**NZQA**

**Approved**

Achievement standard: 90930 Version 3

Standard title: Carry out a practical chemistry investigation, with direction

Level: 1

Credits: 4

Resource title: Best batteries

Resource reference: Chemistry VP-1.1 v2

Vocational pathway: Construction and Infrastructure

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-90930-02-7195 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 90930

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Level: 1

Credits: 4

Resource title: Best batteries

Resource reference: Chemistry VP-1.1 v2

Vocational pathway: Construction and Infrastructure

Learner instructions

# Introduction

This assessment activity requires you to find the best electrolyte for batteries from a series of chemical solutions that your assessor/educator will provide.

You are going to be assessed on how comprehensively you carry out a practical chemistry investigation to find out what is the best electrolyte for a battery.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

Today people are demanding smaller and better batteries. There are three components in batteries that can lead to better current and longer performance. These are the cathodes, the anodes and the electrolyte solution. Your employer has asked you to find the best electrolyte for batteries from a series of chemical solutions developed by its chemists, and report back to him/her.

## Method

Choose a known anode and cathode to make a simple battery. Trialling will be useful here. Once selected, run your battery in the electrolyte solutions provided to find the best. Investigate how to measure the electrical output and how long the circuit lasts.

This activity includes developing and trialling your procedure, carrying out the investigation, recording and processing your results and completing your final report.

## Part 1: Develop a detailed procedure

Develop a detailed step-by-step procedure using the method provided. Collect the necessary primary data with correct units to find the best electrolyte.

Trial your procedure to ensure it works. Make any necessary changes to ensure accuracy and reliability.

Include a detailed step-by-step procedure as part of your final presentation.

Frame your procedure by clearly stating:

* the purpose of your investigation
* the chemicals and equipment you have been provided with.

Write down each step you will need to undertake to be able to draw conclusions that are linked to this purpose. Include sufficient detail so that others could replicate your procedure.

As you trial your procedure record any problems you encounter and any changes you have to make as a result. Record why you made these changes.

Write out the final procedure you intend to use for your actual investigation. Note what you have done to ensure accuracy and reliability.

## Part 2: Collect and process the primary data

Using the procedure determined above, collect relevant primary data with correct units. Record any changes you make to your procedure as you work and why you made them, for example to increase accuracy or reliability.

Process the data you have collected in a way that will enable you to reach a conclusion that is linked to the purpose of your investigation. This could include tables, graphs and calculations (e.g. averaging).

These tips will help you to collect and process your data:

* Create a table which will allow you to easily record your primary data with correct units.
* Decide how you are going to process this data so that it provides clear justifications for your conclusions. This may be suitable for a wall chart and should be easily understood.

## Part 3: Interpret the information

Draw a conclusion from your processed data that is linked to the purpose of the investigation.

In stating your conclusion:

* Justify the choices you made and the procedures you used to increase accuracy and ensure reliability.
* Justify the conclusion in terms of the processed data and the purpose of the investigation.
* Relate investigation findings to applicable chemistry ideas.

## Part 4: Report your investigation

In your report to your employer, include:

* the purpose of your investigation
* the step-by-step procedure you developed and used, including all equipment and chemicals used
* your processed data, with correct units, represented in a way that has enabled you to reach the conclusions you have, for example using tables and/or graphs
* a conclusion that is linked to the purpose of your investigation and justified by your processed data
* your justification for the choices you made to increase accuracy during the investigation
* relating the findings of the investigation to applicable chemistry ideas.

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

The context for this investigation is choosing the best electrolyte solution to make a simple single cell battery. This requires knowledge of electrical currents. Learners are to produce a report for assessment at the end of the investigation.

# Conditions

All work to be assessed can be undertaken individually or in groups. The authenticity of learners’ practical and written work needs to be assured.

# Resource requirements

To enable learners to gather primary data, they must have access to appropriate laboratory chemicals and equipment, for example anodes, cathodes, three electrolyte solutions, dilute sulphuric acid, citric acid, tartaric acid.

You may wish to provide them with a template for the development of the procedure and recording of primary data.

# Additional information

Procedures outlined in *Safety in Science: A Guidance Manual for New Zealand Schools*, Learning Media, Ministry of Education, 2000 should be followed.

You should trial the method prior to learner use to ensure it works and that learners will be able to achieve Excellence.

# Assessment schedule: Chemistry 90930 – Best batteries

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner carries out a practical chemistry investigation, with direction by:* developing a procedure for collecting primary data with correct units to find the best electrolyte for batteries, based on the manipulation of the independent variable over a range of values
* collecting, recording and processing data in an appropriate way (graph, calculation, etc.)
* writing a conclusion based on the processed data

For example, the learner shows that:* + sulphuric acid is the best electrolyte because it has the best electrical output.

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner carries out an in-depth practical chemistry investigation, with direction by:* developing a procedure for collecting primary data with correct units to find the best electrolyte for batteries, based on the manipulation of the independent variable over a valid range of values with repetition to show reliability
* ensuring key variables are controlled
* using techniques to increase the accuracy of the measured values of the variables
* processing and representing data to enable a conclusion to be reached
* writing a conclusion that links to the purpose of the investigation

For example, the learner shows that:* + sulphuric acid is the best electrolyte of all those investigated because it has the best electrical output
	+ the volume of all solutions was kept the same by using the same measuring cylinder. The same thermometer was used to measure and monitor the temperature of all solutions and keep them the same
	+ the accuracy of variables was assured by eliminating the error of parallax, reading from the bottom of the meniscus, etc.

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner carries out a comprehensive practical chemistry investigation, with direction by:* developing a procedure for collecting primary data with correct units to find the best electrolyte for batteries, based on the manipulation of the independent variable over a valid range of values with repetition to show reliability
* ensuring key variables are controlled
* justifying choices made during the investigation to increase the accuracy of the measured values of the variables
* writing a conclusion that is justified in terms of the processed data and linked to the purpose of the investigation
* relating findings of the investigation to applicable chemistry ideas

For example, the learner shows that:* + sulphuric acid is the best electrolyte of all solutions investigated because it produces the most ions
	+ the data is reliable because three repeats for each reactant was done and the average taken. Outliers were not considered when calculating average
	+ sulphuric acid is a strong acid. Strong acids ionise completely, producing a large quantity of ions. More ions in solution mean a better electrolyte.

*The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.