**NZQA**

**Approved**

Achievement standard: 90930 Version 3

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

Level: 1

Credits: 4

Resource title: And the most reactive is …

Resource reference: Chemistry VP-1.1 v2

Vocational pathway: Manufacturing and Technology

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-90930-02-7197 |
| 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

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

Level: 1

Credits: 4

Resource title: And the most reactive is …

Resource reference: Chemistry VP-1.1 v2

Vocational pathway: Manufacturing and Technology

Learner instructions

# Introduction

This assessment activity requires you to carry out a practical chemistry investigation to find the most reactive metal from a series of five.

You are going to be assessed on how comprehensively you carry out a practical chemistry investigation to determine the reactivity of five common metals by investigating their reactions with air, pure oxygen, cold and hot water, and dilute hydrochloric acid.

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

Metals as pure elements or alloys are essential to today’s economy. They come in different forms and reactivities and these chemical and physical properties link to their uses. The company you work for has won a tender to manufacture aircraft parts. The most appropriate metal needs to be chosen to manufacture these parts. You are required to investigate the reactivity series for iron, copper, lead, aluminium, and magnesium and provide a report to the Chief Engineer. You will need to investigate their reactions with air, pure oxygen, cold water, hot water, and dilute hydrochloric acid.

## Method

Set up a series of reactions of the metals with air, pure oxygen, cold water, hot water, and dilute hydrochloric acid.

## 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 investigate the reactivity series for iron, copper, lead, aluminium, and magnesium.

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 and 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 (for example 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 include:

* the purpose of your investigation (as provided by your assessor/educator)
* 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 and ensure reliability 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

This activity requires learners to carry out a comprehensive practical chemistry investigation to determine the reactivity series for five different metals (iron, copper, lead, aluminium, and magnesium) by investigating their reactions with air, pure oxygen, cold and hot water, and dilute hydrochloric acid.

# Conditions

All work to be assessed can be undertaken individually or in groups.

# Resource requirements

To enable learners to gather primary data, they must have access to the metals chosen, pure oxygen (cylinder or made in the lesson), cold and hot water, and 1 M dilute hydrochloric acid.

# 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 – And the most reactive is …

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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 most reactive metal from a series of five, 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 dataFor example, the learner shows that:* + magnesium reacts fastest with air, pure oxygen, cold water, and hot water, and dilute hydrochloric acid.

*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 most reactive metal from a series of five, 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 investigationFor example, the learner shows that:* + magnesium is the most reactive metal because it reacts fastest with air, pure oxygen, cold water, and hot water, and dilute hydrochloric acid
	+ the same volume of oxygen, cold water, hot water and dilute hydrochloric acid was used. The volume of each reactant was measured using the same measuring cylinder
	+ all volumes were measured at eye level to eliminate the error of parallax. Volumes were read from the bottom of the meniscus.

*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 most reactive metal from a series of five, 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 the findings of the investigation to applicable chemistry ideas

For example, the learner shows that: * + magnesium is the most reactive metal because it reacts fastest with air, pure oxygen, cold water, and hot water, and dilute hydrochloric acid
	+ the data is reliable because three repeats for each reactant have been done and the average taken. Outliers are not considered when calculating the average
	+ the closer the valence electrons are to the nucleus (despite shielding of the nuclear charge by the core electrons), the more tightly it is held. For sodium, the valence electron is a 3s electron. For potassium, the valence electron is a 4s electron. The sodium valence electron is closer to the nucleus so more tightly held so less reactive; for potassium the opposite is true.

*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.