

Earth & Environmental Science

2019 v1.4

IA2: Sample assessment instrument

Student experiment (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 of evidence	6	
Interpretation and evaluation	6	
Communication	2	
Overall	20	

Conditions

Technique	Student experiment
Unit	Unit 3: Living on Earth — extracting, using and managing Earth resources
Topic/s	Topic 1: Use of non-renewable Earth resources
Duration	10 hours class time
Mode/length	Written (e.g. scientific report): 1500–2000 words
Individual/group	Individual response: students may collaborate to develop the methodology and perform the experiment
Resources	School science laboratory and library (online: internet and school intranet, databases, journals)

Context

You have completed the following practicals in class:

- Model location, exploration and extraction of a metallic resource. Use a locality map to predict the location of a metallic resource (suggested practical).
- Analyse and interpret geophysical and geochemical exploration datasets (mandatory practical).
- Design and conduct experiments to model other separation or processing techniques (e.g. crushing, smelting and froth flotation, gravitational separation) (suggested practical).
- Conduct an experiment to model turbidity management strategies, using settling ponds (mandatory practical).
- Investigate the effect of slope/revegetation on the volume of water run-off and amount of topsoil lost through erosion (suggested practical).

Task

Modify (i.e. refine, extend or redirect) an experiment in order to address your own related hypothesis or question.

You may use a practical performed in class, a related simulation or another practical related to Unit 3 (as negotiated with your teacher) as the basis for your methodology and research question.

To complete this task, you must:

- identify an experiment to modify*
- develop a research question to be investigated*
- research relevant background scientific information to inform the modification of the research question and methodology
- conduct a risk assessment and account for risks in the methodology*
- conduct the experiment*
- collect sufficient and relevant qualitative data and/or quantitative data to address the research question*
- process and present the data appropriately
- analyse the evidence to identify trends, patterns or relationships
- analyse the evidence to identify uncertainty and the limitations
- interpret the evidence to draw conclusion/s to the research question
- evaluate the reliability and validity of the experimental process
- suggest possible improvements and extensions to the experiment
- communicate findings in an appropriate scientific genre, i.e. scientific report.

*The steps indicated with an asterisk above may be completed in groups. All other elements must be completed individually.

Checkpoints

- Term 1, Week 8: Select modifications, develop research question and complete risk assessment.
- Term 1, Week 9: Start experiment.
- Term 2, Week 1: Collect and analyse data.
- Term 2, Week 3: Submit draft.
- Term 2, Week 8: 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.
- Students will use plagiarism-detection software at submission of the response.
- Students must acknowledge all sources.
- The teacher will compare the responses of students who have worked together in groups.

Scaffolding

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

- a research question
- a rationale for the experiment
- reference to the initial experiment and identification and justification of modifications to the methodology
- raw and processed qualitative data and/or quantitative data
- analysis of the evidence
- conclusion/s based on the interpretation of the evidence
- an evaluation of the methodology and suggestions of improvements and extensions to the experiment
- a reference list.

An example of how one of the practicals could be modified to develop a research question

Practical that will be modified: Investigate the effect of slope/revegetation on the volume of water runoff and amount of topsoil lost through erosion.

Research question: Can a mathematical model be used to describe the relationship between the slope gradient of the land and the mass of soil lost through water erosion?

Developing the research question:

Steps	Details
Identify the independent variable to be investigated.	Per cent slope gradient.
Identify the dependent variable.	Mass of soil collected in run-off.
Identify the methodology to be used.	Laboratory/field trial.
Draft research questions.	How does the slope of the ground affect erosion? What is the relationship between per cent slope gradient and soil erosion?
Refine and focus the research question.	What is the effect of increasing per cent slope gradient on the amount of soil lost through water erosion?
Present research question to teacher for approval.	Can a mathematical model be used to describe the relationship between the slope gradient of the land and the mass of soil lost through water erosion?

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

Instrument-specific marking guide (IA2): Student experiment (20%)

Criterion: Research and planning

Assessment objectives

2. apply understanding of the use of renewable or non-renewable resources to modify experimental methodologies and process primary data
5. investigate phenomena associated with the use of renewable or non-renewable resources through an experiment

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> • informed application of understanding of the use of renewable or non-renewable resources to modify experimental methodologies demonstrated by <ul style="list-style-type: none"> – a considered rationale for the experiment – justified modifications to the methodology • effective and efficient investigation of phenomena associated with the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – a specific and relevant research question – a methodology that enables the collection of sufficient, relevant data – considered management of risks and ethical or environmental issues. 	5–6
<ul style="list-style-type: none"> • adequate application of understanding of the use of renewable or non-renewable resources to modify experimental methodologies demonstrated by <ul style="list-style-type: none"> – a reasonable rationale for the experiment – feasible modifications to the methodology • effective investigation of phenomena associated with the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – a relevant research question – a methodology that enables the collection of relevant data – management of risks and ethical or environmental issues. 	3–4
<ul style="list-style-type: none"> • rudimentary application of understanding of the use of renewable or non-renewable resources to modify experimental methodologies demonstrated by <ul style="list-style-type: none"> – a vague or irrelevant rationale for the experiment – inappropriate modifications to the methodology • ineffective investigation of phenomena associated with the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – an inappropriate research question – a methodology that causes the collection of insufficient and irrelevant data – inadequate management of risks and ethical or environmental issues. 	1–2
<ul style="list-style-type: none"> • does not satisfy any of the descriptors above. 	0

Criterion: Analysis of evidence

Assessment objectives

2. apply understanding of the use of renewable or non-renewable resources to modify experimental methodologies and process primary data
3. analyse experimental evidence about the use of renewable or non-renewable resources
5. investigate phenomena associated with the use of renewable or non-renewable resources through an experiment

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> • appropriate application of algorithms, visual and graphical representations of data about the use of renewable or non-renewable resources demonstrated by correct and relevant processing of data • systematic and effective analysis of experimental evidence about the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – thorough identification of relevant trends, patterns or relationships – thorough and appropriate identification of the uncertainty and limitations of evidence • effective and efficient investigation of phenomena associated with the use of renewable or non-renewable resources demonstrated by the collection of sufficient and relevant raw data. 	5–6
<ul style="list-style-type: none"> • adequate application of algorithms, visual and graphical representations of data about the use of renewable or non-renewable resources demonstrated by basic processing of data • effective analysis of experimental evidence about the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – identification of obvious trends, patterns or relationships – basic identification of uncertainty and limitations of evidence • effective investigation of phenomena associated with the use of renewable or non-renewable demonstrated by the collection of relevant raw data. 	3–4
<ul style="list-style-type: none"> • rudimentary application of algorithms, visual and graphical representations of data about the use of renewable or non-renewable resources demonstrated by incorrect or irrelevant processing of data • ineffective analysis of experimental evidence about the use of renewable or non-renewable resources demonstrated by <ul style="list-style-type: none"> – identification of incorrect or irrelevant trends, patterns or relationships – incorrect or insufficient identification of uncertainty and limitations of evidence • ineffective investigation of phenomena associated with the use of renewable or non-renewable resources demonstrated by the collection of insufficient and irrelevant raw data. 	1–2
<ul style="list-style-type: none"> • does not satisfy any of the descriptors above. 	0

Criterion: Interpretation and evaluation

Assessment objectives

- interpret experimental evidence about the use of renewable or non-renewable resources
- evaluate experimental processes and conclusions about the use of renewable or non-renewable resources

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">insightful interpretation of experimental evidence about the use of renewable or non-renewable resources demonstrated by justified conclusion/s linked to the research questioncritical evaluation of experimental processes about the use of renewable or non-renewable resources demonstrated by<ul style="list-style-type: none">justified discussion of the reliability and validity of the experimental processsuggested improvements and extensions to the experiment that are logically derived from the analysis of evidence.	5–6
<ul style="list-style-type: none">adequate interpretation of experimental evidence about the use of renewable or non-renewable resources demonstrated by reasonable conclusion/s relevant to the research questionbasic evaluation of experimental processes about the use of renewable or non-renewable resources demonstrated by<ul style="list-style-type: none">reasonable description of the reliability and validity of the experimental processsuggested improvements and extensions to the experiment that are related to the analysis of evidence.	3–4
<ul style="list-style-type: none">invalid interpretation of experimental evidence about the use of renewable or non-renewable resources demonstrated by inappropriate or irrelevant conclusion/ssuperficial evaluation of experimental processes about the use of renewable or non-renewable resources demonstrated by<ul style="list-style-type: none">cursory or simplistic statements about the reliability and validity of the experimental processineffective or irrelevant suggestions.	1–2
<ul style="list-style-type: none">does not satisfy any of the descriptors above.	0

Criterion: Communication

Assessment objectives

7. communicate understandings and experimental findings, arguments and conclusions about the use of renewable or non-renewable resources

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



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