

# Agricultural Science 2019 v1.3

IA3: Sample assessment instrument

## Research investigation (20%)

This sample has been compiled by the QCAA to 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	
Overall	2	

# Conditions

<b>Technique</b>	Research investigation
<b>Unit</b>	Unit 4: Agricultural management
<b>Topic/s</b>	Topic 1: Enterprise management Topic 2: Evaluation of an agricultural enterprise's sustainability
<b>Duration</b>	10 hours class time
<b>Mode/length</b>	Written (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:

- Sustainable natural resource use is essential for the continuation of agricultural industries in Australia.
- Dryland salinity is affecting Australian agriculture.
- Animal welfare requirements will change animal production practices in Australia.
- Intensive animal industries need to have efficient waste management systems.
- Native fisheries are causing the extinction of edible marine species.
- Biofuel production can save the Australian grain industry.
- Soil degradation can be controlled with sustainable farming practices.
- Climate change is threatening the continuation of the grain industry in temperate 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. empirical 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 a claim could be developed into a research question**

**Claim:** Sustainable natural resource use is essential for the continuation of agricultural industries in Australia.

**Research question:** How have centre-pivot and lateral-move irrigation machine systems (CPLM) improved water efficiency in cotton production compared to traditional furrow irrigation systems in terms of producing higher yields with less irrigation water?

## Developing the research question

Steps	Details
1. Identify the key (important) terms in the claim.	<ul style="list-style-type: none"> <li>• sustainable natural resource</li> <li>• resource use</li> <li>• agricultural industries</li> </ul>
2. Propose refining questions that need to be addressed to refine key terms and narrow the focus of the claim.	<ul style="list-style-type: none"> <li>• How can sufficient and relevant evidence be collected to evaluate sustainable natural resource use?</li> <li>• How do you determine what is a sustainable agricultural management practice?</li> <li>• Which agricultural industry in Australia should be chosen to investigate?</li> </ul>
3. Provide an example of how one of the claims could be developed into a research question. Conduct research, gathering information to respond to the refining questions.	<ul style="list-style-type: none"> <li>• The natural resource relevant to agriculture that will be investigated is water, specifically the use of water for irrigation purposes.</li> <li>• Cotton is an agricultural industry that has a high demand for irrigation water.</li> <li>• There are several different types of irrigation systems that growers currently use or could convert to.</li> <li>• There are differences between irrigation systems in terms of water-use efficiency.</li> <li>• The efficiency of water use can be measured by the volume of water required to produce one bale of cotton. Other factors to consider when choosing an irrigation system are the reliability of irrigation water, soil type, infrastructure costs, energy requirements for pumping water, etc.</li> </ul>
4. Draft the research question to address the claim.	What effect can the choice of irrigation system have on sustainable water use and the sustainability of the cotton industry?
5. Refine and focus the research question.	<ul style="list-style-type: none"> <li>• What type of data is relevant?</li> <li>• What time period and range of environmental conditions would be considered sufficient to demonstrate the water efficiency of a specific irrigation system and its effect on the sustainability of the industry?</li> </ul>
6. Present the research question to the teacher for approval.	How have centre-pivot and lateral-move irrigation machine systems (CPLM) improved water efficiency in cotton production compared to traditional furrow irrigation systems in terms of producing higher yields with less irrigation water?

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

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

## Criterion: Research and planning

### Assessment objectives

2. apply understanding of enterprise management or evaluation of an agricultural enterprise to develop research questions
5. investigate phenomena associated with enterprise management or evaluation of an agricultural enterprise through research

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> <li>• informed application of understanding of enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise demonstrated by a reasonable rationale that links the research question and the claim</li> <li>• effective investigation of phenomena associated with enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise demonstrated by a vague or irrelevant rationale for the investigation</li> <li>• ineffective investigation of phenomena associated with enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise
- interpret research evidence about enterprise management or evaluation of an agricultural enterprise

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 enterprise management or evaluation of an agricultural enterprise 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 agricultural enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise 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 agricultural enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise 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 agricultural enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise
- evaluate research processes, claims and conclusions about enterprise management or evaluation of an agricultural enterprise

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>insightful interpretation of research evidence about enterprise management or evaluation of an agricultural enterprise demonstrated by justified conclusion/s linked to the research question</li><li>critical evaluation of the research processes, claims and conclusions about enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise demonstrated by reasonable conclusion/s relevant to the research question</li><li>basic evaluation of the research processes, claims and conclusions about enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise demonstrated by inappropriate or irrelevant conclusion/s</li><li>superficial evaluation of the research processes, claims and conclusions about enterprise management or evaluation of an agricultural enterprise 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 objective

7. communicate understandings and research findings, arguments and conclusions about enterprise management or evaluation of an agricultural enterprise

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 enterprise management or evaluation of an agricultural enterprise 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 enterprise management or evaluation of an agricultural enterprise 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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