

Chemistry 2019 v1.3

Units 1 and 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 the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions
3. analyse evidence about the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions
4. interpret evidence about the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions
5. investigate phenomena associated with the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions
6. evaluate processes, claims and conclusions about the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions
7. communicate understandings, findings, arguments and conclusions about the properties and structure of atoms and materials; chemical reactions in terms of reactants, products and energy change; intermolecular forces and gases; aqueous solutions and acidity; and rates of chemical reactions.

Note: Objective 1 is not assessed in this instrument.

Subject	Chemistry		
Technique	Research investigation		
Unit	Unit 1: Chemical fundamentals — structure, properties and reactions Unit 2: Molecular interactions and reactions		
Topic	Unit 1 Topic 3: Chemical reactions — reactants, products and energy change Unit 2 Topic 2: Aqueous solutions and acidity Unit 2 Topic 3: Rates of chemical reactions		
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			
<p>Investigate one of the following claims:</p> <ul style="list-style-type: none"> • Green energy is clean energy. • You are what you eat. • Biofuels are more efficient and have less environmental impact than fossil fuels. • Sulphur dioxide released from burning fossil fuels causes acid rain. <p>You may identify an alternative claim in consultation with your teacher. This claim must be related to the subject matter of Unit 1 Topic 3, Unit 2 Topic 2 or Unit 2 Topic 3.</p>			
Task			
<p>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.</p> <p>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.</p>			
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
—
Checkpoints
<input type="checkbox"/> Week 1: Select claim and develop research question.
<input type="checkbox"/> Week 2: Identify sources and conduct research.
<input type="checkbox"/> Week 3: Analyse and evaluate evidence.
<input type="checkbox"/> Week 4: Submit draft.
<input type="checkbox"/> Week 5: Submit final response.
Feedback
Authentication strategies
<ul style="list-style-type: none"> • 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
<p>The response must be presented using an appropriate scientific genre (i.e. scientific essay) and contain:</p> <ul style="list-style-type: none"> • 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. <p>An example of how one of the claims could be developed into a research question</p> <p>Claim: Biofuels are more efficient and have less environmental impact than fossil fuels.</p>

Research question: Is the combustion of biodiesel more efficient than petroleum-based diesel in terms of energy output (enthalpy) and CO₂ emissions?

Developing the research question:

1. Identify the key (important) terms in the claim.
 - a. biofuels
 - b. more efficient
 - c. fossil fuels
2. Propose questions that need to be addressed to refine key terms and narrow the focus of the claim.
 - a. What are biofuels?
 - b. Which biofuels and fossil fuels will be investigated?
 - c. What does 'more efficient' mean in relation to energy output and greenhouse gas emissions?
 - d. How do energy output and greenhouse gas emissions link to the chemistry of fuels, exothermic reactions and enthalpy?
3. Conduct research to gather information to address the questions.
 - a. How will energy output be compared/evaluated?
 - b. Which greenhouse gases are produced as a by-product of combustion of biofuels and fossil fuels?
 - c. How will greenhouse gases be compared/evaluated?
 - d. What data will be collected for energy output and greenhouse gas emissions?
 - e. What is the chemistry related to energy production and greenhouse gases produced from the combustion of biofuels and fossil fuels?
4. Draft the research question to address the claim.
 - a. Do biofuels produce fewer greenhouse gases and more energy than fossil fuels?
5. Refine and focus the research question.
 - a. Focus on products of combustion: energy output (enthalpy) and CO₂ produced.
 - b. Focus on biodiesel and petroleum-based diesel.
 - c. Define efficiency in terms of higher energy output and lower CO₂ emissions.
6. Present the research question to the teacher for approval.
 - a. Is the combustion of biodiesel more efficient than petroleum-based diesel in terms of energy output (enthalpy) and CO₂ emissions?

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