2017 HSC Earth and Environmental Science Marking Guidelines

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

Section I, Part A

Multiple-choice Answer Key

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

Section I, Part B

Question 21 (a)

Criteria	Marks
• Outlines TWO features of the named natural disaster associated with tectonic activity	2
• Outlines ONE feature of the named natural disaster associated with tectonic activity OR • Identifies TWO features of a natural disaster associated with tectonic activity	1

Sample answer:

Japanese Earthquake 2011

This disaster resulted in ground motion that caused some damage to the built environment but the largest impact of the resulting tsunami was the devastation of many coastal communities with wide scale flooding and destruction of the environment.

Question 21 (b)

Criteria	Marks
• Outlines the cause of the tectonic movement or process resulting in the named disaster • Links the disaster to the tectonic movement or process	3
• Outlines the cause of the tectonic movement or process resulting in this disaster	2
• Provides some relevant information	1

Sample answer:

Japanese Earthquake 2011

Japan makes up a volcanic island arc that characterises a convergent ocean–ocean plate boundary. The earthquake resulted from the release of tensional forces that had built up over time, resulting in both ground motion and tsunamis.

Question 21 (c)

Criteria	Marks
• Describes TWO possible ways to minimise the effects of this type of natural disaster • Provides evidence to support identified strategies	4
• Outlines TWO possible ways to minimise the effects of this type of natural disaster • Provides evidence to support identified strategies	3
• Describes ONE possible way to minimise the effects of this type of natural disaster • Provides evidence to support the identified strategy OR • Outlines TWO possible ways to minimise the effects of this type of natural disaster	2
• Provides some relevant information	1

Sample answer:

Japanese Earthquake 2011

1. Many towns already had protective walls but in some cases, 10 m walls proved to be ineffective. Bigger walls would better protect the environment, infrastructure and save lives.
2. Rezone low lying coastal areas and move urban areas to higher ground. This would require massive relocation of infrastructure but more human lives would be saved.

Question 22

Criteria	Marks
• Provides features of TWO land management issues and for each shows how or why it would be addressed by planting native vegetation	4
• Provides some features of TWO land management issues and for each provides some reasons how or why it would be addressed by planting native vegetation	3
• Provides features of TWO land management issues OR • Provides features of ONE land management issue and shows how or why it should be addressed by planting native vegetation	2
• Provides some relevant information	1

Sample answer:

Soil erosion and water table issues.
Planting native trees around the edges of fields would reduce the wind velocity and therefore reduce wind erosion and loss of topsoil from fields. Planting deep-rooted native trees in recharge areas (usually top of a hill) would reduce runoff and soil erosion. It would also reduce the amount of water that would reach the water table, helping to lower the water table and reduce salinity issues.

Question 23 (a)

Criteria	Marks
• Identifies TWO trends from the diagram	2
• Identifies ONE trend from the diagram	1

Sample answer:

The greater the age of the eruption, the greater the Volcanic Explosivity Index (VEI). The bigger the circle, the bigger the volume of ejecta.

Question 23 (b)

Criteria	Marks
• Provides details of ONE strength of the diagram as a model	2
• Provides some relevant information	1

Sample answer:

The size of the coloured circles clearly shows the relative size of each eruption in terms of its ejecta making this contrast very evident.

Question 23 (c)

Criteria	Marks
• Provides details of ONE weakness of the diagram as a model	2
• Provides some relevant information	1

Sample answer:

The position of each eruption is not in clear chronological order, making it difficult to identify the resulting trend over time.

OR

The sizes of the circles are not to scale, making this model less realistic. Yellowstone is 50 times greater in ejecta than Krakatau, but this is not reflected by the circles.

Question 24

Criteria	Marks
• Outlines the proposed changes • Details the impacts of reduced environmental flows including appropriate terminology • Details the impacts of increased water for agriculture including appropriate terminology • Makes a judgement regarding sustainability with supporting evidence	6
• Outlines the proposed changes • Details impacts of reduced environmental flows OR increased water for agriculture including appropriate terminology • Makes a judgement regarding sustainability with supporting evidence	5
• Outlines the proposed changes • Identifies impacts of reduced environmental flows AND identifies impacts of increased water for agriculture OR • Outlines impacts of reduced environmental flows OR increased water for agriculture • Makes a judgement regarding sustainability	4
• Outlines the proposed changes • Identifies impacts of reduced environmental flows OR identifies impacts of increased water for agriculture • Makes a judgement regarding sustainability	3
• Outlines the proposed changes • Identifies impacts of reduced environmental flows OR identifies impacts of increased water for agriculture	2
• Provides some relevant information	1

Sample answer:

Water allocations and damming severely affect the sustainability of Australia's river systems. Environmental flows are an artificial release of water into a river system to maintain natural processes. Advantages of environmental flows include depositing sediments on top of decaying organisms, the stimulation of eggs to hatch for the breeding of fish, the encouragement of water birds back to an area, reducing salinity and preventing eutrophication.

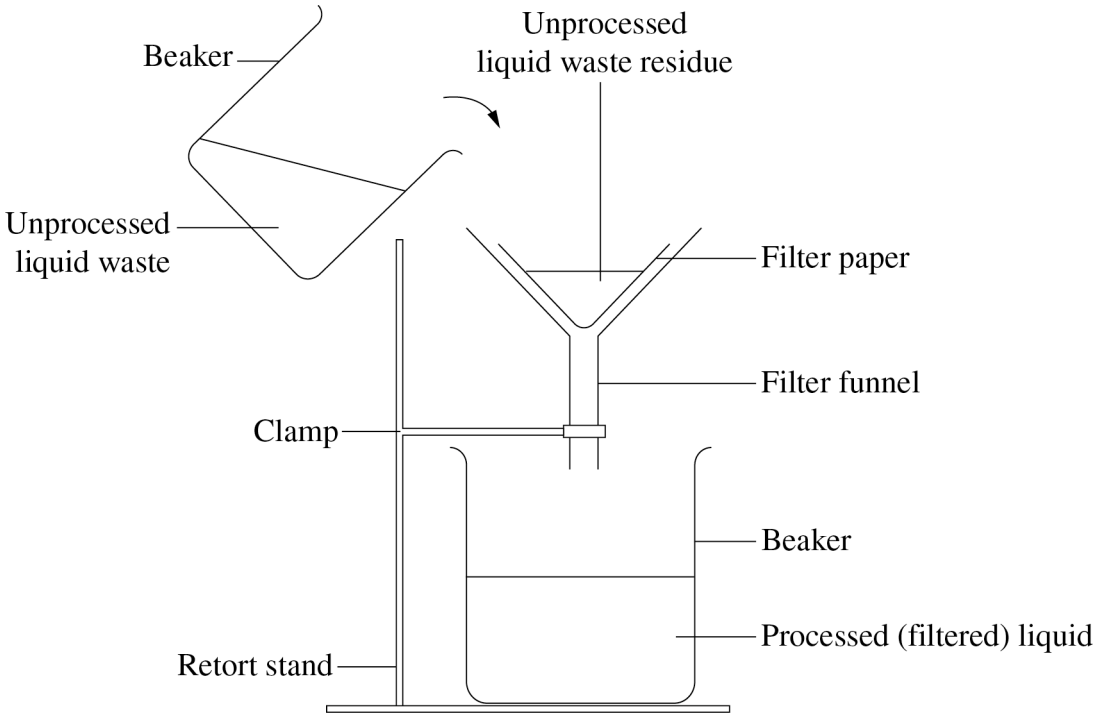
As a result of cutting the amount of water set out for environmental flows, the sustainability of Australian river systems such as the Murray-Darling are severely affected. This is due to less oxygen being available for organisms as decaying organisms reduce the available oxygen and as a result fish can be deprived of oxygen. Eutrophication can also occur and limit light available for photosynthesising aquatic plants.

This does not strike a 'sensible balance' between social, economic and environmental interests as the economic benefits of agriculture are being preferred to environmental sustainability. Flood irrigation methods used by some farmers can also increase salinity due to the rising water table, resulting in higher management and rehabilitation costs into the future. Therefore, changes to water allocation severely affect river systems such as the Murray-Darling river system and result in an unsustainable river system.

Question 25 (a)

Criteria	Marks
• Draws an appropriate diagram to simulate a process to treat liquid waste • Labels apparatus • Gives the features of the process	4
• Draws an appropriate diagram to simulate a process to treat liquid waste • Labels apparatus • Gives some of the features of the process	3
• Draws a diagram to simulate a process to treat liquid waste • Provides some labels for apparatus or process	2
• Provides some relevant information	1

Sample answer:



Answers could include:

Aeration, precipitation, sedimentation.

Question 25 (b)

Criteria	Marks
• Identifies an appropriate method for disposal or recycling of solid waste • Gives features of the method • Makes a judgement regarding the suitability of method with supporting evidence	3
• Identifies an appropriate method for disposal or recycling of solid waste • Details features of the method • Makes a judgement of the method	2
• Provides some relevant information	1

Sample answer:

Council provision of a range of bins has been very effective in getting household waste pre-sorted into garbage/recycling thereby reducing the amount of landfill. Plastics/glass/paper are placed into different containers by individuals and taken away for reprocessing.

OR

Collection of glass bottles has been a significant initiative by governments, reducing the amount of glass found in landfill. In SA and NT containers are taken back to point of sale for refund and reprocessing.

Question 26 (a)

Criteria	Marks
• Demonstrates a thorough understanding of the relationship between reviewing secondary sources and reliability	3
• Demonstrates some understanding of the need to review secondary sources and/or reliability	2
• Provides some relevant information	1

Sample answer:

Secondary sources should be reviewed to ensure they are current because up to date information is important for drawing reliable conclusions. Sources should be checked for credibility and lack of bias, for example recognised institutions and peer-reviewed sources are assumed to be more reliable than popular magazines.

Answers could include:

Age, source, bias, authorship, peer reviewed, comparison with other sources or other appropriate criteria.

Question 26 (b)

Criteria	Marks
• Identifies an appropriate investigation • Provides advantages of working as a team and linking these to better experimental outcomes	3
• Identifies an appropriate investigation • Provides advantage(s) of working as a team or links these to better experimental outcomes	2
• Identifies at least ONE advantage of working as a team	1

Sample answer:

Investigation – soil compaction

The effect of soil compaction was better undertaken by a team as it is possible to repeat and collect more data with more people sharing the work. The method was discussed and improved by the members of the team. The team was able to share jobs, collect data and set up more samples than an individual. The results were collated and it was possible to attain a more statistically valid average.

Question 27 (a)

Criteria	Marks
• Demonstrates an understanding of evolution • Relates changes in organisms over time to changes in fossils	2
• Provides some relevant information	1

Sample answer:

Evolution is the change in groups of organisms over time. As environments change over time, mutations may allow some organisms to better survive. The changes are preserved in the fossils and thus the changes in the organisms can be traced over time, showing the evolutionary paths.

Question 27 (b)

Criteria	Marks
• Identifies ONE feature of the terrestrial environment • Shows how the feature was an advantage	2
• Provides some relevant information	1

Sample answer:

Movement of spores in water is restricted by the current movement. In the drier terrestrial environment, wind is an agent of dispersal and this allows a wider range for the dispersal of seeds and pollen, thus allowing new habitats to be colonised.

Question 27 (c)

Criteria	Marks
• Demonstrates a detailed understanding of evolution • Details a mechanism for the evolution of the Australian songbird • Uses information or examples from the diagram to support mechanism	4
• Demonstrates an understanding of evolution OR details a mechanism for the evolution of the Australian songbird OR gives information about both • Uses information and/or examples from the diagram to support mechanism	3
• Gives information about evolution OR a mechanism for evolution • Gives an example from the diagram	2
• Provides some relevant information	1

Sample answer:

Australian songbirds evolved from a common ancestor over time due to variations in the gene pool being selected for by pressures in the environment (natural selection). Survival of the fittest means these changes would be passed on to offspring resulting in a new species such as the divergence of finches from warblers (*Passerida*) or honeyeaters from crows (*Corvida*) giving rise to a greater variety of songbirds.

Question 28

Criteria	Marks
• Correctly completes all of the table	4
• Correctly completes most of the table	3
• Correctly completes some of the table	2
• Provides some relevant information in the table	1

Sample answer:

Point on graph	*Age* (Ma BP)	*Typical life form*	*Major event*
Q	**4500**	**None**	Formation of Earth
R	2800	Stromatolites	**BIF OR** **Photosynthesis begins OR** **Oxygen released into ocean**
S	**550**	**Molluscs with protective shells**	Cambrian explosion
T	450	**Plants**	First life on land

Question 29

Criteria	Marks
• Identifies TWO relevant mass extinction hypotheses related to named Period • Details the characteristics of each hypothesis • Shows how the TWO hypotheses are similar or different	5
• Identifies TWO relevant mass extinction hypotheses related to named Period • Gives similarities or differences of the TWO hypotheses	3–4
• Identifies ONE relevant mass extinction hypothesis related to name Period and gives features OR • Names TWO hypotheses and gives some information about each	2
• Provides some relevant information	1

Sample answer:

Two hypotheses that have been used to explain the Cretaceous mass extinction are the catastrophic or bolide theory and the gradual theory.

The catastrophic theory states a large object such as an asteroid or comet collided with the Earth with sudden extinction. The gradual theory involves global climate change associated with an ocean regression resulting in a slower extinction possibly as long as 2–3 million years. Both theories state numerous groups of organisms on land and in the ocean became extinct. Both theories can be used to explain sea level changes, and volcanic events, whereas only the bolide theory explains tidal waves and impact debris deposits. Some people believe the bolide impact may have accentuated regression and volcanism that was already happening whereas others believe it was more instantaneous.

Section II

Question 30 (a)

Criteria	Marks
• Identifies an introduced animal • Provides criteria that led to the introduced species becoming a pest	3
• Identifies an introduced animal and provides a criterion for the introduced species becoming a pest	2
• Identifies an animal or a criterion for an introduced species becoming a pest	1

Sample answer:

The rabbit has become a 'pest' in Australia because it has been successful at establishing colonies due to reproducing rapidly by early maturation of young. This puts it into competition with native species.

Question 30 (b)

Criteria	Marks
• Names biological control of identified plant • Gives features of a successful biological control and links it to named example	4
• Names biological control and plant • Provides features of a successful biological control	3
• Names a biological control and plant with at least ONE feature stated	2
• Provides some relevant information	1

Sample answer:

Biological control was used very effectively against the prickly pear. The Cactoblastis moth was used to lay eggs on the prickly pear. The larvae hatch and feed on the plant. Over time the population of prickly pear was so significantly reduced that the Cactoblastis moth died off as it ran out of food. Cactoblastis is not able to feed on other plants and thus it is a very good biological control because it has no deleterious effect on native vegetation.

Question 30 (c) (i)

Criteria	Marks
• Describes why incoming passengers are required to complete the questions	2
• Outlines why incoming passengers are required to complete the questions	1

Sample answer:

Passengers are required to complete questions 1–5 to provide information to aid in prevention of entry of possible pathogens/spores that may affect local flora and fauna.

Question 30 (c) (ii)

Criteria	Marks
• Demonstrates a comprehensive understanding of the effect of a breach of quarantine regulations on the biotic and abiotic features of Australia • Uses appropriate examples to support answer	4
• Demonstrates some understanding of the effect of a breach of quarantine regulations on the biotic and abiotic features of Australia • Uses appropriate examples to support answer	3
• Demonstrates some understanding of the effect of a breach of quarantine regulations on either biotic or abiotic features of Australia • Provides at least ONE example	2
• Provides some relevant information	1

Sample answer:

Experience has shown that many introduced species affect the Australian environment, for example the introduction of foxes and cats resulted in the loss of many Australian animals because the endemic animals were used as food. Thus the biota of Australia changed. The introduced rabbits dig burrows that make the local terrain prone to erosion, this affecting the abiotic environment.

It is imperative that quarantine laws are not breached because new introduced species could also affect the biotic and abiotic features of Australia in the future, as new introduced species can have unknown consquences.

Question 30 (d) (i)

Criteria	Marks
• Identifies independent variable	1

Sample answer:

Distance from water source (in metres).

Question 30 (d) (ii)

Criteria	Marks
• Identifies the overall trend	1

Sample answer:

As distance from water source increases, the numbers of the introduced species decrease.

Question 30 (d) (iii)

Criteria	Marks
• Constructs a completed table – Appropriately enclosed table – Appropriate number of columns – Column headers including units • Correct transcription of all data from graph	4
• Constructs a completed table – Appropriate number of columns – Column headers and/or units • Correct transcription of most data from graph	3
• Constructs a table – Appropriate number of columns – Column headers • Correct transcription of most data from graph	2
• Some attempt at tabulation or display of data from the graph	1

Sample answer:

Distance from water source (m)	*Number of an introduced species*
0	27
200	20
400	15
600	9
800	7
1000	7

Question 30 (e)

Criteria	Marks
• Demonstrates a detailed knowledge and understanding of the use of rehabilitation strategies regarding introduced species in an area • Makes a supported judgement regarding the effectiveness of identified strategies • Provides appropriate examples • Demonstrates a coherent and logical progression of thought and indicates a high level of the use of scientific principles, ideas and terminology	6
• Demonstrates a good knowledge and understanding of the use of rehabilitation strategies regarding introduced species in an area • Identifies different strategies • Makes a supported judgement regarding the effectiveness of an identified strategy • Provides appropriate examples • Uses appropriate terminology and progression of thought	5
• Demonstrates some knowledge and understanding of the use of rehabilitation strategies regarding introduced species in an area • Makes a judgement regarding the effectiveness of an identified strategy • Gives at least a point for strategy OR a point against a strategy • Provides appropriate examples • Uses suitable terminology and progression of thought	4
• Provides points for strategy OR points against strategy • Limited use of appropriate terminology	3
• Provides points for OR against a strategy	2
• Provides some relevant information	1

Sample answer:

Many different strategies have been used to control introduced species in an area that have had little impact on rehabilitation, such as biological control, use of pesticide, culling, destruction of breeding grounds, and transplanting of more suitable species.

The Bradley method involves an annual removal of introduced plant species, such as Bitou Bush from a coastal area. Firstly removing plants from the least affected area and then moving on to the most affected areas, avoiding soil disturbance, and providing top-up soil or even native seeds. Native plants are allowed to revegetate the area, dictating the rate of pest removal over time as a dense native cover builds up.

It is important that small areas are cleared at a time so as not to provide opportunity for the introduced species to compete with the regenerating natives. While this method is very labour and time consuming it is efficient at clearing the area of the pest species, over time giving rise to a permanent solution requiring very little maintenance. Biological control can only be effective if a species-specific control can be found. This is not always possible.

Question 31 (a)

Criteria	Marks
• Provides characteristics and features of gaseous fossil fuels • Identifies energy yield of each fuel	3
• Identifies TWO gaseous fossil fuels • Refers to energy yield	2
• Provides some relevant information	1

Sample answer:

Natural gas can be processed to produce a) liquefied petroleum gas (LPG) which has the highest heat per volume of gas burned (27 000 kJ m^{-3}), and b) dry natural gas which has a lower heat output at 37 kJ m^{-3}. Gas produced from coal has the lowest output at 3kJ m^{-3}.

Question 31 (b)

Criteria	Marks
• Demonstrates an understanding of the formation of coal and oil • Provides the similarities and/or differences between the formation of coal and oil	4
• Demonstrates an understanding of the formation of coal and oil • Provides some similarities or differences between the formation of coal and oil	3
• Provides some relevant information for both coal and oil formation	2
• Provides some relevant information regarding coal or oil formation	1

Sample answer:

Coal is a solid formed from the burial of plant material in a low oxygen, freshwater or brackish environment. Oil is a liquid formed from the remains of microscopic organisms, normally in a marine environment. Both coal and oil are formed in sedimentary environments and require heat and pressure over time to form.

Question 31 (c) (i)

Criteria	Marks
• Provides characteristics and features of seismic technology	2
• Provides some relevant information about seismic technology	1

Sample answer:

The seismic technology uses a vibrator truck to create a shock wave, which travels through the earth. Some waves travel through a rock layer boundary and some are reflected back to the geophones and passed to the recording trucks.

Question 31 (c) (ii)

Criteria	Marks
• Describes appropriate exploration technology • Links technology to identification of coal seam	4
• Identifies appropriate exploration technology • Links technology to identification of coal seam	3
• Identifies some information about a technology and coal seams	2
• Provides some relevant information	1

Sample answer:

Geological exploration includes a drilling program to provide core samples over a wide area of interest. These core samples can be examined to determine relative thickness and depth of rock strata including the presence and distribution of coal seams.

Question 31 (d) (i)

Criteria	Marks
• Identifies independent variable	1

Sample answer:

Depth below surface in metres.

Question 31 (d) (ii)

Criteria	Marks
• Identifies the overall trend	1

Sample answer:

As depth increases, porosity decreases.

Question 31 (d) (iii)

Criteria	Marks
• Constructs a completed table – Appropriately enclosed table – Appropriate number of columns – Column headers including units • Correct transcription of all data from graph	4
• Constructs a completed table – Appropriate number of columns – Column headers including units • Correct transcription of most data from graph	3
• Constructs a table – Appropriate number of columns – Column headers • Correct transcription of most data from graph	2
• Some attempt at tabulation or display of data from the graph	1

Sample answer:

Depth (m)	*Porosity* (%)
0	27
200	20
400	15
600	9
800	7
1000	7

Question 31 (e)

Criteria	Marks
• Demonstrates a detailed knowledge and understanding of the use of fossil fuels in modern society • Makes a supported judgement regarding continued use of fossil fuels in society • Provides appropriate examples • Demonstrates a coherent and logical progression of thought and indicates a high level of the use of scientific principles, ideas and terminology	6
• Demonstrates a good knowledge and understanding of the use of fossil fuels in modern society • Makes a supported judgement regarding continued use of fossil fuels in society • Provides appropriate examples • Uses appropriate terminology and progression of thought	5
• Demonstrates some knowledge and understanding of the use of fossil fuels in modern society • Makes a judgement regarding continued use of fossil fuels in society • Gives a point for continued use OR a point against continued use • Provides appropriate examples • Uses suitable terminology and progression of thought	4
• Provides points for continued use OR points against continued use of fossil fuels • Limited use of appropriate terminology	3
• Provides points for OR against continued use of fossil fuels	2
• Provides some relevant information	1

Sample answer:

The continued dependence of modern society on fossil fuels is not sustainable. Fossil fuels include coal, oil and natural gas that were formed from organic sources millions of years ago. Fossil fuels are relatively cheap and have a high-energy yield per kilogram (eg anthracite coal provides 35 MJ/kg and LPG is even higher). Fossil fuels provide reliable energy for the majority of transport, electricity production and industrial processes in modern societies. They also provide substances for production of plastics and essential pharmaceuticals.

Fossil fuels are a finite, non-renewable resource and unlike other substances (eg metals), they cannot be recycled. This means they will eventually run out and alternative energy sources will need to be found. Fossil fuels also have a huge environmental impact in their production and consumption. Mining such as strip mining for coal in NSW, and oil and gas drilling, such as the Deepwater Horizon oil spill in the Gulf of Mexico, have caused widespread habitat destruction. Burning fossil fuels produces gases such as SO_2 (causing acid rain) and CO_2 (a potent greenhouse gas that is thought to be responsible for global warming and associated issues of climate change).

Fossil fuels are a finite, polluting resource so the continued dependence of modern society on them is not sustainable.

Question 32 (a)

Criteria	Marks
• Identifies an ore body • Provides characteristics and features of a model relevant to a sedimentary environment • Relates features of the deposit to elements of the model	3
• Outlines a model relevant to a sedimentary environment • Relates the model to a deposit	2
• Provides some relevant information	1

Sample answer:

Placer gold deposits formed in a sedimentary environment. These deposits can form in rivers, lakes or oceans. For fluvial placer deposits, gold is liberated from primary deposits such as hydrothermal deposits, by weathering and erosion. The gold is carried along the river by high-energy currents when the river is in flood. Where the energy is reduced, such as behind bars or on meander banks, the gold is deposited and accumulated in the coastal sediment.

Question 32 (b)

Criteria	Marks
• Provides features of an Environmental Impact Statement • Shows a relationship between an EIS and a reduction in the environmental impact of mining • Shows how each feature addresses the impact of mining	4
• Provides features of an Environmental Impact Statement • Shows a link between an EIS and the impact of mining • Shows how the features address the impact of mining	3
• Provides features of an Environmental Impact Statement OR • Provides an example of ONE criterion and relates the criterion to the impact of mining OR • Outlines features of an Environmental Impact Statement and gives an example	2
• Provides some relevant information	1

Sample answer:

An Environmental Impact Statement describes the site before mining and mandates how the site will be rehabilitated. The EIS should cover such things as contamination, social impact, impact on the environment, Indigenous culture and compliance with government regulations. By specifying the tests that have to be carried out on water on the mine site, the contamination levels can be monitored and steps undertaken to reduce them. The EIS should stipulate what vegetation and landform rehabilitations have to be carried out to reduce the destructive impacts of mining. By carrying out surveys of Indigenous culture before mining, important areas can be avoided during mining. All of these reduce the impact of mining.

Question 32 (c) (i)

Criteria	Marks
• Provides features of ONE method that could have been used in exploration	2
• Provides some relevant information	1

Sample answer:

As the deposit was near the surface a surface magnetic survey may have been useful. Ore bodies are often associated with magnetic minerals. Grid lines would have been set out and the magnetic intensity measured at equal distances along the grid lines. The data could then have been put into a computer and a model produced.

Question 32 (c) (ii)

Criteria	Marks
• Provides the features that determine the costs of the mine • Provides the features that determine the income of the mine • Provides examples of both • Relates the features to the economic value of the mine	4
• Provides some features that determine the costs of the mine and the features that determine income • Provides an example • Attempts to relate features to the economic value of the mine	3
• Provides features that determine cost of the mine and/or income	2
• Provides some relevant information	1

Sample answer:

The economic value of the deposit would have been determined by calculating exploration and production costs and comparing these to the market value of the ore minerals. A drilling program would determine the grade and size of the deposit and, using these in conjunction with the market value of the commodities, the expected value of the deposit would be determined. Exploration mining and processing costs would be calculated and these are deducted from the market value of the deposit to give the net value of the deposit.

Question 32 (d) (i)

Criteria	Marks
• Identifies independent variable	1

Sample answer:

Depth below surface in metres.

Question 32 (d) (ii)

Criteria	Marks
• Identifies the overall trend	1

Sample answer:

As depth increases, copper value decreases.

Question 32 (d) (iii)

Criteria	Marks
• Constructs a completed table – Appropriately enclosed table – Appropriate number of columns – Column headers including units • Correct transcription of all data from graph	4
• Constructs a completed table – Appropriate number of columns – Column headers including units • Correct transcription of most data from graph	3
• Constructs a table – Appropriate number of columns – Column headers • Correct transcription of most data from graph	2
• Some attempt at tabulation or display of data from the graph	1

Sample answer:

Depth below surface (m)	*Copper value* (ppm)
0	27
200	20
400	15
600	9
800	7
1000	7

Question 32 (e)

Criteria	Marks
• Demonstrates a detailed knowledge and understanding regarding technology and government policy in the modern mining industry • Makes a supported judgement regarding the effects of technology and government policy in the modern mining industry • Provides appropriate examples • Demonstrates a coherent and logical progression of thought and indicates a high level of the use of scientific principles, ideas and terminology	6
• Demonstrates a good knowledge and understanding regarding technology and government policy in the modern mining industry • Identifies different policies or technologies • Makes a supported judgement regarding the effects of technology and government policy on the modern mining industry • Provides appropriate examples • Uses appropriate terminology and progression of thought	5
• Demonstrates some knowledge and understanding regarding technology and government policy in the modern mining industry • Makes a judgement regarding the effects of technology and government policy on the modern mining industry • Provides a point related to technology OR a point related to government policy • Provides appropriate examples • Uses suitable terminology and progression of thought	4
• Provides points for OR points against technology and government policies • Limited use of appropriate terminology	3
• Provides points for OR against technology and government policies	2
• Provides some relevant information	1

Sample answer:

The modern mining industry is vastly different to what it used to be because of changes resulting from technological change and government policy. Initially there were no government policies in regard to mining. EIS statements are now needed and this results in better mine management and less destructive impact on the mine site giving rise to more sustainable use of the mine site.

Laws now specify the rights of the landowner and the mining company. Also Indigenous cultures now have to be considered whereas once they were ignored. For example, the Wik decision mandates that where Aboriginal peoples' have native title, the mine must coexist with the Aboriginal peoples' activities. Likewise the Mabo court case gave Aboriginal peoples the right to occupy the land according to their laws and customs.

Many technological advances have taken place and this has resulted in more efficient exploration and mining, reduction in costs and thus greater mine viability, more accurate location of deposits and more efficient mining methods. For example, traditional ground magnetic surveys have been replaced by airborne surveys that provide more accurate and larger quantities of data. Drilling techniques have improved to such an extent that several holes can be drilled from the one site thus reducing costs.

Question 33 (a)

Criteria	Marks
• Provides detailed features of one type of mass motion of ocean waters	3
• Outlines features of one type of mass motion of ocean waters	2
• Provides some relevant information	1

Answers could include:

Either – surface currents, deep circulation, tides or tsunamis.
Surface currents are created when a mass of water moves in a certain direction. This can be related to both friction between the atmosphere and the ocean and to the Earth's rotation.

Question 33 (b)

Criteria	Marks
• Provides detailed features of hydrothermal waters • Links features to leaching or scavenging of elements	4
• Provides features of hydrothermal waters • Links some features to leaching or scavenging of elements	3
• Provides information on hydrothermal waters OR scavenging of elements	2
• Provides some relevant information	1

Sample answer:

Cracks in the ocean floor allow seawater to seep into the ocean crust. The hot, hydrothermal waters, brines, dissolve some of the minerals in the rock, effectively scavenging them. The fluid with dissolved elements is eventually ejected through the hydrothermal vents.

Question 33 (c) (i)

Criteria	Marks
• Identifies ONE technology and provides features of the technology	2
• Provides some relevant information	1

Answers could include:

Technologies include echo sounders, dredges, grabs and core samplers, fish and plankton nets, bathythermographs, magnetometers.

Example – Echo sounding (sonar systems) is a method by which sound waves can be bounced off the ocean floor and reflected back to the ship. From the time taken for this to occur, the distance to the ocean floor can be found and a floor profile created.

Question 33 (c) (ii)

Criteria	Marks
• Identifies a relevant technology and gives detailed features of the technology • Links to data about the ocean	4
• Identifies a relevant technology and gives some features of the technology • Links to data about the ocean	3
• Provides information about a technology OR information about the ocean	2
• Provides some relevant information	1

Answers could include:

Technologies include echo sounders, dredges, grabs and core samplers, fish and plankton nets, bathythermographs, magnetometers.

Dredges can be dropped from the ship to the ocean floor. The ship then moves along a set path. At known intervals the dredge is brought up and samples from the ocean floor are collected. Samples are analysed and data collated to identify the type of ocean floor sediment and organisms present.

Question 33 (d) (i)

Criteria	Marks
• Identifies independent variable	1

Sample answer:

Depth below surface in metres.

Question 33 (d) (ii)

Criteria	Marks
• Identifies the overall trend	1

Sample answer:

As depth increases, temperature decreases.

Question 33 (d) (iii)

Criteria	Marks
• Constructs a completed table – Appropriately enclosed table – Appropriate number of columns – Column headers including units • Correct transcription of all data from graph	4
• Constructs a completed table – Appropriate number of columns – Column headers including units • Correct transcription of most data from graph	3
• Constructs a table – Appropriate number of columns – Column headers • Correct transcription of most data from graph	2
• Some attempt at tabulation or display of data from the graph	1

Sample answer:

Depth (m)	*Temperature* (°C)
0	27
200	20
400	15
600	9
800	7
1000	7

Question 33 (e)

Criteria	Marks
• Demonstrates detailed knowledge and understanding regarding the effectiveness of laws about the management ocean • Makes a supported judgement regarding the effectiveness of laws about the ocean • Provides appropriate examples • Demonstrates a coherent and logical progression of thought and indicates a high level of the use of scientific principles, ideas and terminology	6
• Demonstrates good knowledge and understanding regarding the importance of laws about the management of the ocean • Identifies at least TWO laws • Makes a supported judgement regarding the effectiveness of a law about the ocean • Provides appropriate examples • Uses appropriate terminology and progression of thought	5
• Demonstrates some knowledge and understanding regarding the importance of laws about the management of the ocean • Makes a judgement regarding the importance of laws about the ocean • Provides at least ONE point regarding the effectiveness of laws OR at least ONE point regarding the ineffectiveness of laws • Provides appropriate examples • Uses suitable terminology and progression of thought	4
• Provides points for OR points against the effectiveness of laws • Limited use of appropriate terminology	3
• Provides points for OR against the effectiveness of laws	2
• Provides some relevant information	1

Sample answer:

Laws that relate to the management of the world's oceans are becoming increasingly important but their effectiveness can vary for a variety of reasons. Many countries have their own territorial waters and many laws relate to pollution and the use of resources in what can be regarded as an exclusive economic zone. International waters are governed by the United Nations under such agreements as the 1982 United Nations Convention on the Law of the Sea.

Laws can be effective in terms of ecosystem integrity and these can vary depending on the specific demands of different locations. International laws can prove ineffective as they may be in conflict with the interests of some counties. The enforcement of these laws may be further limited due the difficulty of monitoring and identification of where specific sources of pollution may have originated.

Overall, the laws relating to the management of the world's oceans in terms of such things as pollution and the use of resources can be effective. Unfortunately, the long-term benefits can be limited by deliberate breaches of these laws and the difficulty of detecting and resolving such breaches.

2017 HSC Earth and Environmental Science Mapping Grid

Section I
Part A

Question	Marks	Content	Syllabus outcomes
1	1	9.2.2.3.1	H7, H8
2	1	9.2.2.2.1	H7, H8
3	1	9.3.2.2.1	H7, H8
4	1	9.2.3.2.2	H7, H8
5	1	9.2.4.2.1, 9.2.4.3.1	H8
6	1	9.2.4.2.8	H7, H8
7	1	9.3.1.2.3	H7
8	1	9.4.7.2.1	H6, H9
9	1	9.4.7.2.3	H6, H9
10	1	9.4.3.3.1	H9
11	1	9.4.4, H14.1	H9, H14.1
12	1	9.2.4.2.5	H4
13	1	9.3.4.2.4	H8
14	1	9.2.4.2.5	H4
15	1	9.4.3.2.2	H6, H9
16	1	9.3.3.2.3	H1, H3
17	1	9.4.2.3.1	H3
18	1	9.3.5.2.3, 9.3.5.2.4	H7
19	1	9.3.1.2.5	H7
20	1	9.3.5.2.3	H7

Section I
Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	Natural disaster case study 9.2.4	H3, H5
21 (b)	3	Natural disaster case study 9.2.4	H3, H5
21 (c)	4	Natural disaster case study 9.2.4	H3, H5
22	4	Soil erosion strategy 9.4.2	H6, H9
23 (a)	2	Volcanic features 9.2.5	H14
23 (b)	2	Volcanic features 9.2.5	H2, H14
23 (c)	2	Volcanic features 9.2.5	H2, H14
24	6	Environmental flows 9.4.5	H6, H9, H10
25 (a)	4	Waste management 9.4.7	H6, H11, H13
25 (b)	3	Waste management 9.4.7	H6, H11
26 (a)	3	Skills 9.1	H14, H15
26 (b)	3	Skills 9.1	H14, H15

Question	Marks	Content	Syllabus outcomes
27 (a)	2	Fossils 9.3.4	H7
27 (b)	2	Evolution 9.3.4	H7, H8
27 (c)	4	Natural selection 9.3.4	H7, H8
28	4	9.3.4.3.1, 9.3.3.3.2	H7
29	5	Mass extinctions 9.3.5	H2, H7

Section II

Question	Marks	Content	Syllabus outcomes
Question 30		**Introduced Species and the Australian Environment**	
(a)	3	9.5.1.2.2, 9.5.1.3.2	H6
(b)	4	9.5.5.2.1, 9.5.5.2.2, 9.5.5.2.3 9.5.5.3.1	H4
(c) (i)	2	9.5.6.2.1, 9.5.6.2.2, 9.5.6.3.1	H3
(c) (ii)	4	9.5.6.2.3, 9.5.6.3.1	H9
(d) (i)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (ii)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (iii)	4	H12.3 (c), H12.3 (d)	H12
(e)	6	9.5.5.2.5, 9.5.5.2.6, 9.5.5.2.7, 9.5.5.3.2, 9.5.5.3.3, 9.5.5.3.4	H10
Question 31		**Organic Geology – A non-renewable Resource**	
(a)	3	9.6.1.2.6	H6
(b)	4	9.6.2.2.2, 9.6.2.2.3, 9.6.2.2.4, 9.6.2.3.2	H6
(c) (i)	2	9.6.3.3.1	H6
(c) (ii)	4	9.6.3.2.1, 9.6.3.2.2	H3, H6
(d) (i)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (ii)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (iii)	4	H12.3 (c), H12.3 (d)	H12
(e)	6	9.6.5.2.2, 9.6.5.3.3, 9.6.6.2.1	H6, H9
Question 32		**Mining and the Australian Environment**	
(a)	3	9.7.1.2.2	H2, H7
(b)	4	9.7.5.2.2, 9.7.5.2.3	H7, H9
(c) (i)	2	9.7.4.2.1	H6
(c) (ii)	4	9.7.3.2.6, 9.7.4.2.3	H6
(d) (i)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (ii)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (iii)	4	H12.3 (c), H12.3 (d)	H12
(e)	6	9.7.2.2.1, 9.7.4.2.1, 9.7.4.2.6, 9.7.5.2.3	H3, H6, H9
Question 33		**Oceanography**	
(a)	3	9.8.4.2.1	H8
(b)	4	9.8.6.2.3	H8

Question	Marks	Content	Syllabus outcomes
(c) (i)	2	9.8.8.2.1	H1
(c) (ii)	4	9.8.8.2.1, 9.8.9.3.1	H1
(d) (i)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (ii)	1	H11.2 (a), H14.1 (a)	H11, H14
(d) (iii)	4	H12.3 (c), H12.3 (d)	H12
(e)	6	9.8.4.3.2, 9.8.4.2.4, 9.8.5.3.2	H9, H10