

Earth & Environmental Science marking guide and response

Sample external assessment 2020

Combination response (125 marks)

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. describe and explain the use of renewable and non-renewable resources and the cause and impact of Earth hazards and global climate change
2. apply understanding of use of renewable and non-renewable resources and the cause and impact of Earth hazards and global climate change
3. analyse evidence about the use of renewable and non-renewable resources and the cause and impact of Earth hazards and global climate change to identify trends, patterns, relationships, limitations or uncertainty
4. interpret evidence about use of renewable and non-renewable resources and the cause and impact of Earth hazards and global climate change to draw conclusions based on analysis.

Note: Objectives 5, 6 and 7 are not assessed in this instrument.

Introduction

The Queensland Curriculum and Assessment Authority (QCAA) has developed mock external assessments for each General senior syllabus subject to support the introduction of external assessment in Queensland.

An external assessment marking guide (EAMG) has been created specifically for each mock external assessment.

The mock external assessments and their marking guides were:

- developed in close consultation with subject matter experts drawn from schools, subject associations and universities
- aligned to the external assessment conditions and specifications in General senior syllabuses
- developed under secure conditions.

Purpose

This document consists of an EAMG and an annotated response.

The EAMG:

- provides a tool for calibrating external assessment markers to ensure reliability of results
- indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- informs schools and students about how marks are matched to qualities in student responses.

Mark allocation

Where a response does not meet any of the descriptors for a question or a criterion, a mark of '0' will be recorded.

Where no response to a question has been made, a mark of 'N' will be recorded.

External assessment marking guide

Paper 1: Multiple choice

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

Paper 1: Short response

| Question | Sample response | The response |
|----------|---|--|
| 21 | <p>a</p> <p>The slopes surrounding the town are steep, so there is quick runoff into the catchment area.</p> <p>There are many streams funnelling into the one river valley (i.e. larger volume of water reaching the area at the same time).</p> <p>The bottom of the river valley is relatively narrow and flat (i.e. rate at which water levels rise).</p> | <ul style="list-style-type: none"> · identifies <ul style="list-style-type: none"> - steep slopes [1 mark] - streams [1 mark] - narrow valley [1 mark] |
| | <p>b</p> <p>A positive impact of flooding is that it will help spread useful fish populations up and down the stream.</p> <p>A negative impact is that it will washing seeds and weeds downstream and spread them across the floodplain, which will create new stands of undesirable plants.</p> | <ul style="list-style-type: none"> · identifies a positive impact [1 mark] · identifies a negative impact [1 mark] |
| | <p>c</p> <p>Two ways to mitigate for the impact of flood events would be to construct a levee bank along the river to divert water away from buildings and remove the hard surface that is marked on the map to alleviate instantaneous run-off and allow for greater infiltration of rainwater, reducing the force and volume of water.</p> | <ul style="list-style-type: none"> · identifies two mitigation strategies [2 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> · identifies one mitigation strategy [1 mark] |

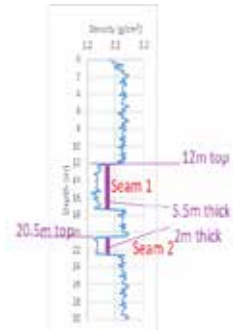
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| | d | <p>North and west of the township of Llamaquizu and either side of the Quebrada Llamaquizu stream.</p> <p>A flooding event will move top soil/sediment off the slopes and water will carry it downstream via the Rio Chorobamba to the Quebrada Llamaquizu stream into this area.</p> <p>Sediment washed downstream will contain plant nutrients and where it settles will offer a more fertile environment for agriculture.</p> | <ul style="list-style-type: none"> · identifies a possible location for agricultural activity in the area [1 mark] · provides two acceptable reasons for the location [2 marks] <li style="text-align: center;">OR · provides one acceptable reason for the location [1 mark] |
| 22 | a | <p>Higher ^{18}O concentrations in fossils are associated with glacial periods indicating cooler temperatures.</p> | <ul style="list-style-type: none"> · identifies the relationship between ^{18}O and temperature [1 mark] |
| | b | <p>Stimulus 3 suggests that water containing heavy oxygen isotopes condenses over the mid-latitudes. During periods of colder temperatures, more of this heavy water will condense over mid-latitudes leaving a greater concentration of ^{16}O isotopes condensing over the Antarctic.</p> <p>In addition to this, when a glacial period occurs, there is less ^{16}O-rich water returned to ocean waters due to lower levels of melting. Therefore, the ice will be high in ^{16}O.</p> <p>Therefore, during a glacial period, more ice containing ^{16}O will be deposited as ice that can be extracted in future ice-cores.</p> | <ul style="list-style-type: none"> · explains that ^{18}O-rich water condenses over mid-latitudes [1 mark] · explains that during colder temperatures, more ^{16}O-rich water condenses over the Antarctic [1 mark] · explains less ^{16}O-rich water melting during glacial period [1 mark] · explains why glacial ice-cores contain more ^{16}O [1 mark] |
| 23 | a | <p>Fish stocks are replenished in a time scale of less than 80 years. It is therefore considered to be a renewable resource (i.e. within a lifetime).</p> | <ul style="list-style-type: none"> · explains why fish stocks are a renewable resource [1 mark] |

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| | b | From 1990 to 2020, there has been a levelling off for the volume of wild caught seafood production (i.e. it has plateaued from earlier increases) | <ul style="list-style-type: none"> describes low growth trend [1 mark] |
| | c | <p>From 1950 to 1990, aquaculture production showed a small increase in contrast to wild caught seafood during the same time.</p> <p>From 1990 to 2020, the increase in aquaculture production has risen steeply in contrast to wild caught seafood.</p> <p>From 1990 to 2020, the gap between total seafood production (i.e. wild caught production plus aquaculture production) and per capita consumption closed.</p> | <ul style="list-style-type: none"> describes the level of increase in aquaculture production in contrast to the growth in wild caught seafood up to 1990 [1 mark] contrasts a new trend in aquaculture production with the trend in wild caught seafood production [1 mark] describes the potential of total seafood production to meet the supply required for per capita consumption [1 mark] |
| | | <p>The reason for the small increase in aquaculture production is that per capita consumption has been met by increasing the level of wild caught seafood (i.e. increased fishing activity in native fisheries). Therefore, there is little demand for further aquaculture production.</p> <p>The reason for the levelling of volume of wild caught seafood production from 1990 is due to wild caught fisheries having quotas imposed on the quantity of seafood species that can be harvested to ensure the sustainability of the fishery.</p> <p>The reason for the sharp increase in aquaculture production from 1990 is to meet the level of supply required for per capita consumption by supplementing wild caught seafood production.</p> | <ul style="list-style-type: none"> explains the reason for a small increase in aquaculture production. [1 mark] explains a reason for trend in wild caught seafood production from 1990 [1 mark] explains a reason for trend in aquaculture production from 1990 [1 mark] |
| 24 | a | <p>An agricultural activity that can have a positive impact on the concentration of particulate materials in the atmosphere is conservation tillage. When agricultural crops are planted directly into the previous crop, there is less disturbance of the soil and consequently less particulate material in the atmosphere.</p> <p>An agricultural activity that can have a negative impact is when land is cleared for cropping or pasture improvement. When the paddocks are ploughed the soil is exposed. Winds can pick up the soil particles and create dust storms. This releases the particulates into the atmosphere.</p> | <ul style="list-style-type: none"> identifies activity with positive impact [1 mark] explains positive impact [1 mark] identifies activity with negative impact [1 mark] explains negative impact [1 mark] |

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| | <p>b</p> <p>Natural processes: respiration, volcanic eruptions The amount of CO₂ released by respiration occurring in all living organisms will increase as the size of the population increases. The amount of CO₂ released during volcanic eruptions can vary depending on the size of the eruption. Anthropogenic processes: combustion, deforestation Combustion from human activity is a significant cause of increased levels of CO₂ compared to natural processes. A greater concentration of CO₂ will occur in the atmosphere with trees removed and no longer able to remove CO₂ from the atmosphere during the process of photosynthesis.</p> | <p>For natural processes</p> <ul style="list-style-type: none"> · identifies two examples · explains those two examples [3 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> · identifies one example · explains that example [2 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> · identifies one example [1 mark] <p>For anthropogenic processes</p> <ul style="list-style-type: none"> · identifies two examples · explains those two examples [3 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> · identifies one example · explains that example [2 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> · identifies one example [1 mark] |
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| 25 | a | <p>Aluminium</p> <p>Aluminium is extracted from bauxite. Bauxite ore is formed when the surrounding soil or rock is dissolved by natural weathering processes until it forms a new type of rock that is usually rich in aluminium ore</p> <p>Mineral sands</p> <p>Mineral sands are old beach, river or dune sands that contain concentrations of the important minerals: rutile, ilmenite, zircon and monazite. Mineral sands are formed mostly in beach environments by concentration due to the specific gravity of the mineral grains (i.e. lighter minerals are washed away by wave action).</p> | <ul style="list-style-type: none"> · identifies bauxite [1 mark] · explains formation of bauxite [1 mark] · identifies rutile, ilmenite, zircon or monazite [1 mark] · explains formation of mineral sands [1 mark] |
| | b | <p>Hydrothermal setting</p> <p>Gold can be found in intrusions/deposits because of a hydrothermal process in an igneous setting.</p> <p>Hydrothermal deposits are formed at great depths and high temperatures. Hot, rising water escaping from cooling igneous plutons deposits gold as it ascends through the crust.</p> <p>Placer setting</p> <p>Gold can be found in placer deposits that originate from areas subjected to water currents. Placer deposits are found in places where the velocity of the transporting medium, usually water, begins to fall.</p> <p>Placer deposits are accumulations of heavy or durable metals like gold, which are concentrated by the mechanical sorting action of currents.</p> | <ul style="list-style-type: none"> · For hydrothermal setting <ul style="list-style-type: none"> - identifies hydrothermal setting [1 mark] - identifies large depth and high temperature [1 mark] - describes deposition [1 mark] · For placer setting <ul style="list-style-type: none"> - identifies placer setting [1 mark] - identifies the conditions for the formation of the placer deposit [1 mark] - explains concentration via sorting [1 mark] |

Paper 2: Short response

| Question | Sample response | The response |
|----------|---|---|
| 1 | <p>a</p>  <p>Coal has a significantly lower density than the associated sedimentary rocks. This is indicated in the wireline log by a shift to the left of the line for both seams.</p> <p>b</p> <p>12 m seam solution Thickness of seam = 17.5 – 12 Thickness of coal seam = 5.5 m OR 20.5 m seam solution Thickness of seam = 22.5 – 20.5 Thickness of coal seam = 2.0 m</p> | <ul style="list-style-type: none"> identifies top of each coal seam [2 marks] OR identifies top of one coal seam [1 mark] explains the top of a coal seam [1 mark] <ul style="list-style-type: none"> correctly determines the thickness of one seam [1 mark] shows working [1 mark] |
| 2 | <p>a</p> <p>If ash and gaseous eruptions do not escape the troposphere, then the effect on plants would be a reduction in photosynthesis due to less solar radiation getting through the atmosphere. This would have a flow-on effect on animals in terms of there being less available forage, which affects the herbivores that are the source of food for predators. This would also be dangerous for humans who have respiratory problems.</p> | <ul style="list-style-type: none"> explains an effect on plants [1 mark] explains an effect on animals [1 mark] describes an effect on humans [1 mark] |

| Question | Sample response | The response | |
|----------|--|--|--|
| | b | <p>The early warning system is reasonably effective in terms of protecting human life. The lahar is slowing down the further it travels from the summit. Therefore, there is sufficient time (i.e. 28 minutes) to evacuate people from the valley, but infrastructure would be damaged, and plants and animals destroyed by lava flows.</p> | <ul style="list-style-type: none"> provides a conclusion [1 mark] explain two factors supporting the conclusion [2 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> explains one factor supporting the conclusion [1 mark] |
| 3 | <p>Clearing of land for agriculture can cause dryland salinity because it removes deep-rooted perennial native vegetation and replaces it with shallow-rooted annual crops and pasture.</p> <p>Clearing of land allows for more groundwater recharge. This enables rainfall water to move down to the water table, raising it and in some cases, bringing the salt to the surface.</p> | <ul style="list-style-type: none"> identifies an action and explains two ways the action causes dryland salinity [2 marks] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> identifies an action and explains one way the action causes dryland salinity [1 mark] | |
| 4 | a | <p>The ecological footprint is the sum of all the cropland, grazing land, forest and fishing areas that are required by each person to produce the goods consumed (e.g. food, timber and fibre), and the land required for the infrastructure to build on and to assimilate the wastes generated.</p> <p>Australia has an ecological footprint that is approximately four times the accepted sustainable level. This means that Australians use four times the biological area for consumption of resources compared to the amount of biologically productive area available in Australia that can regenerate and be used sustainably.</p> | <ul style="list-style-type: none"> describes impact of a person or community on the environment [1 mark] describes amount of land required to sustain use of natural resources [1 mark] identifies and explains an example [1 mark] |

| Question | Sample response | The response |
|----------|--|--|
| | <p>b</p> <p>Case study: Introduction of the <i>Cactoblastis</i> caterpillar into Queensland to control a species of prickly pear that itself was introduced to Australia.</p> <p>The introduction of <i>Cactoblastis</i> caterpillars into paddocks infested with prickly pear has seen a decline in prickly pear and allowed other plant species to grow.</p> <p>There have been no recorded negative influences to date on a local or regional scale with the introduction of <i>Cactoblastis</i> caterpillars.</p> <p>It was a success in clearing prickly pear from millions of hectares of Queensland in the 1930s, which improved the sustainability of ecosystems.</p> <p>In fact, the moth is still hard at work. Even today, it remains in Queensland, doing its job of controlling remnants of prickly pear.</p> <p>However, on a global scale, the introduction of the <i>Cactoblastis</i> moth has not had a positive influence.</p> <p>It was introduced to the Caribbean, Mexico and North America, where there are many species of <i>Opuntia</i>. The various prickly pear species are an important part of the native flora of that part of the world.</p> <p>Since 1957, it has spread through the Caribbean and in some cases endangered species of cactus are now close to extinction.</p> <p>Biological control can be effective in ecosystems at a local or regional scale if the introduced species specifically controls an organism that does not belong to the natural ecosystem in the first place.</p> | <ul style="list-style-type: none"> • describes positive influence at local scale [1 mark] • describes negative influence at local scale [1 mark] • describes positive influence at regional scale [1 mark] • describes negative influence at regional scale [1 mark] • describes positive influence at global scale [1 mark] • describes negative influence at global scale [1 mark] |
| 5 | <p>a</p> <p>There is a similar trend in projected risk of species extinction for both birds and amphibians with increases in global temperatures.</p> <p>There is a much greater projected risk of species extinction for amphibians with increases in global temperatures when dispersal is considered.</p> <p>Birds can migrate (i.e. move away from the ecosystem) more easily than amphibians so projected losses of bird species will be less.</p> | <ul style="list-style-type: none"> • describes similarity in trend for extinction for both birds and amphibians [1 mark] • describes difference when ability to disperse is considered [1 mark] • explains significance of a species' ability to disperse [1 mark] |
| | <p>b</p> <ul style="list-style-type: none"> • Initial increase due to less predation by birds, amphibians and reptiles because of species extinction with increasing temperature. • Initial increase possibly due to ability of insects to reproduce quickly in warmer climates (i.e. high metabolic rates/warmer winters) | <ul style="list-style-type: none"> • explains a reason for initial increase in population due to less predation [1 mark] • explains a reason for |

| Question | Sample response | The response | |
|----------|---|--|--|
| | <ul style="list-style-type: none"> Some species would continue to thrive if they can disperse to cooler climates as temperatures increase. Further reductions in insect species populations would occur as more plant species (i.e. food sources) becomes extinct. Further reductions in populations would occur with increasing global temperatures as insects do not have the ability to regulate their temperature. | <ul style="list-style-type: none"> increase in population due to favourable conditions for reproduction [1 mark] describes a reason for increase in population due to possible ability of some insect species to disperse [1 mark] describes reason for reduction in insect populations due to decreasing food source [1 mark] describes reason for reduction in insect populations due to inability to regulate body temperature [1 mark] | |
| 6 | a | <p>Figure C</p> <p>The average number of cyclones close to the Queensland coast is greater than the average number of cyclones in either Figure A or B.</p> | <ul style="list-style-type: none"> identifies Figure C [1 mark] provides a valid reason [1 mark] |
| | b | <p>The total number of tropical cyclones decreased from 1970 to 2016.</p> | <ul style="list-style-type: none"> identifies the trend [1 mark] |
| | c | <p>You can normally expect 2–5 severe cyclones per year.</p> <p>The general trend from 1970 to 2016 has stayed relatively constant at around 2–5 per year.</p> <p>There are a number of years with a large number of severe tropical cyclones; the frequency of these events represents natural variability.</p> | <ul style="list-style-type: none"> provides conclusion about severe tropical cyclones [1 mark] describes a reason for conclusion [1 mark] identifies anomalies [1 mark] |

| Question | Sample response | The response |
|----------|--|--|
| d | <p>The number and severity of drought and flooding events are likely to increase.</p> <p>From Stimulus 3, the number of cyclones is decreasing, which means that if this trend were to continue, northern Queensland is likely to have longer periods of lower average rainfall (i.e. drought) as much of the area relies on monsoonal weather for its rainfall.</p> <p>From Stimulus 2 and 3, the trend of an increasing percentage of severe cyclones is likely to cause more severe flooding due to the size/magnitude of the cyclones.</p> | <ul style="list-style-type: none"> • predicts frequency and magnitude of droughts and floods [1 mark] • provides a reason for drought prediction [1 mark] • provides a reason for flood prediction [1 mark] |
| e | <p>Due to the increasing chance of prolonged droughts there is likely to be an increasing level of erosion. This will be due to decreased vegetation holding the soil together (i.e. less vegetative cover for surface soil).</p> <p>There will be a change in the vegetation distribution pattern due to decreasing average annual rainfall. Decreased average rainfall will change the vegetation pattern as existing species will only be found in more favourable environmental conditions (soil moisture).</p> <p>Ecosystem regeneration could differ to account for effects of drought. Whether by natural or anthropogenic activities, a changing environment will see new species of plants become more dominant in the ecosystem (i.e. tolerance to lower rainfall totals, soil degradation, etc.).</p> | <ul style="list-style-type: none"> • provides an effect on erosion [1 mark] • explains the effect on erosion [1 mark] • provides an effect on vegetation distribution [1 mark] • explains the effect on vegetation distribution [1 mark] • provides an effect on ecosystem regeneration [1 mark] • explains the effect on ecosystem regeneration prediction [1 mark] |

| Question | Sample response | The response |
|----------|--|--|
| 7 | <p>Both farmer A and B would be able to reduce the water table by implementing their methods. Farmer B is planting trees and targeting the upper catchment area of the ground water system, whereas Farmer A is maintaining a vegetative cover to extract moisture and prevent further erosion caused by grazing animals.</p> <p>Farmer B's method would be more effective than Farmer A's as Farmer B planted deep-rooted trees, which would be more effective in reducing the water table due to the deep root system being able to extract greater soil moisture compared to grasses.</p> <p>Farmer A's method would be less sustainable in terms of preventing salinity as tall grasses have shallow root systems compared to trees. Farmer A would have to continuously manage the pasture to retain a vegetative cover if they want to use the pasture as well as reduce salinity. Farmer B would have a long-term sustainable solution to the salinity problem because larger rainfall events will have less of an effect on the water table.</p> | <ul style="list-style-type: none"> • identifies similarity in approach by both farmers [1 mark] • identifies difference in approach by both farmers [1 mark] • identifies significance of difference [1 mark] • provides an outcome for Farmer A's method [1 mark] • provides an outcome for Farmer B's method [1 mark] |

Paper 2: Extended response

| Question | Sample response | The response |
|----------|--|--|
| 8 | <p>The salt interception scheme, in conjunction with water releases, would have a positive influence (reduce water salinity levels) on sustaining natural ecosystems beyond Morgan as the water moves towards the ocean. The effectiveness of the interception scheme prior to Morgan will depend upon the level of human activity in the region and the number of salt interception points.</p> <p>For a large part of the recorded period, the interception scheme has made a significant difference to the amount of salt that has been removed from the river before it reaches Morgan.</p> <p>Evidence from the graph shows that at times over the two years, the scheme has been effective in removing the same level of salt that has been recorded (difference between actual and predicted).</p> <p>The salt interception scheme has had a positive effect on decreasing salinity from approximately day 360 to day 510.</p> <p>Evidence from the graph shows that from day 360 to day 510, a release of water as part of the scheme would have occurred with larger rainfall events occurring across this time.</p> <p>Actual salinity levels showed a significant increase between 510 and 540 days. Salinity levels stayed higher than previously measured values from 0 to 510 days. The gap between the actual and predicted levels is closer during this time.</p> <p>This could be due to changes in the volume of water coming from the Darling River due to human activities and the associated level of salinity flowing into the Murray River. This could be due to changes in the volume of water flowing from Mildura due to human activities (e.g. irrigation) and a subsequent increase in salinity.</p> <p>Increased water flows from larger rainfall events and release of water will increase the food supply available in natural ecosystems, which would assist natural ecosystems.</p> <p>Growth of plants along the Murray–Darling basin will be assisted by higher quality water.</p> <p>Larger rainfall events with release of water will help spread the aquatic biota (distribution of plant and animal species), up and down the stream.</p> | <p>For effectiveness of salt interception scheme</p> <ul style="list-style-type: none"> · identifies a positive outcome on reducing actual water salinity levels [1 mark] · provides a conclusion about the effectiveness of the salt interception scheme [1 mark] <p>OR</p> <ul style="list-style-type: none"> · describes three reasons to support conclusion [3 marks] OR · describes two reasons to support conclusion [2 marks] OR · describes one reason to support conclusion [1 mark] <p>OR</p> <ul style="list-style-type: none"> · recognises a difference in the data from day 510 to 540 [1 mark] · identifies that the scheme has not had a significant effect across the whole of the two years of recorded measurements [1 mark] · describes a reason for variation in water flows [1 mark] · describes a reason for variation in actual salinity along the Murray–Darling River system [1 mark] <p>For sustaining the natural ecosystems</p> <ul style="list-style-type: none"> · describes six positive influences on natural ecosystems [6 marks] <p>OR</p> <ul style="list-style-type: none"> · describes five positive influences on natural ecosystems [5 marks] <p>OR</p> |

| Question | Sample response | The response |
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| | <p>Greater natural flows provide better quality water. Better quality water (less salinity) will have a positive impact on local ecosystems. For example, wetlands will be recharged, providing more breeding areas for wildlife. This will lead to an increase in population numbers, which will assist the sustainability of the local ecosystem.</p> | <ul style="list-style-type: none"> <li data-bbox="1370 256 2033 320">· describes four positive influences on natural ecosystems [4 marks] <li data-bbox="1727 328 1771 352" style="text-align: center;">OR <li data-bbox="1370 360 2047 424">· describes three positive influences on natural ecosystems [3 marks] <li data-bbox="1727 432 1771 456" style="text-align: center;">OR <li data-bbox="1370 464 2027 528">· describes two positive influences on natural ecosystems [2 marks] <li data-bbox="1727 536 1771 560" style="text-align: center;">OR <li data-bbox="1370 568 2018 632">· describes one positive influence on natural ecosystems [1 mark] |