**NZQA**

**Approved**

Achievement standard: 90930 Version 3

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

Level: 1

Credits: 4

Resource title: Sweet and sour soil

Resource reference: Chemistry VP-1.1 v2

Vocational pathway: Primary Industries

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| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-90930-02-7196 |
| 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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Learner instructions

# Introduction

This assessment activity requires you to carry out a practical chemistry investigation to find out how much lime is needed to change the pH of a given soil sample by 1 pH unit.

You are going to be assessed on how comprehensively you carry out a practical chemistry investigation to find out how much lime is required to change soil pH.

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

The agricultural industry in New Zealand adds millions of tonnes of lime or calcium carbonate to the soils each year. The lime is added to take the pH of the soil up (from about a pH 5.5 to about a pH of 6.5) allowing grasses and clovers to grow better. As a dairy farm worker, you are required to investigate the amount of lime required to increase the pH of soil to about 6.5 and provide a report to the dairy farmer.

## Method

Use the soil sample provided by your assessor/educator that has a pH of 5.5. You will need to extract the acid solution out of the soil using distilled water and then use this solution to change the pH by adding lime until you get a pH of 6.5.

## 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 meet the increase in soil pH to 6.5.

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 find out how much lime is required to change soil pH.

# 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 appropriate laboratory chemicals and equipment, for example soil with a pH of 5.5, universal indicator, distilled water, a pH probe/meter, narrow range pH paper, a measuring cylinder and conical flask, and a pH scale.

# 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 – Sweet and sour soil

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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 how much lime is needed to change the pH of a given soil sample, 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:   * + 15 g of lime is required to change the pH of soil by one pH unit.   *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 how much lime is needed to change the pH of a given soil sample, 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:   * + 15 g of lime is required to change the pH of soil by one pH unit   + the same mass of soil is used for each trial and is measured by the same electronic scale. Lime from the same source was used for each trial   + the same type of soil was used so that the mass and volume of soil for each trial was consistent. Reading on the electronic scale was allowed to settle before being recorded   + all volumes are measured at eye level to eliminate the error of parallax. Volumes are 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 how much lime is needed to change the pH of a given soil sample, 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:   * + 15 g of lime is required to change the pH of soil by one pH unit   + the data is reliable because three repeats for each reactant is done and the average taken. Outliers are not considered when calculating the average   + an alkaline solution or base has a pH greater than 7 and will increase the pH of soil because they have a high concentration of hydroxide ions.   *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.