Earth & Environmental Science 2019 v1.3

IA1 sample marking scheme

August 2018

Data test (10%)

This sample has been compiled by the QCAA to model one possible approach to allocating marks in a data test. It matches the examination mark allocations as specified in the syllabus (~ 30% apply understanding, ~ 30% analyse evidence and ~ 40% interpret evidence) and ensures that a balance of the objectives are assessed.

Assessment objectives

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

2. apply understanding of the use of renewable or non-renewable resources to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features
3. analyse evidence about the use of renewable or non-renewable resources to identify trends, patterns, relationships, limitations or uncertainty in datasets
4. interpret evidence about the use of renewable or non-renewable resources to draw conclusions based on analysis of datasets.

Note: Objectives 1, 5, 6 and 7 are not assessed in this instrument.

Instrument-specific marking guide (ISMG)

Criterion: Data test

Assessment objectives

2. apply understanding of the use of renewable or non-renewable resources to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features
3. analyse evidence about the use of renewable or non-renewable resources to identify trends, patterns, relationships, limitations or uncertainty in datasets
4. interpret evidence about the use of renewable or non-renewable resources to draw conclusions based on analysis of datasets

The student work has the following characteristics:	Cut-off	Marks
• consistent demonstration, across a range of scenarios about the use of renewable or non-renewable resources, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data – correct and appropriate use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 90%	10
	> 80%	9
• consistent demonstration, in scenarios about the use of renewable or non-renewable resources, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 70%	8
	> 60%	7
• adequate demonstration, in scenarios about the use of renewable or non-renewable resources, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 50%	6
	> 40%	5
• demonstration, in scenarios about the use of renewable or non-renewable resources, of elements of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual or graphical representations of scientific relationships or data – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations or uncertainty – correct interpretation of evidence to draw valid conclusions.	> 30%	4
	> 20%	3

The student work has the following characteristics:	Cut-off	Marks
• demonstration, in scenarios about the use of renewable or non-renewable resources, of elements of – application of scientific concepts, theories, models or systems to predict outcomes, behaviours or implications – calculation of quantities through the use of algebraic or graphical representations of scientific relationships and data – use of analytical techniques to identify trends, patterns, relationships, limitations or uncertainty – interpretation of evidence to draw conclusions.	> 10%	2
	> 1%	1
• does not satisfy any of the descriptors above.	≤ 1%	0

Task

See the sample assessment instrument for IA1: Data test (10%) (available on the QCAA Portal).

Sample marking scheme

Criterion	Marks allocated	Result
Data test Assessment objectives 2, 3, 4	10	—
Total	**10**	**—**

Marking scheme symbols and abbreviations

Symbol or abbreviation	Meaning
✓	The preceding section of the expected response is worth one mark.
/	Separates acceptable alternative wordings in the expected response.
()	Terms in brackets are not necessary in the response for the mark to be awarded.
shaded and underlined text	Shaded and underlined text must be included in the response for the mark to be awarded.
Accept converse.	Award the mark even if the answer is stated in its converse form, e.g. 'A comes before B' can be stated as 'B comes after A'.
Accept *min–max*.	Award the mark for any numerical answer that falls within the specified range, e.g. 'Accept 1.5–1.9' means that any answer between 1.5 and 1.9 should be considered correct. This is used in items that involve a multi-step calculation where differences in rounding in the intermediate steps could result in slight differences in the final answer.
Allow for FT error …	Means 'allow for follow-through error'. Initial errors should only be penalised once. Marks should be awarded for subsequent steps that are correct.
Allow FT error for transcription only.	Follow-through error is only allowed if the student has written down information incorrectly but processed it correctly.
AND	Separates two parts of the response that are both required for the mark to be awarded.
Correct d.p. required.	The answer must be stated to the number of decimal places indicated in the item for the mark to be awarded.
Correct s.f. required.	The answer must be stated to the correct number of significant figures indicated in the item for the mark to be awarded.
Max. # marks.	The maximum number of marks that can be awarded for the response is indicated by #.
OR	Separates acceptable alternative wordings.
OWTTE	Means 'or words to that effect'. This is used in questions where students are unlikely to use the exact wording given in the expected response. If the student's response has the same meaning as the expected response, then the mark should be awarded.
Working not required.	Evidence of working, reasoning or calculations is not required for the mark to be awarded.

The annotations are written descriptions of the expected response for each question and are related to the assessment objectives.

Assessment objective — annotation	Expected response Note: ✓ = 1 mark	Mark allocation
Item 1		**1 mark**
Apply understanding The item uses the cognitive verb 'identify'. The expected response is an unknown scientific quantity.	436 tonnes✓	1 mark for identifying the commercial catch of orange roughy from the Eastern Zone fishery.
Item 2		**1 mark**
Apply understanding The item uses the cognitive verb 'identify'. The expected response is an unknown scientific quantity.	The only fishery to record a commercial catch of orange roughy for 2010 was the Western Zone fishery.✓	1 mark for identifying the name of the only fishery to have a recorded catch of orange roughy in 2010.
Item 3		**2 marks**
Apply understanding The item uses the cognitive verb 'calculate'. The expected response is an unknown scientific quantity.	Total mass of orange roughy caught in 2006 = 502 + 224 + 89 = 815 t✓ % catch from Eastern Zone = $\frac{502}{815} \times 100$ = 61.6%✓	1 mark for calculating the total mass of orange roughy caught in 2006. 1 mark for calculating the percentage of the total catch that was caught in the Eastern Zone. Allow for FT error.

<table>
<tr><th>Assessment objective — annotation</th><th>Expected response
Note: ✓ = 1 mark</th><th>Mark allocation</th></tr>
<tr><td colspan="2">Item 4</td><td>4 marks</td></tr>
<tr><td>Analyse evidence

The item uses the cognitive verb ‘identify’.

The expected response is a relationship.</td><td>2004–2005:

$\frac{45}{275} \times 100 = 16\%$✓

2014–2015:

$\frac{78}{238} \times 100 = 33\%$✓

The percentage of production from aquaculture has increased by 17% / (more than) doubled.✓✓</td><td>1 mark for calculating the percentage of total production from aquaculture in 2004–2005. Accept 15–17%.

1 mark for calculating the percentage of total production from aquaculture in 2014–2015. Accept 32–34%.

1 mark for identifying that the percentage from aquaculture has increased.

1 mark for quantifying the increase in percentage of production.

Note: Stating that production has doubled receives both marks because it implies an increase and quantifies the increase.</td></tr>
<tr><td colspan="2">Item 5</td><td>2 marks</td></tr>
<tr><td>Apply understanding

The item uses the cognitive verb ‘identify’.

The expected response is an unknown scientific feature.</td><td>Answer could include any two of the following grid points: G11, H11, H12, I12.✓✓</td><td>1 mark for each grid point. Max. 2 marks.</td></tr>
<tr><td colspan="2">Item 6</td><td>2 marks</td></tr>
<tr><td>Analyse evidence

The item uses the cognitive verb ‘categorise’.

The expected response is a pattern.</td><td><table><tr><th>Grid points</th><th>Copper concentration</th></tr><tr><td>G7</td><td>high✓</td></tr><tr><td>E4</td><td>medium✓</td></tr></table></td><td>1 mark for each categorisation.</td></tr>
</table>

Assessment objective — annotation	Expected response Note: ✓ = 1 mark	Mark allocation
Item 7		**2 marks**
Interpret evidence The item uses the cognitive verb 'infer'. The expected response is a conclusion based on analysis.	The ore body is most likely to be between sites B and C on Figure 3. OR The ore body is most likely to be between within the > 5000 ppm ring on Figure 4.✓ Water flow has been responsible for washing sediments from the ore body towards the creek sites A and B, but not towards sites C and D. OR The copper concentration in the soil is highest between H11 and H12 on Figure 4.✓	1 mark for identifying the likely location of the ore body. Accept a location identified on either Figure 3 or Figure 4. 1 mark for giving a reason.
Item 8		**3 marks**
Interpret evidence The item uses the cognitive verb 'compare'. The expected response draws a conclusion based on analysis.	In both 2015 and 2017, the frequency of red waratah anemones is greatest in the mid-tide zone.✓ The number of red waratah anemones found in each quadrat is lower in 2017 than in 2015.✓ The desalination plant has not affected the distribution pattern of red waratah anemone, although it has reduced the numbers.✓	1 mark for identifying similar patterns across the tidal zones for 2015 and 2017. 1 mark for identifying the reduction in numbers at each quadrat sampling point. Accept converse. 1 mark for identifying the significance of these patterns.
Item 9		**3 marks**
Interpret evidence The item uses the cognitive verb 'draw conclusions'. The expected response draws a conclusion based on analysis.	The mean frequency of red waratah anemone has reduced between 2015 and 2017 (from 12.6 to 2.6).✓ Since the p-value in 2015 is smaller than 0.05, this means that there is a statistically significant difference between the mean values for red waratah anemone in 2015 and 2017.✓ (Using the red waratah anemone as an indicator) the desalination plant has had a negative impact on the health of the rocky shore ecosystem.✓	1 mark for identifying change in mean frequency. 1 mark for interpretation of p-value. 1 mark for conclusion about the health of the rocky shore ecosystem.