

Earth & Environmental Science 2019 v1.3

Unit 2 sample assessment instrument

August 2018

Research investigation

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

Schools develop internal assessments for each senior subject, based on the learning described in Units 1 and 2 of the subject syllabus. Each unit objective must be assessed at least once.

Unit objectives

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

2. apply understanding of energy for Earth, atmospheric, hydrologic and biogeochemical processes
3. analyse evidence about energy for Earth, atmospheric, hydrologic and biogeochemical processes
4. interpret evidence about energy for Earth, atmospheric, hydrologic and biogeochemical processes
5. investigate phenomena associated with energy for Earth, atmospheric, hydrologic and biogeochemical processes
6. evaluate processes, claims and conclusions about energy for Earth, atmospheric, hydrologic and biogeochemical processes
7. communicate understandings, findings, arguments and conclusions about energy for Earth, atmospheric, hydrologic and biogeochemical processes.

Note: Objective 1 is not assessed in this instrument.

Subject	Earth & Environmental Science		
Technique	Research investigation		
Unit	Unit 2: Earth processes — energy transfers and transformations		
Topic	Topic 1: Energy for Earth processes Topic 2: Energy for atmospheric and hydrologic processes Topic 3: Energy for biogeochemical processes		
Conditions			
Duration	10 hours class time		
Mode	Written response — scientific essay	Length	1500–2000 words
Individual/group	Individual	Other	—
Resources available	School library (online: internet and school intranet, databases, journals)		
Context			
Investigate one of the following claims:			
<ul style="list-style-type: none"> • Man-made ecosystems are causing the extinction of Australian native fauna. • Soil sequestration of carbon will reduce greenhouse gas emissions. • Solar energy will eventually replace coal as a source for electricity. • Burning fossil fuels is causing the Earth to get warmer. • Rumen bacteria are the key to reducing greenhouse gases. • Climate change will cause an increase in the frequency of El Niño events along the Australian east coast. 			
You may identify an alternative claim in consultation with your teacher. This claim must be related to Unit 2 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:			
<ul style="list-style-type: none"> • 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. scientific essay.

Stimulus

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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.

Feedback

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 drafts.
- 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: Rumen bacteria are the key to reducing greenhouse gases.

Research question: To what extent can kangaroo microflora introduced to the rumen of cattle reduce the production of methane gas from cellulose digestion?

Developing the research question:

1. Identify the key (important) terms in the claim.
 - a. rumen bacteria
 - b. greenhouse gases
2. Propose 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 to evaluate the effect of rumen bacteria on greenhouse gas reduction?
 - b. How do you determine which rumen bacteria will decrease greenhouse gases?
 - c. What animals are regarded as major contributors to greenhouse gases?
 - d. Which animal species in Australia should be chosen to investigate?
3. Conduct research to gather information to address the questions.
 - a. What are examples of greenhouse gases?
 - b. Current research has shown that microflora found in the digestive system of kangaroos produce no methane as a by-product.
 - c. Identify the specific microflora in kangaroos that could be transferred to the digestive systems of other animals which currently produce methane.
 - d. Find a practical application for this type of investigation.
4. Draft the research question to address the claim.
 - a. Can kangaroo microflora reduce methane emissions in cattle?
5. Refine and focus the research question.
 - a. What type of data is relevant?
 - b. What effect can kangaroo microflora transferred to the rumen of cattle have on reducing the production of methane gas from digestion?
6. Present the research question to the teacher for approval.
 - a. To what extent can kangaroo microflora introduced to the rumen of cattle reduce the production of methane gas from cellulose digestion?

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