**NZQA**

**Approved**

Achievement standard: 90931 Version 3

Standard title: Demonstrate understanding of the chemistry in a technological application

Level: 1

Credits: 2

Resource title: Portland cement

Resource reference: Chemistry VP-1.2 v2

Vocational pathway: Construction and Infrastructure

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| Date version published | February 2015 Version 2To support internal assessment from 2015 |
| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-90931-02-7198 |
| 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: 90931

Standard title: Demonstrate understanding of the chemistry in a technological application

Level: 1

Credits: 2

Resource title: Portland cement

Resource reference: Chemistry VP-1.2 v2

Vocational pathway: Construction and Infrastructure

Learner instructions

# Introduction

This assessment activity requires you to demonstrate understanding of the chemistry related to the use of Portland cement.

You are going to be assessed on how comprehensively you demonstrate understanding of the chemistry in a technological application. You need to show that you can link the chemistry applicable with the use of Portland cement in the building industry.

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 building industry in New Zealand uses large amounts of cement in making concrete for foundations, walls, etc. The cement used in New Zealand is called Portland cement and is made at places like Cape Foulwind on the west coast of the South Island, near Westport.

Produce a report for apprentice builders that demonstrates comprehensive understanding of the chemistry related to the use of Portland cement in the building industry by:

* describing the chemistry related to the use of Portland cement
* explaining how or why the chemistry applies to the use of Portland cement
* linking the chemistry applicable to Portland cement with its use
* giving balanced chemical equations where appropriate.

# Resources

The following websites may be useful:

<http://en.wikipedia.org/wiki/Cement>

<http://classes.engr.oregonstate.edu/cce/winter2012/ce492/Modules/03_materials/03-4_body.htm#chemical_properties>

<http://teaching.ust.hk/~civl111/CHAPTER4.pdf>

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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 produce a report for apprentice builders to demonstrate their comprehensive understanding of the chemistry in a technological application. In the report the learners will explain the chemistry related to the use of Portland cement in the building industry. The report will link all the chemistry applicable with its use and include balanced equations where applicable.

# Conditions

This is an individual activity.

# Resource requirements

Learners require access to relevant resource materials such as the internet, library resources and specific chemistry texts.

# Additional information

None.

# Assessment schedule: Chemistry 90931 – Portland cement

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of the chemistry in a technological application by:* describing or giving an account of the chemistry related to the use of Portland cement

For example:*Cement hardens because of a chemical reaction. Cement is able to harden due to the water that is added in its mixture. The water causes aggregate bonds to form between it and the cement which eventually harden to its more functional form. The amount of water added is also a key factor to how strong cement will be.**The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of the chemistry in a technological application by:* describing or giving an account of the chemistry related to the use of Portland cement
* explaining how or why the chemistry applies to the use of Portland cement

For example:*Cement used in construction can be characterised as being either hydraulic or non-hydraulic. Hydraulic cement (e.g. Portland cement) hardens because of hydration, a chemical reaction between the anhydrous cement powder and water. Non-hydraulic cement such as slaked lime (calcium hydroxide mixed with water) hardens due to the reaction of carbonation in presence of the carbon dioxide naturally present in the air. Calcium oxide is produced by lime calcination at temperatures above 825 °C (1,517 °F) for about 10 hours at atmospheric pressure.**The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of the chemistry in a technological application by:* describing or giving an account of the chemistry related to the use of Portland cement
* explaining how or why the chemistry applies to the use of Portland cement
* linking the chemistry to the use of Portland cement. Linking may include elaborating, justifying, evaluating, comparing and contrasting or analysing

For example:*The chemistry ruling the action of the hydraulic cement is the hydration. Hydraulic cement (such as the Portland cement) is made of a mixture of silicates and oxides, with four main components.**One component being: Celite (3CaO·Al2O3)**A reaction during the setting of the cement is:**(3CaO·Al2O3)2 + (x+8) H2O → 4 CaO·Al2O3·xH2O + 2 CaO·Al2O3·8H2O**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.