

# Earth & Environmental Science

## 2019 v1.4

IA3: Sample assessment instrument

### Research investigation (20%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

**Student name**

**Student number**

**Teacher**

**Issued**

**Due date**

### Marking summary

Criterion	Marks allocated	Provisional marks
Research and planning	6	
Analysis and interpretation	6	
Conclusion and evaluation	6	
Communication	2	
<b>Overall</b>	<b>20</b>	

# Conditions

<b>Technique</b>	Research investigation
<b>Unit</b>	Unit 4: The changing Earth — the cause and impact of Earth hazards
<b>Topic/s</b>	Topic 1: The cause and impact of Earth hazards Topic 2: The cause and impact of global climate change
<b>Duration</b>	10 hours class time
<b>Mode/length</b>	Written response (e.g. scientific essay): 1500–2000 words
<b>Individual/group</b>	Individual
<b>Resources</b>	School library (online: internet and school intranet, databases, journals)

## Context

Investigate one of the following claims:

- Earthquake early warning systems save lives.
- Volcanic eruptions can be predicted.
- Tsunami early warning systems save lives.
- An increase in extreme weather events will kill the Great Barrier Reef.
- Poor urban planning can destroy lives and property.
- Excessive urbanisation of coastal shorelines will cause destruction of coastal ecosystems.
- Prolonged drought causes the extinction of endangered animal species.
- Burning fossil fuels is causing the Earth to get warmer.
- Climate change will make extreme weather events more frequent.
- Climate change will cause sea levels to rise.
- Climate change will change species distribution across Australia.

You may identify an alternative claim in consultation with your teacher. This claim must be related to Unit 4 subject matter.

## Task

Gather secondary evidence related to a research question in order to evaluate the claim. Develop your research question based on a number of possible claims provided by your teacher.

Obtain evidence by researching scientifically credible sources, such as scientific journals, books by well-credentialed scientists, and websites of governments, universities, independent research bodies or science and technology manufacturers. You must adhere to research conventions.

**To complete this task, you must:**

- select a claim to be evaluated
- identify the relevant scientific concepts associated with the claim
- pose a research question addressing an aspect of the claim
- conduct research to gather scientific evidence that may be used to address the research question and subsequently evaluate the claim
- analyse the data to identify sufficient and relevant evidence
- identify the trends, patterns or relationships in the evidence
- analyse the evidence to identify limitations
- interpret the evidence to construct justified scientific arguments
- interpret the evidence to form a justified conclusion to the research question
- discuss the quality of the evidence
- evaluate the claim by extrapolating the findings of the research question to the claim
- suggest improvements and extensions to the investigation
- communicate findings in an appropriate scientific genre, i.e. empirical essay.

## Checkpoints

- Week 1: Select claim and develop research question.
- Week 2: Identify sources and conduct research.
- Week 3: Analyse and evaluate evidence.
- Week 4: Submit draft.
- Week 5: Submit final response.

## Authentication strategies

- The teacher will provide class time for task completion.
- Students will provide documentation of their progress at indicated checkpoints.
- The teacher will collect and annotate one draft.
- The teacher will conduct interviews or consultations with each student as they develop the response.
- Students will use plagiarism-detection software at submission of the response.
- Students must acknowledge all sources.

## Scaffolding

The response must be presented using an appropriate scientific genre (i.e. scientific essay) and contain:

- a claim
- a research question
- a rationale for the investigation
- justified scientific arguments using evidence
- a conclusion to the research question based on the interpretation of the evidence
- evaluation of the claim and suggestions of improvements and extensions to the investigation
- a reference list.

### **An example of how one of the claims could be developed into a research question**

**Claim:** Climate change will make extreme weather events more frequent.

**Research question:** What effect does climate change have on the frequency of cyclones crossing the Queensland coast?

#### **Developing the research question:**

1. Identify the key (important) terms in the claim.
  - a. 'climate change', 'extreme weather event', 'frequent'
2. Propose refining questions that need to be addressed to refine key terms and narrow the focus of the claim.

- a. How can sufficient and relevant evidence be collected for climate change?
  - b. How is an 'extreme' weather event defined?
  - c. Which example of an extreme weather event should be chosen?
3. Provide an example of how one of the claims could be developed into a research question. Conduct research to gather information to address the refining questions.
- a. The extreme weather events that will be investigated are cyclones.
  - b. Cyclones are severe hazards that threaten coastal communities and cause significant damage to infrastructure and agriculture. The effect of a cyclone will vary according to its severity.
  - c. Assumption is made that climate change can be linked to increasing atmospheric temperatures across the surface of the Earth.
  - d. The severity of a cyclone can be measured by factors such as central pressure, radius, wind speed or classification number for warnings.
4. Draft the research question to address the claim.
- a. To what extent has air temperature caused an increase in the number and severity of cyclones crossing the Queensland coast?
5. Refine and focus the research question.
- a. What type of data is relevant?
  - b. What time period is sufficient to show a correlation between air temperature and frequency and severity of cyclones?
6. Present the research question to the teacher for approval.
- a. To what extent has average temperature increase across the continent correlated with the number or severity of cyclones around Australia?

**Note:** You cannot use this sample research question for your investigation.

# Instrument-specific marking guide (IA3): Research investigation (20%)

## Criterion: Research and planning

### Assessment objectives

2. apply understanding of the cause and impact of Earth hazards or global climate change to develop research questions
5. investigate phenomena associated with the cause and impact of Earth hazards or global climate change through research

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> <li>• informed application of understanding of the cause and impact of Earth hazards or global climate change demonstrated by a considered rationale identifying clear development of the research question from the claim</li> <li>• effective and efficient investigation of phenomena associated with the cause and impact of Earth hazards or global climate change demonstrated by               <ul style="list-style-type: none"> <li>– a specific and relevant research question</li> <li>– selection of sufficient and relevant sources.</li> </ul> </li> </ul>	5–6
<ul style="list-style-type: none"> <li>• adequate application of understanding of the cause and impact of Earth hazards or global climate change demonstrated by a reasonable rationale that links the research question and the claim</li> <li>• effective investigation of phenomena associated with the cause and impact of Earth hazards or global climate change demonstrated by               <ul style="list-style-type: none"> <li>– a relevant research question</li> <li>– selection of relevant sources.</li> </ul> </li> </ul>	3–4
<ul style="list-style-type: none"> <li>• rudimentary application of understanding of the cause and impact of Earth hazards or global climate change demonstrated by a vague or irrelevant rationale for the investigation</li> <li>• ineffective investigation of phenomena associated with the cause and impact of Earth hazards or global climate change demonstrated by               <ul style="list-style-type: none"> <li>– an inappropriate research question</li> <li>– selection of insufficient and irrelevant sources</li> </ul> </li> </ul>	1–2
<ul style="list-style-type: none"> <li>• does not satisfy any of the descriptors above.</li> </ul>	0

## Criterion: Analysis and interpretation

### Assessment objectives

- analyse research evidence about the cause and impact of Earth hazards or global climate change
- interpret research evidence about the cause and impact of Earth hazards or global climate change

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>systematic and effective analysis of qualitative data and/or quantitative data within the sources about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>the identification of sufficient and relevant evidence</li><li>thorough identification of relevant trends, patterns or relationships</li><li>thorough and appropriate identification of limitations of evidence</li></ul></li><li>insightful interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by justified scientific argument/s.</li></ul>	5–6
<ul style="list-style-type: none"><li>effective analysis of qualitative data and/or quantitative data within the sources about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>the identification of relevant evidence</li><li>identification of obvious trends, patterns or relationships</li><li>basic identification of limitations of evidence</li></ul></li><li>adequate interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by reasonable scientific argument/s.</li></ul>	3–4
<ul style="list-style-type: none"><li>rudimentary analysis of qualitative data and/or quantitative data within the sources about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>the identification of insufficient and irrelevant evidence</li><li>identification of incorrect or irrelevant trends, patterns or relationships</li><li>incorrect or insufficient identification of limitations of evidence</li></ul></li><li>invalid interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by inappropriate or irrelevant argument/s.</li></ul>	1–2
<ul style="list-style-type: none"><li>does not satisfy any of the descriptors above.</li></ul>	0

## Criterion: Conclusion and evaluation

### Assessment objectives

- interpret research evidence about the cause and impact of Earth hazards or global climate change
- evaluate research processes, claims and conclusions about the cause and impact of Earth hazards or global climate change

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>insightful interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by justified conclusion/s linked to the research question</li><li>critical evaluation of the research processes, claims and conclusions about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>insightful discussion of the quality of evidence</li><li>extrapolation of credible findings of the research to the claim</li><li>suggested improvements and extensions to the investigation that are considered and relevant to the claim.</li></ul></li></ul>	5–6
<ul style="list-style-type: none"><li>adequate interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by reasonable conclusion/s relevant to the research question</li><li>basic evaluation of the research processes, claims and conclusions about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>reasonable description of the quality of evidence</li><li>application of relevant findings of the research to the claim</li><li>suggested improvements and extensions to the investigation that are relevant to the claim.</li></ul></li></ul>	3–4
<ul style="list-style-type: none"><li>invalid interpretation of research evidence about the cause and impact of Earth hazards or global climate change demonstrated by inappropriate or irrelevant conclusion/s</li><li>superficial evaluation of the research processes, claims and conclusions about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>cursory or simplistic statements about the quality of evidence</li><li>application of insufficient or inappropriate findings of the research to the claim</li><li>ineffective or irrelevant suggestions.</li></ul></li></ul>	1–2
<ul style="list-style-type: none"><li>does not satisfy any of the descriptors above.</li></ul>	0



## Criterion: Communication

### Assessment objectives

7. communicate understandings and research findings, arguments and conclusions about the cause and impact of Earth hazards or global climate change

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>• effective communication of understandings and research findings, arguments and conclusions about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>– fluent and concise use of scientific language and representations</li><li>– appropriate use of genre conventions</li><li>– acknowledgment of sources of information through appropriate use of referencing conventions.</li></ul></li></ul>	2
<ul style="list-style-type: none"><li>• adequate communication of understandings and research findings, arguments and conclusions about the cause and impact of Earth hazards or global climate change demonstrated by<ul style="list-style-type: none"><li>– competent use of scientific language and representations</li><li>– use of basic genre conventions</li><li>– use of basic referencing conventions.</li></ul></li></ul>	1
<ul style="list-style-type: none"><li>• does not satisfy any of the descriptors above.</li></ul>	0



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