion occurs at a conservative boundary?

(A) The plates move away from each other.

(B) The plates move toward each other.

(C) The plates slide past each other.

(D) The plates do not move in relation to each other.

4 Which force driving plate motion is dependent on heat?

(A) Slab pull

(B) Ridge push

(C) Trench suction

(D) Convection currents

5 Which of the following is NOT a location where tectonic plates are diverging?

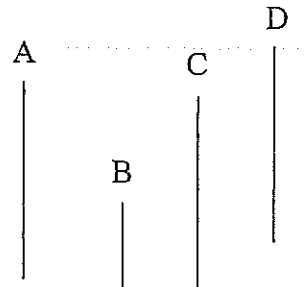
(A) Iceland

(B) Indonesia

(C) East Africa

(D) Mid-ocean ridge

6 Based on the information below, what would the age of a rock formation be if it contained fossils A, B, C and D?

Period		*Fossil age range*
Cenozoic	Quaternary	
	Tertiary	
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Palaeozoic	Permian	
	Carboniferous	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	

(A) Silurian-Tertiary

(B) Cretaceous

(C) Silurian

(D) Carboniferous

7 Which of the following correctly matches the adaptation with the challenge of living on land?

	Lacking support	*Breathing air*	*Drying out*
(A)	Shell	Gills	Porous skin
(B)	Naked skin	Nostrils	Feathers
(C)	Stronger skeleton	Lungs	Waterproof skin
(D)	Exoskeleton	Fins	Scaly skin

8 What period did plants first appear on land in the fossil record?

(A) Ordovician

(B) Silurian

(C) Devonian

(D) Permian

9 Which of the following is the correct value for the number 3.8×10^9?

(A) 389

(B) 3809

(C) 3 800 000 000

(D) 38 000 000 000

10 A stratigraphic sequence is composed of sedimentary layers of marine mudstone with occasional layers of basalt.

Which is the most suitable method for dating this sequence?

(A) Relative

(B) Absolute

(C) Relative and absolute

(D) Neither relative nor absolute

11 Which of the following gives a correct example for each heading?

	Eon	*Era*	*Period*	*Epoch*
(A)	Hadean	Mesozoic	Quaternary	Cambrian
(B)	Phanerozoic	Palaeozoic	Silurian	Oligocene
(C)	Cenozoic	Tertiary	Devonian	Pliocene
(D)	Proterozoic	Cenozoic	Archaean	Miocene

12 What is a *stromatolite*?

(A) A type of Australian megafauna

(B) A structure built be cyanobacteria

(C) A silicate mineral high in chromium

(D) A feature associated with mid-ocean ridges

13 What is the process by which soluble minerals are removed from the soil profile?

(A) Infiltration

(B) Precipitation

(C) Leaching

(D) Capillary rise

14 A student is to conduct an experiment to tests the hypothesis that an increase in phosphates in water will increase algal growth.

What should be the control group for this experiment?

(A) Water with no phosphates

(B) Water with an excess of algae

(C) Water with no algae

(D) Water at 0° C

15 In sewage treatment, one of the final stages often involves the use of UV radiation.

What is the purpose of this stage?

(A) Kill pathogens

(B) Remove large objects

(C) Allow sediments to settle

(D) Decompose organic matter

16 What are the most likely effects of soil compaction?

	Runoff	*Permeability*	*Soil moisture*
(A)	Increase	Decrease	Increase
(B)	Increase	Decrease	Decrease
(C)	Decrease	Increase	Decrease
(D)	Decrease	Increase	Increase

17 In waste treatment, when would it be appropriate to use a precipitation reaction?

(A) When the pollutant is in a soluble form that cannot be filtered

(B) When the pollutant is acidic and is too corrosive

(C) When the pollutant is an oil that will not mix with water

(D) When the pollutant is a heavy metal trapped in the mud on a river bottom

18 A student tests the hypothesis that having native vegetation bordering crops will attract birds that will eat insect pests. What is the independent variable in this investigation?

(A) The number of birds

(B) The yield of the crop

(C) The number of insects

(D) The amount of native vegetation

19 What is the best indicator that an experiment is reliable?

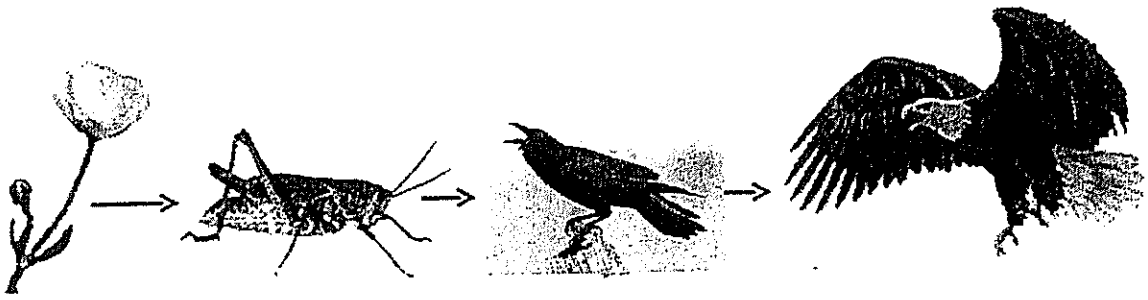
(A) The averages agree with published data.

(B) Each time it is repeated the results are very similar.

(C) The measurements are made using the smallest units possible.

(D) The measurements are made using the best possible equipment.

20 Observe the following image.



What is a possible effect if a pesticide was used on locusts in the above food chain?

(A) The locusts will become extinct causing all other species to die out.

(B) The plants will acquire higher levels of the pesticide than the locust through the process of biomagnification.

(C) The eagles will acquire higher levels of the pesticide than the locust through the process of biomagnification.

(D) The small birds will begin to eat the plants as a substitute for have less locusts available for food.

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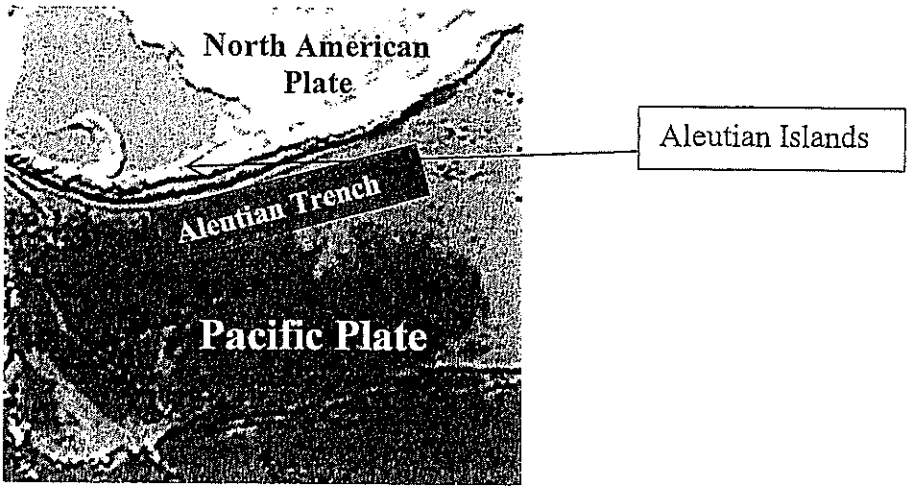
Section I

Part B – 55 marks
Attempt Questions 21–31
Allow about 1 hour and 40 minutes for this part

Answer the questions in the spaces provided.

Question 21 (6 marks) **Marks**

The image below shows a plate boundary marked by the Aleutian Trench. The Aleutian Islands run parallel to the trench. The Pacific Plate is at the bottom of the diagram and the North American plate is at the top.



(a) Draw a labelled cross-section diagram to show the type of plate boundary occurring at this location. **4**

(b) Explain how an eruption from a volcano on this type of boundary could affect global climate. **2**

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STUDENT NUMBER/NAME: .....

Marks

Question 22 (5 marks)

(a) Describe a method used in the prediction of earthquakes. **2**

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(b) Explain the impact earthquake shock waves can have on the built environment. **3**

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Question 23 (6 marks)

Outline the main stages involved in the growth of the Australian continent over geological time as a result of plate tectonic processes. **6**

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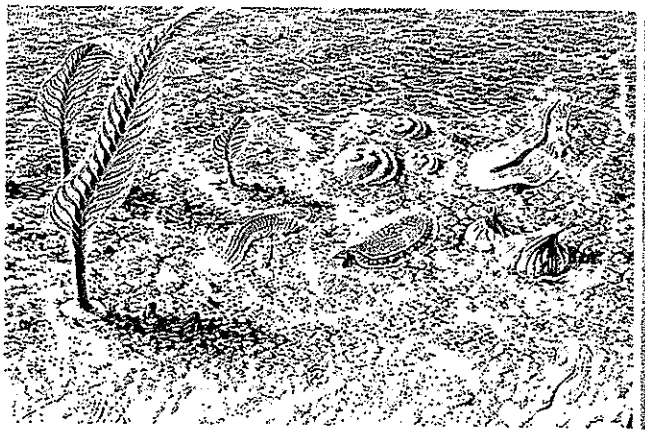
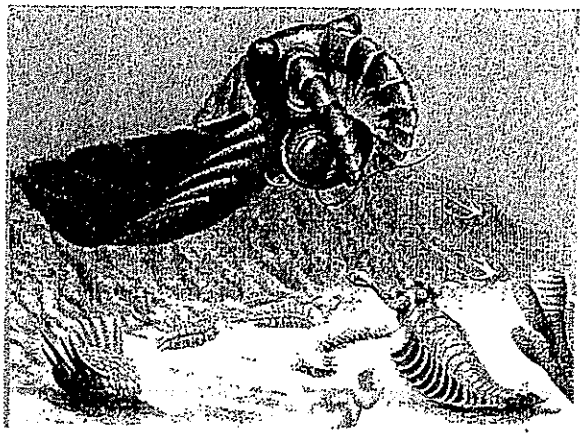
STUDENT NUMBER/NAME: .....

Question 24 (5 marks) **Marks**

The images below show what animals would have looked like in the late Proterozoic and the early Phanerozoic.





(a) Compare the animals from each time period. Arrange your work in a table. **3**

(b) Account for the greater abundance and diversity of animals that occurred in the early Phanerozoic. **2**

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STUDENT NUMBER/NAME: .....

Question 25 (5 marks)

Marks

Climate drove demise of South America's giant beasts – ABC Science, by Dani Cooper

Sabre-toothed cats, one-tonne bears and sloths the size of elephants all happily coexisted with humans for up to 3000 years, but were extinct within 300 years after the climate of South America rapidly warmed.

The extract above is from an article that first appeared on 18 June 2016. Using carbon-dated bones and teeth a team from the University of Adelaide found evidence that it was the climate, not humans, that caused the extinction of megafauna in South America.

Compare these findings to the extinction of Australian megafauna. **5**

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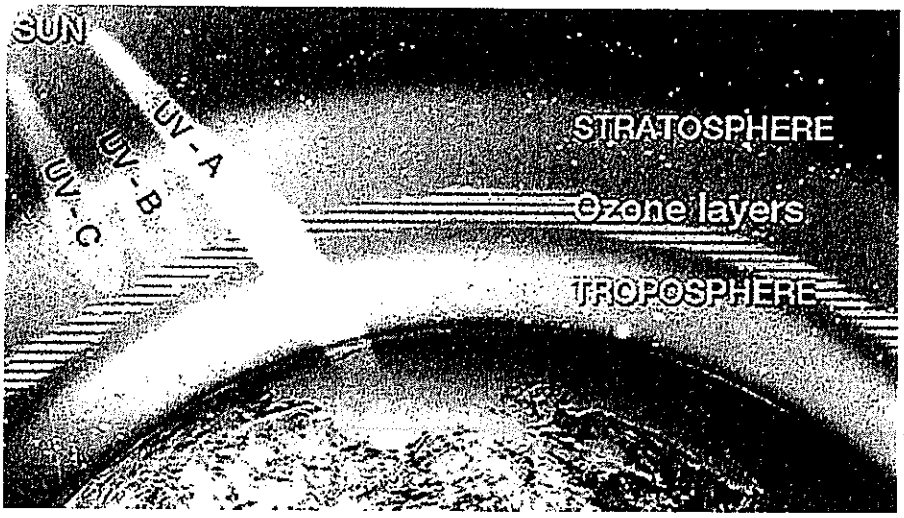
STUDENT NUMBER/NAME: .....

Question 26 (2 marks) **Marks**

The image below shows how the ozone layer protects Earth from UV radiation.



Describe the role the ozone layer had in the evolution of life in the Phanerozoic eon. **2**

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Question 27 (4 marks)

Outline TWO pieces of evidence that present-day organisms have developed from different organisms in the distant past. **4**

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STUDENT NUMBER/NAME: .....

Question 28 (7 marks) **Marks**

The images below show farming in Indonesia and Australia.

Compare the overall fertility of the soils in each country and explain why there is a difference. 7

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STUDENT NUMBER/NAME: .....

Question 29 (3 marks) **Marks**

The image below shows mature trees being used as a border on pasture land, a strategy farmers can use to address soil salinity.

Explain how this or an alternative strategy can reduce soil salinity. **3**

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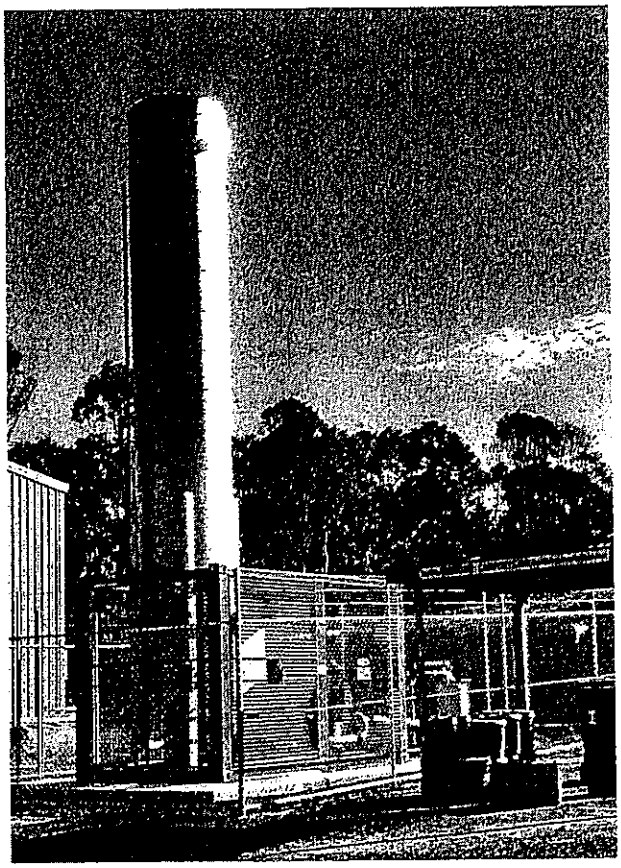
Question 30 (6 marks) **Marks**

The image below shows a methane burner at a landfill site.



(a) Explain why landfill sites produce methane gas. **2**

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(b) Explain how burning methane, rather than venting it to the atmosphere, helps to reduce global warming. **4**

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Question 31 (6 marks) **Marks**

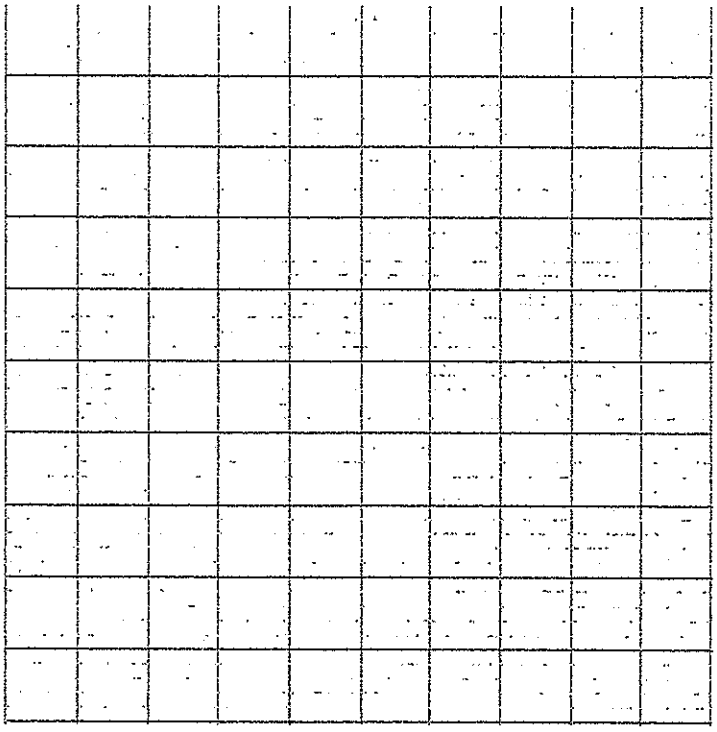
A student conducted an experiment to test the effect of soil compaction on plant growth. She put 5 cress seeds in the soil of each pot and then compacted the soil by placing masses on top of the soil for 10 minutes. Each pot had a different mass placed on it. After 2 weeks she measured the length of each seedling.

Her results were as follows:

Amount of compaction (kg)	*Seedling length (mm)*					
	1	2	3	4	5	*Average*
0	87	84	85	83	86	
1	83	86	84	83	84	
2	81	79	77	81	82	
3	64	73	64	83	81	
4	42	51	75	84	63	

(a) Calculate the average seedling length for each amount of compaction and write it in the appropriate space in the table. **1**

(b) Plot the averages on an appropriate graph. **3**



Question 31 continues on the next page

Question 31 (continued) **Marks**

(c) Describe the trends in the data. **2**

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End of Question 31

STUDENT NUMBER/NAME: .....

Section II

25 marks
Attempt ONE question from Questions 32–35
Allow about 45 minutes for this section

Answer the question on your own paper or in a writing booklet, if provided.

STUDENT NUMBER/NAME: .....

Question 32 – Introduced Species and the Australian Environment (25 marks) **Marks**

(a) Prickly pear (*Opuntia stricta*) is a species of introduced plant that has had a significant impact on the Australian environment.

(i) Describe how this species OR another named introduced plant can affect an ecosystem. 1

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(ii) Outline a strategy being used to rehabilitate an ecosystem damaged by an introduced plant species. 1

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(iii) Justify the use of the named rehabilitation method in this ecosystem. 2

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Question 32 continues on the next page

Question 32 (continued) **Marks**

(b) Describe a method that could be used to conduct a valid AND reliable investigation on the effect of an introduced plant species on ONE *abiotic* component of an environment. **6**

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Question 32 continues on the next page

Question 32 (continued) **Marks**

(c) The introduction of the feral cat (*Felis catus*) to Australia caused a significant impact on local ecosystems.

For this species OR another named introduced animal species:

(i) State when AND why your species was introduced to Australia. **2**

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(ii) Describe ONE impact this species has had on the Australian environment. **1**

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(iii) Outline TWO different strategies that can be implemented to decrease the impact of this introduced species on the Australian environment. **4**

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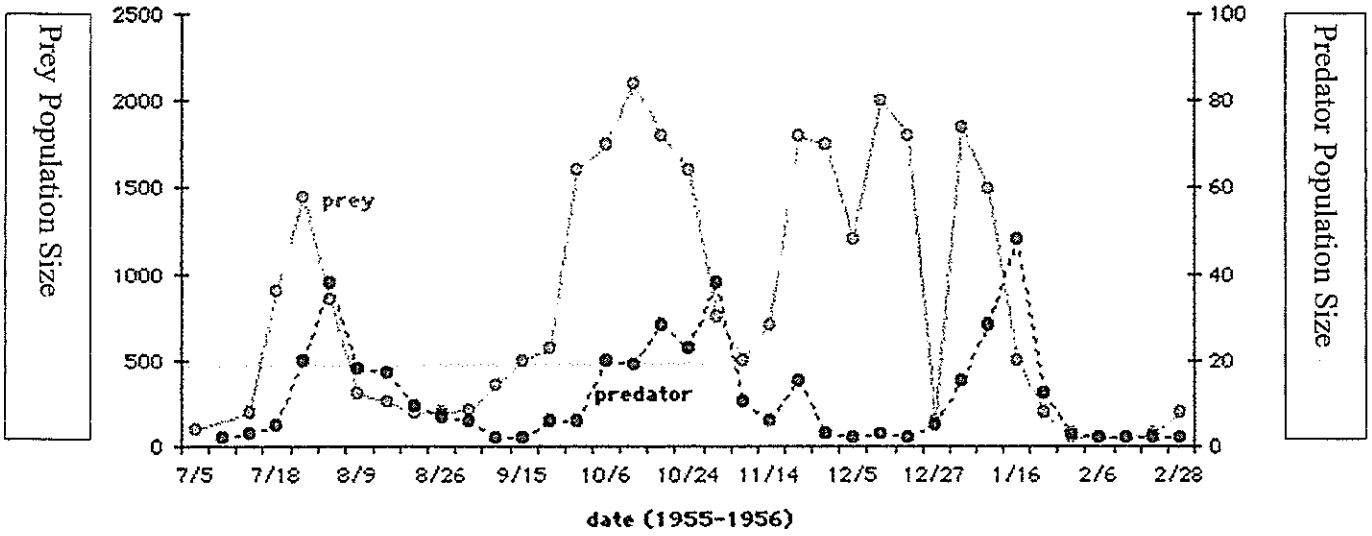
Question 32 continues on the next page

Question 32 (continued) **Marks**

(d) Predator-prey biological control can be used to manage the population size of introduced species.



(i) Describe the process of predator-prey biological control AND give an example of its use in Australia. **2**

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(ii) With reference to the graph, explain how predator-prey biological control affects the populations of BOTH predator and prey species over time. **2**

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Question 32 continues on the next page

Question 32 (continued) **Marks**

(e) Assess the effectiveness of ONE quarantine procedure in place in Australia to prevent introduction of new species. **4**

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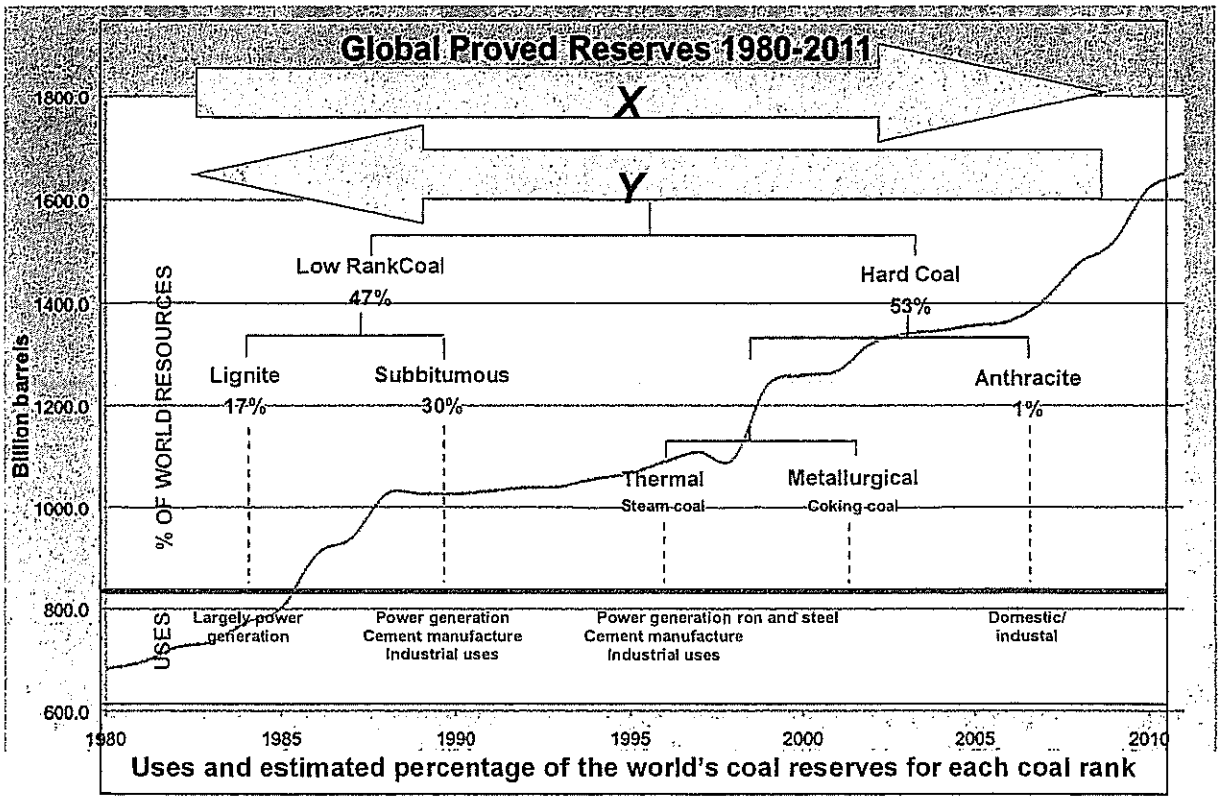
End of Question 32

STUDENT NUMBER/NAME: .....

Question 33 – Organic Geology – A Non-Renewable Resource (25 marks) **Marks**

(a) Oil reserves are the known deposits of oil that could be utilised as a resource. The following graph shows estimates of known global proved oil reserves over time.



(i) Oil is commonly identified as a non-renewable resource yet the graph above suggests a trend of increasing global proved reserves.

Justify the identification of oil as a non-renewable resource. **2**

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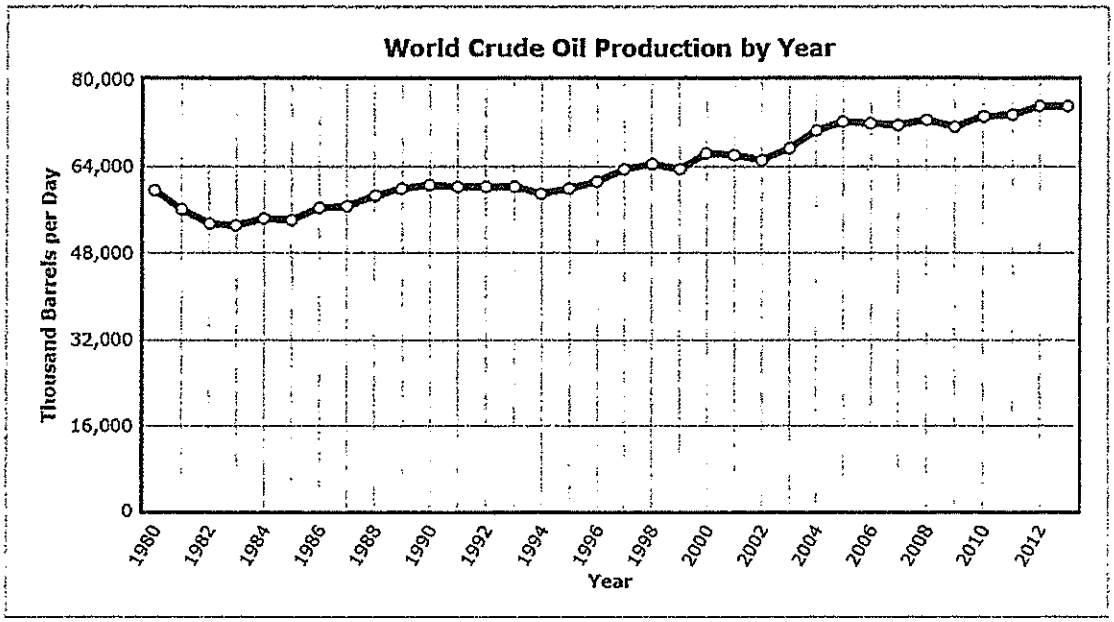
Question 33 continues on the next page

Question 33 (continued) **Marks**

(ii) The graph below shows the trend in oil consumption over time.



Source: http://www.indexmundi.com/energy.aspx?product=oil&graph=production

Discuss reasons for the trend of increasing oil-proved reserves in light of the increasing trend of oil consumption. **2**

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Question 33 continues on the next page

Question 33 (continued) **Marks**

(iii) Observe the table below.

Gas	Energy Value(kJ/m^3)	Dominant Compound in Gas
Coal seam gas	40	
Natural gas	39	
	105	propane

Complete the above table based on the information provided **3**

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(b) There are three main stages in the process of petroleum maturation. They are identified as diagenesis, catagenesis and metagenesis.

Outline the nature of the products that are derived due to changes that occur to organic matter during each of these processes. **3**

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Question 33 continues on the next page

Question 33 (continued) **Marks**

(c) Coal has the following geophysical properties: low density, low seismic density and low magnetic susceptibility.

Describe the exploration methods that utilise these properties, and hence, can be used to determine the existence and extent of coal deposits. **3**

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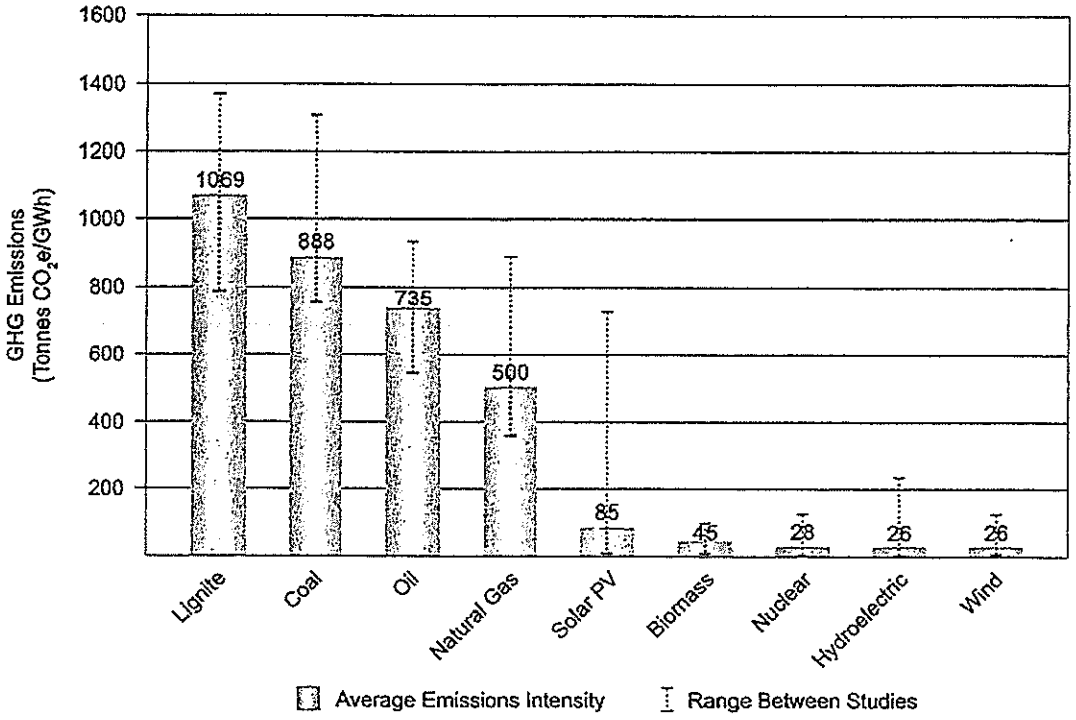
Question 33 continues on the next page

Question 33 (continued) **Marks**

(d) The graph below shows the greenhouse gas emissions intensity for various sources of electricity along with differences in opinion about their impact.



Evaluate the potential future importance of renewable and non-renewable energy resources in light of concerns over the negative impact of greenhouse gas emissions. **5**

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Question 33 continues on the next page

Question 33 (continued)

Marks

(e) During your study of organic geology, you were required to plan and perform a first-hand investigation to distinguish between the products of complete and incomplete combustion.

(i) Identify and describe the factors you considered as you planned the investigation. **4**

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(ii) Outline the investigation you performed. **3**

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End Question 33

STUDENT NUMBER/NAME: .....

Question 34 – Mining and the Australian Environment (25 marks) **Marks**

(a)

(i) Describe a model of mineral genesis related to tectonic processes responsible for the formation of an identified Australian metal province. **3**

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(ii) Identify the main geological features of a named Australian iron ore-producing locality. **2**

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Question 34 continues on the next page

Question 34 (continued)

Marks

(b) Mining in Australia is subject to the rights of the landholder and the role of governments in granting leases.

(i) Discuss the impacts that ONE named and described landmark decision, such as *Wave Hill*, *Mabo* or *Wik*, has had on an identified mining operation in Australia. **3**

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(ii) Outline the effects of ONE identified State or Commonwealth Government policy on mining operations in the context of sustainability. **2**

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Question 34 continues on the next page

Question 34 – Mining and the Australian Environment (25 marks) **Marks**

(a)

(i) Describe a model of mineral genesis related to tectonic processes responsible for the formation of an identified Australian metal province. **3**

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(ii) Identify the main geological features of a named Australian iron ore-producing locality. **2**

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Question 34 continues on the next page

Question 34 (continued)

Marks

(c) Explain 3 factors that need to be considered to determine whether mining an ore deposit is economically viable. **6**

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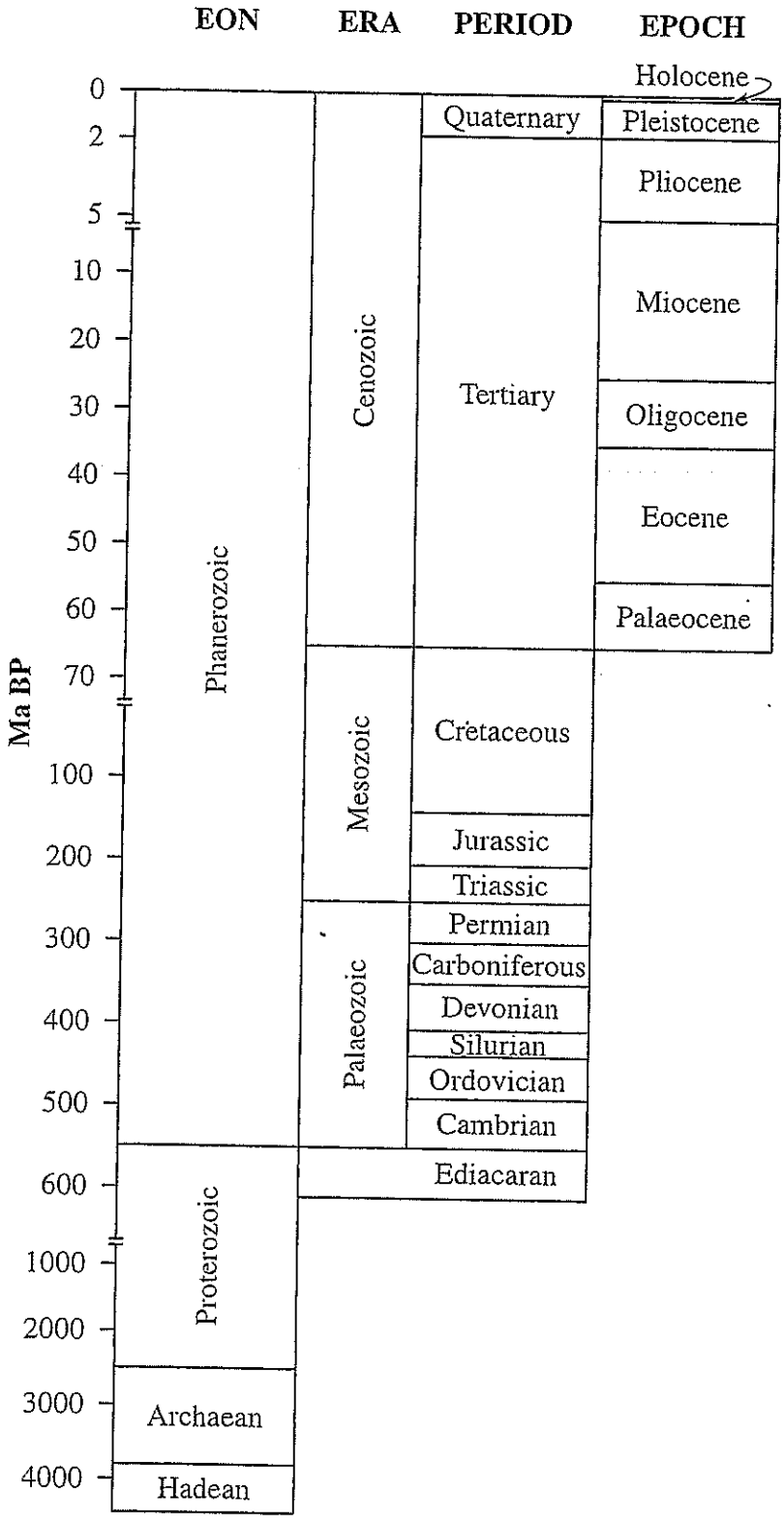
Question 34 continues on the next page

Geological Time Scale



STUDENT NUMBER/NAME: .....

Singleton High School

Earth and Environmental Science

Section I Part A - Multiple Choice

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

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

A ○ B ● C ○ D ○

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

A ● B ⊗ C ○ D ○

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

A ⊗ B ● ← correct C ○ D ○

Start Here →

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