20/05/2018

THE KING'S SCHOOL

2018
Higher School Certificate
Year 11 Examination

Earth & Environmental Science

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- NESA-approved calculators may be used
- Write using black pen
- Draw diagrams using pencil
- Write your student number where marked
- Show all relevant working in questions involving calculations
- Use the Multiple Choice Response Sheet provided for your answers to Section I

Total marks – 77

Section I
Total marks **(20)**
Attempt all questions
Allow about 30 minutes for this part

Section II
Total marks **(57)**
Attempt all questions
Allow about 1 hour 10 minutes for this part

This paper MUST NOT be removed from the examination room

Section I
**Total marks (20)**
Attempt questions 1-20
Allow about XX minutes for this part

1. *Meteorites* provide evidence for the formation of the Earth. This is because they are believed to:

    A   be the same size and shape as the Earth.
    B   have formed around the same time as the Earth.
    C   have come from another solar system similar to ours.
    D   be small planets like the Earth.

2. During the formation of the Earth, the *early atmosphere* is believed to have formed from:

    A   gases separated out from within the molten Earth.
    B   the cellular respiration of living things.
    C   gas planets colliding with the Earth.
    D   chemical reactions between the early crust and acid rain.

3. Concentrations of naturally-occurring *non-renewable resources* of potential economic value in the Earth's lithosphere are known as:

    A   findings.
    B   tailings.
    C   deposits.
    D   blocks.

4. Examine the *half-life curve* of radioisotopic Element X shown below.
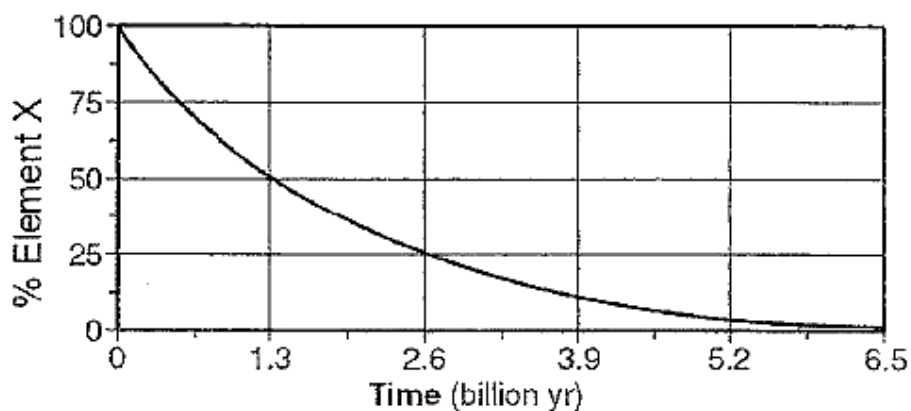
What is the *half-life* of Element X?

A   0.65 billion years
B   1.3 billion years
C   2.6 billion years
D   6.5 billion years

5. Which of the following dating techniques results in an actual numerical date?

A   relative dating
B   back-dating
C   absolute dating
D   speed dating

6. Johnathan is comparing a map showing the position of earthquakes and volcanoes around the world and notices that, in many places, they seem to form long lines that run along together for hundreds of kilometres.

What are these lines likely to indicate?

A   Nazca Lines
B   the edges of tectonic plates
C   continental coastlines
D   rivers

7. In the *scientific model* shown here, a Mars Bar is slowly being pulled apart.

The centre of the Mars Bar could represent:

A   a subduction zone.
B   a collision zone.
C   a rift valley.
D   an island arc volcano.

8. In 1968, the "Glomar Challenger" criss-crossed the Atlantic Ocean between South America and Africa, drilling core samples as it went. When the age of the samples was determined, the scientific world was amazed by its findings.

   What did the Glomar Challenger discover?

A   the Atlantic Ocean crust was far older than anyone had suspected
B   the edges of the Atlantic Ocean crust are very young, and get older and older towards the centre
C   the Atlantic Ocean crust is exactly the same age wherever you look
D   the centre of the Atlantic Ocean crust is very young, and gets older and older towards its edges

9. Divergent plate boundaries are also known as "*constructive plate boundaries*" because:

A   new crust is created at these boundaries.
B   large mountain ranges are formed at these boundaries.
C   they provided particularly useful data for scientists.
D   they produce large explosive volcanic eruptions.

10. The diagram below shows the crust of the Pacific Plate.
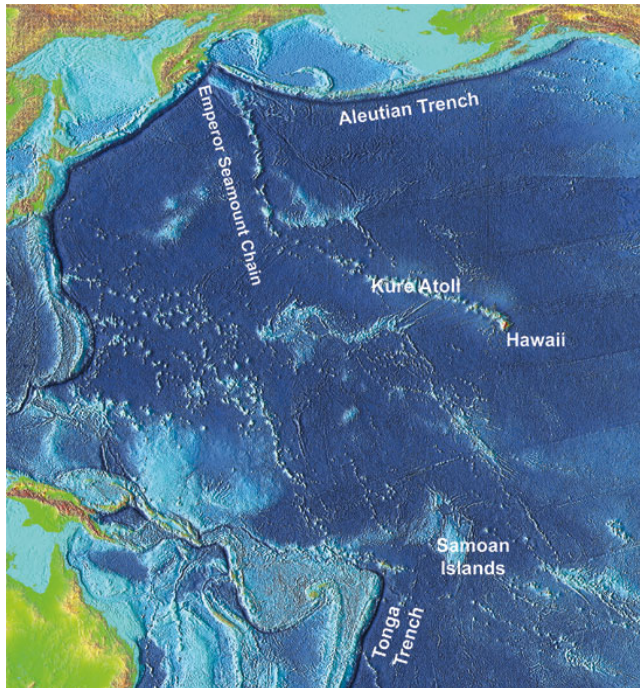
The 'Aleutian Trench' shown at the top of the image indicates that:

A   the Pacific Plate is being subducted beneath the North American Plate.
B   the Pacific Plate and the North American Plate form a transform boundary
     at this point.
C   the North American Plate is being subducted beneath the Pacific Plate.
D   the northern edge of the Pacific Plate is a large mountain range.

11. Heated fluids, like water, rise when they absorb heat energy. This is because:

A   the fluid is pushed away from the source of the heat energy.
B   the fluid becomes less dense, and gravity pulls on it with less force.
C   the fluid re-emits the heat energy, pushing it in the opposite direction.
D   the fluid expands in all directions, including upwards.

12. Earthquakes occur when elastic potential energy is suddenly released,
    transforming into _____ energy as the rocks break.

A   heat
B   solar
C   kinetic
D   gravitational potential

13. Darren plotted the speed of tectonic plates vs the length of their boundary that was convergent. His results are shown in the graph below.

Speed of Tectonic Plates
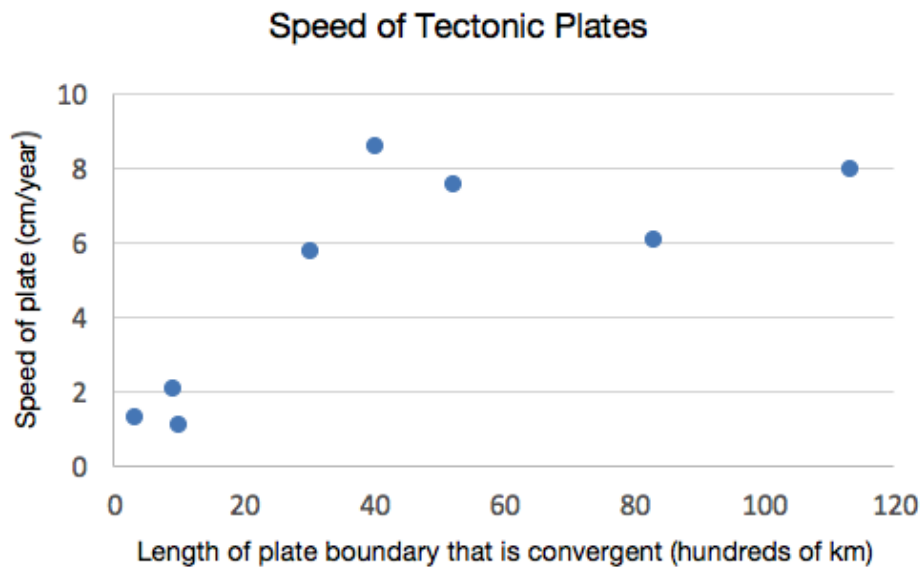
How would you BEST describe the *correlation* between these two variables?

A   no correlation
B   weak negative correlation
C   medium positive correlation
D   strong negative correlation

14. In the Earth's water cycle, the change from liquid water to water vapour due to the Sun's heat energy is known as:

A   advection.
B   condensation.
C   precipitation.
D   evaporation.

15. The movement of water from the poles to the equator and back again, due to a combination of heat energy and salinity, is sometimes known as:

A   upwelling.
B   the Coriolus Effect.
C   a Hadley Cell
D   the Thermohaline Circulation.

16. Of the total water on Earth, approximately what percentage is fresh water?

    A   97%
    B   22%
    C   5%
    D   3%

17. Which of the following pollutants could best be separated from stormwater by *filtration*?

    A   rubber from tyres
    B   pesticides
    C   petrol
    D   water-soluble fertilisers

18. Andy is conducting an experiment to test the hypothesis that "a reduction in vegetation ground cover will lead to increased soil erosion".

 Which of the following results would indicate to Andy that his experiment has been a *reliable* one?

    A   Andy has made sure that his measurements of the erosion have been carefully done
    B   Andy's measurements of the erosion have produced very similar results in repeated trials of the experiment
    C   Andy has conducted a controlled experiment
    D   Andy's measurements of the erosion have provided results that are close to the theoretical results that he was expecting

19. The table below shows the results of a study measuring the depth to the water table for an area of inland NSW.

Year	Depth beneath ground to water table (m)
1975	3.8
1985	2.9
1995	2.2
2005	1.8

What is a likely cause of the trend shown in the table?

A   soil compaction due to trampling by livestock
B   over-extraction of groundwater
C   replacement of native vegetation with seasonal crops
D   the re-establishment of native vegetation on previously bare ground

20. What types of pollutants can lead to *eutrophic* conditions in a water body?

A   heavy metals
B   nutrients (such as nitrates or phosphates)
C   pathogens
D   acids

End of Section I

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Section II
Total marks (65)
Attempt ALL questions
Allow about 1 hour for this part
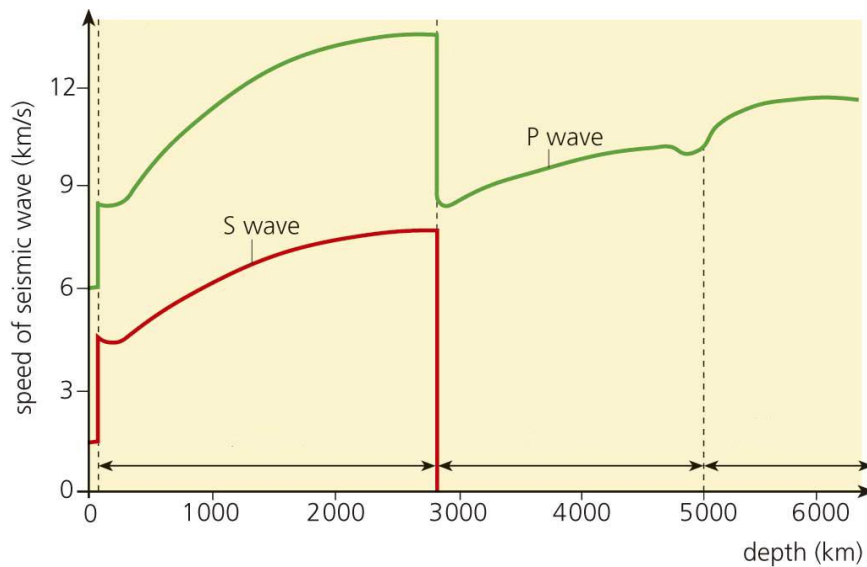
Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Question 21   (3 marks)   **Marks**

Scientists study the path of seismic waves produced by earthquakes as they pass
through the Earth. An example of some of the data that has been collected is shown
below.

Outline THREE things that scientists have inferred about the internal structure of the
Earth using seismic data like that shown above.
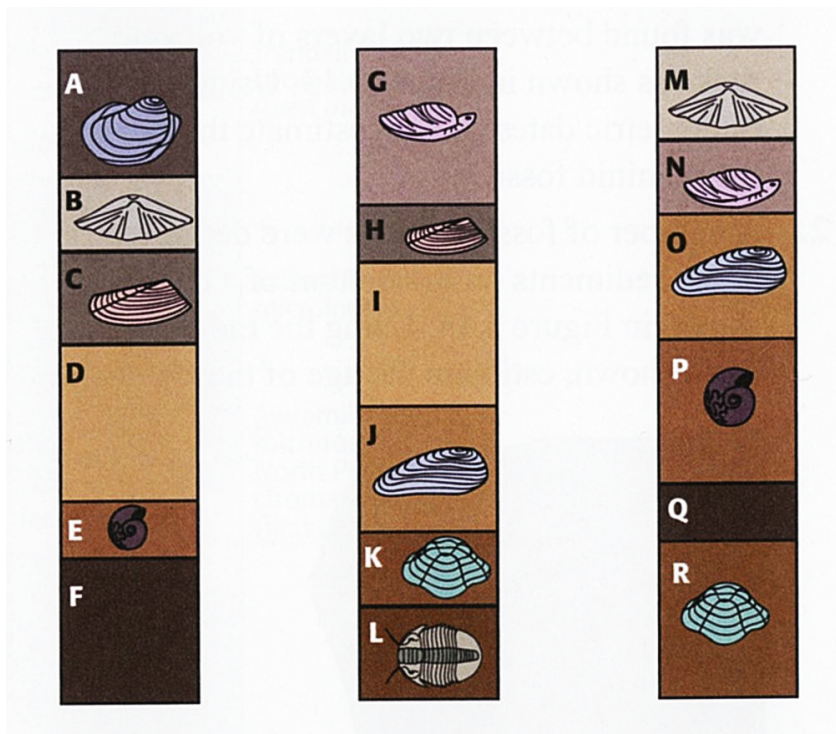
3

Question 22 (3 marks)   **Marks**

Explain the role of gravity in the formation of the early Earth.

3

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Question 23 (4 marks)   **Marks**

Rock strata from three separate locations are shown below.

4

(a)   Relative dating of strata such as those in the diagram above rely on *'The Law of Superposition'*. Recall the main idea of this Law.   **1**

_____

_____

_____

(b)   Using relative dating, identify the letter of the oldest layer in the first set of strata (on the left).   **1**

_____

(c)   Using relative dating, and the fossils in the layers, identify the letter of the layer that is the oldest of all three sets of strata.   **1**

_____

(d)   Radioisotope dating is used to date the fossil in Layer N as 76 million years old. Suggest a suitable age for the fossil in Layer A.   **1**

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Question 24   (8 marks)

Explain the formation of soil in terms of the interaction of atmospheric, geologic, hydrologic and biotic processes.

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Question 25 (7 marks)

In the 1940s, Harry Hess was an officer in the US Navy who was given the opportunity to use sonar to map the ocean floor of the Pacific Ocean. Off the west coast of South America he mapped the unusual feature shown in the elevation profile below.
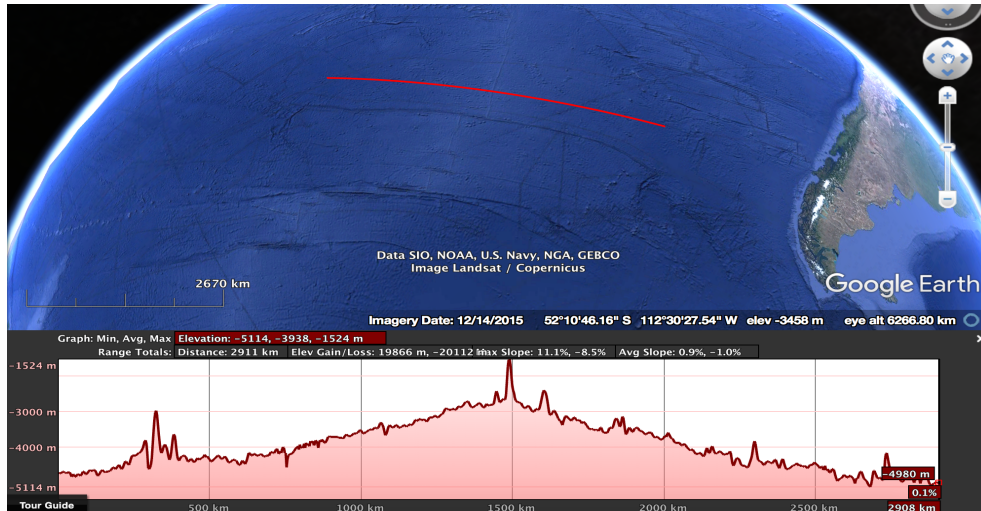
(a) Using data from the image above, describe what the elevation profile shows in this part of the Pacific Ocean.

3

(b) Using the concepts of '*Plate Tectonic Theory*', explain the processes that are believed to have contributed to the formation of this feature.

4

Question 26 (7 marks)

In 1620, explorer Francis Bacon noted the similarity in the shapes of the coastlines of Africa and South America.

Nearly three hundred years later, another scientist set about trying to find evidence to prove that Africa and South America were once joined together. According to his "*Theory of Continental Drift*" all of the southern hemisphere continents were once joined together in a supercontinent that he called "Gondwana".

(a)   Recall the name of this scientist.

1

_____

(b)   Outline TWO pieces of evidence that he used to try and reconstruct Gondwana.

2

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_____

_____

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(c)   The '*Theory of Continental Drift*' suggests that one day most of the continents of the Earth will be reunited. Using the concepts of *plate tectonic theory*, explain how tectonic processes are believed to bring sections of continental crust together.

4

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Question 27 (6 marks)

In the *Year 11 Earth & Environmental Science Course*, you conducted a practical investigation to demonstrate convection currents.

(a) Write a method of the investigation that you conducted. Be sure to identify any equipment used.

3

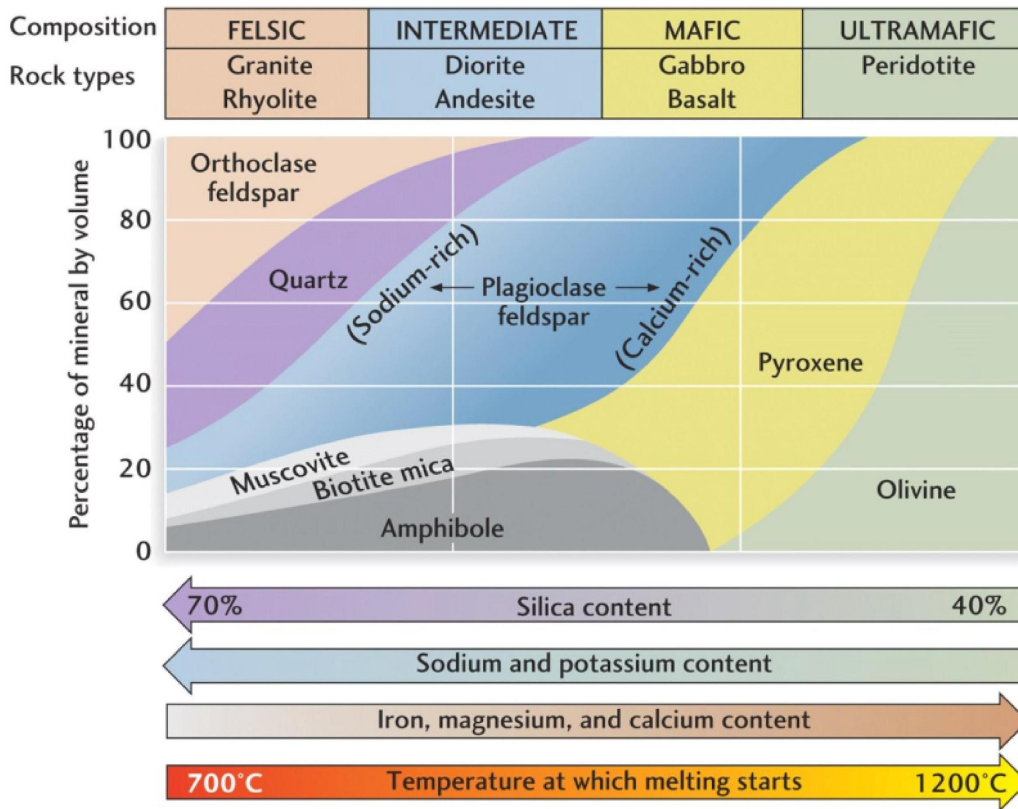(b) Convection is a form of *heat transfer*. Explain why.

1

(c) Describe a real-world example of convection currents in action (besides the investigation that you described above).

2

Question 28 (10 marks)

As magma in the mantle undergoes various processes, it is chemically and physically changed. Examine the chart showing some of these changes below.

(a) Identify which composition shown above is believed to be closest to the composition of the magma in the mantle of the Earth.

1

(b) Using the chart above, outline how an element found in the magma changes from *ultramafic* to *felsic*.

1

(c) Using the data above, describe the approximate mineral composition (as a percentage by volume) of a *mafic* rock such as basalt.

2

Question 28 continued...

(d)   One of the processes that change the composition of magma is "*partial melting*". Explain one way that partial melting of magma occurs.

2

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(e)   Felsic magma is said to be very '*viscous*'. This affects the kind of eruptions that volcanoes formed from this magma have.

(i)   Describe the eruptions that felsic volcanoes have.

2

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(ii)   Explain why they erupt in this way.

2

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Question 29 (3 marks)

In the *Year 11 Earth & Environmental Science Course*, you completed a case study involving the *rehabilitation of a salt-affected area*.

Describe a rehabilitation method used in the area and explained how it reduced the impact of salinity.

3

Question 30 (4 marks)

(a) Outline what is meant by '*heavy metal contaminants*' in soils.

1

(b) Identify a source of heavy metal pollution.

1

(c) Describe some of the effects of soil contamination of this type on living things.   **2**

Question 31 (6 marks)

Examples of polluted water include sewage, stormwater and industrial wastewater.

Choose ONE of these examples of polluted water mentioned above and answer the following questions.

> Identify the type of polluted water that you have chosen:
>
> _____

(a) Give at least TWO examples of pollutants that might be found in this kind of polluted water (be as specific as you can).

2

_____

_____

(b) Explain ONE key process that could be used to help treat this kind of water.

2

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_____

(c) Describe a potential re-use of the treated polluted water.

2

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Question 32 (4 marks)

Salvinia molesta is a water weed that has been introduced to Australia from South America. It that forms thick floating mats on the surface of water bodies, as shown below.

(a) Suggest ONE likely abiotic effect and ONE biotic effect of this water weed.

(i) Abiotic

1

(ii) Biotic

1

(b) Using knowledge gained in the *Year 11 Earth & Environmental Science Course*, explain how humans have changed the natural environment in a way that has help ensure the spread of weeds such as *Salvinia* in Australia.

2

End of Section II

End of paper

Year 11 EES Yearly Exam 2018 SOLUTIONS

Section I

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

Section II

Question 21

Criteria	Marks
• Outlines THREE things that scientists have inferred about the internal structure of the Earth using seismic data	3
• Does TWO of the above	2
• Does ONE of the above	1

e.g. Using seismic data, scientists have learned that the Earth has layers. As the seismic waves enter the Earth, they speed up, indicating that the Earth becomes denser with depth. Also, the S waves cannot travel past a certain point, and it is believed that this layer is in liquid form.

Question 22

Criteria	Marks
• Identifies that matter is attracted to other matter (by gravity) AND • Describes how gravity pulled matter together (in a nebula) to begin the formation of the Earth AND • Describes how gravity pulled or formed the Earth into a ball or sphere as it grew larger OR • Describes how gravity pulled the denser material to the centre of the Earth	3
• Does TWO of the above	2
• Does ONE of the above	1

e.g. All matter has gravitational force that attracts it to other masses. In the early solar system, the matter in the giant gas cloud clumped together to form early planets or 'planetesimals', such as Earth. Over time, gravity formed the Earth into a ball as all the matter was pulled into the centre.

Year 11 EES Yearly Exam 2018 SOLUTIONS

Question 23(a)

Criteria	Mark
• Outlines that *'The Law of Superposition'* states that the older rock layers will be found towards the bottom of the strata (or vice versa)	1

e.g. [as above]

Question 23(b)

Criteria	Mark
• Identifies layer F as the oldest layer in the left set of strata	1

e.g. [as above]

Question 23(c)

Criteria	Mark
• Identifies layer L as the oldest layer all the sets of strata	1

e.g. [as above]

Question 23(d)

Criteria	Mark
• Suggests an age younger than 76 million years old	1

e.g. [as above]

Year 11 EES Yearly Exam 2018 SOLUTIONS

Question 24(a)

Criteria	Marks
• Gives TWO features of the elevation profile shown AND • Uses data from the image	3
• Does TWO of the above	2
• Does ONE of the above	1

e.g. The elevation profile resembles a gentle-sided hill or mountain, rising from a depth of nearly 5000m to 1524m below sea level.

Question 24(b)

Criteria	Marks
• Relates TWO properties of divergent plate boundary processes ('cause') to the formation of mid-ocean ridges ('effect')	4
• Does THREE of the above	3
• Does TWO of the above	2
• Recalls some property of heat OR gravity OR the movement of tectonic plates	1

e.g. The convection currents in the mantle below a divergent plate boundary are rising to the surface and spreading apart. This puts upward pressure on the crust, leading to the 'thermal uplift' of the crust at the boundary compared to the surrounding area.

Question 25(a)

Criteria	Mark
• Identifies the scientist as (Alfred) Wegener	1

e.g. As above.

Question 25(b)

Criteria	Marks
• Gives TWO pieces of evidence (besides the shape of the continents) that he used to try and reconstruct Gondwana	2
• Gives ONE pieces of evidence	1

e.g. Wegener used the location of particular fossil pieces and particular mountain ranges and rock types scattered across the southern continents to try and reconstruct Gondwana.

Year 11 EES Yearly Exam 2018 SOLUTIONS

Question 25(c)

Criteria	Marks
• Relates TWO properties of tectonic processes ('cause') to TWO understandings about the how pieces of continental crust are brought together	4
• Does THREE of the above	3
• Does TWO of the above	2
• Recalls some property of tectonic processes OR the convergence of tectonic plates	1

e.g. Often tectonic plates are made of a combination of oceanic and continental crust. Convection currents often move two tectonic plates containing continental crust towards each other. If one of these plates has oceanic crust moving towards continental crust, it will be subducted and destroyed as it melts back in to the mantle. In this way, two pieces of continental crust can be brought together.

Question 26(a)

Criteria	Marks
• Includes mention of a heat source AND • Includes the observation of the motion of a liquid (or gas) AND • Includes the identification of all relevant equipment (including the liquid or gas)	3
• Does TWO of the above	2
• Does ONE of the above	1

e.g. To demonstrate convection currents, water was added to a round-bottomed flask, which was clamped to a retort stand. A Bunsen burner was set up underneath the flask and used to heat the water. The water was observed for any movement or currents related to the application of the heat from below.

Question 26(b)

Criteria	Mark
• Explains that convection is a form of heat transfer as it moves heat from one place to another (or similar)	1

e.g. [as above]

Question 26(c)

Criteria	Marks
• Gives TWO features of a real-world example of convection currents	2
• Gives ONE feature OR identifies a real-world example	1

e.g. One real-world example of convection currents occurs inside the Earth. The Inner Core heats the asthenosphere above, leading to large-scale motions of magma.

Question 27(a)

Criteria	Mark
• Identifies the composition that is believed to be closest to the composition of the magma in the mantle of the Earth as ultramafic	1

e.g. [as above]

Question 27(b)

Criteria	Mark
• Outlines how an element found in the magma changes from ultramafic to felsic	1

e.g. From ultramafic to felsic, the silica content becomes higher in the magma.

Question 27(c)

Criteria	Marks
• Identifies plagioclase feldspar in the range 10-70% AND • Identifies pyroxene in the range 5-80% AND • Identifies olivine in the range 1-20% OR identifies amphibole in the range 1-25%	2
• Does TWO of the above	1

e.g. [as above]

Question 27(d)

Criteria	Marks
• Relates the 'cause' of partial melting to the 'effect' on the magma	2
• Describes the 'cause' or 'effect' of partial melting	1

e.g. As heated magma rises towards the surface, the pressure on the magma rapidly drops. Elements with lower melting points, such as silica and aluminium, rise to the surface before other elements, leaving other elements behind, changing the composition of the magma.

Question 27(e)(i)

Criteria	Marks
• Gives TWO features of felsic volcano eruptions	2
• Gives ONE feature	1

e.g. Felsic volcanoes produce explosive eruptions that release lots of ash and gases in a very short period.

Question 27(e)(ii)

Criteria	Marks
• Relates a property of viscous magma ('cause') to the 'effect' on the eruption	2
• Recalls some feature of felsic magma	1

e.g. Viscous felsic magma is very slow flowing (or 'viscous'), which means that any bubbles rising from below are trapped in the magma for longer. This can lead to the build-up of large pressures that result in an explosive eruption.

Question 28

Criteria	Marks
• Gives TWO features of a rehabilitation method AND • Relates a property of the rehabilitation method ('cause') to the 'effect' on the salinity	3
• Does TWO of the above	1
• Does ONE of the above	

e.g. The landowners had a lot of cleared land on their property, and high levels of salt in the topsoil. They planted a lot of salt-tolerant saltbush, which is able to tolerate the high levels of soil while their long roots soak up excess water from the water table. This lowered the water table over time and removed some of the salt from the soil.

Year 11 EES Yearly Exam 2018 SOLUTIONS

Question 29(a)

Criteria	Mark
• Outlines that heavy metal contaminants are pollution containing metals	1

e.g. [as above]

Question 29(b)

Criteria	Mark
• Identifies a source of heavy metal pollution	1

e.g. A source of heavy metal pollution is waste from industrial processes or mine tailings.

Question 29(c)

Criteria	Marks
• Gives TWO features of the effects of heavy metal soil contamination - must have at least ONE specific effect such as damage to nervous, immune or reproductive system rather than just 'effecting the health' or 'killing' living things	2
• Gives ONE feature	1

e.g. Heavy metal soil contamination affected the nervous and immune systems of living things.

Question 30(a)

Criteria	Marks
• Gives TWO examples of pollutants that might be found in the specific polluted water	2
• Gives ONE example	1

e.g. [answer varies]

Question 30(b)

Criteria	Marks
• Relates the 'cause' of a key process to the 'effect' of treating the water	2
• Does ONE of the above OR identifies ONE process	1

e.g. One key process that could be used to treat the water is filtration, using large metal screens. This process quickly removes large solid waste, such as rubbish.

Year 11 EES Yearly Exam 2018 SOLUTIONS

Question 30(c)

Criteria	Marks
• Gives TWO features of the a potential re-use of the treated water	2
• Gives ONE feature OR identifies ONE re-use	1

e.g. The treated water still has high levels of nutrients. For this reason, the water can be used on a playing field or golf course to help the grass grow.

Question 31(a)(i)

Criteria	Marks
• Outlines one likely abiotic effect	1

e.g. One likely abiotic effect would be a decrease in light levels below the weed mat.

Question 31(a)(ii)

Criteria	Marks
• Outlines one likely biotic effect	1

e.g. One likely biotic effect would be a decline in native vegetation (like reeds) covered by the weed mat.

Question 31(b)

Criteria	Marks
• Relates the 'cause' of a change in the natural environment to the 'effect' of ensuring the spread of weeds	2
• Does ONE of the above	1

e.g. By putting fertilisers on garden beds and farmlands, human have added excess nutrients to the natural Australian environment. Native plants do like excess nutrients but some weeds thrive under these conditions, as they are adapted to grow well when nutrient levels in the water or soil are high.