**NZQA**

**Approved**

Achievement standard: 90946 Version 3

Standard title: Investigate the implications of the properties of metals for their use in society

Level: 1

Credits: 4

Resource title: Tie it

Resource reference: Science VP-1.7 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-02-2015-90946-02-7293 |
| 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

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Learner instructions

# Introduction

This assessment activity requires you to investigate the implications of the properties of metals and how this determines their suitability for use in wall ties used in brick and block work in the construction industry.

You are going to be assessed on how comprehensively you investigate the implications of the properties of metals for their use in wall ties in the construction 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 construction company that you work for has been awarded the contract to build a commercial high rise building in the local city. The cladding of the building will be brick and some block as well. New building legislation on wall ties passed by the local council identifies iron, aluminium, zinc and copper as the most suitable metals to use. Wall ties are used to join the internal and external walls of a cavity and need qualities such as resistance to corrosion, ductility and malleability. You, the engineer in the construction company, are tasked with the responsibility of identifying the best metal that could be used as wall ties in brick and block work.

This activity can be carried out individually or in groups.

## Investigate

Investigate iron, aluminium, zinc and copper and provide the following information for each:

* chemical symbol
* reaction with oxygen
* reaction with acid
* reaction with water
* density
* ductility and malleability.

## Research

Use library and internet sources to research the implications of the properties of iron, aluminium, zinc and copper for their use in wall ties used in brick and block work.

## Design a poster

Design a poster to show the different types of wall ties used in brick and block work, what metal they are made out of, and the implications of the properties of the metals for their use in the construction industry.

Use your poster to:

* Compare and contrast the different metals and the different situations in which they would be used in for brick and block work.
* Explain in detail how the physical and chemical properties of the metals make them suitable (or not) for their use in brick and block work.
* Explain in detail any links between the chemical and physical properties of the metals and their different uses.
* Justify in what circumstances you would use these different types of wall ties, and why.

On the poster use chemistry vocabulary, symbols and conventions, for example names and formulae, including writing balanced symbol equations.

# Resources

The following websites may be useful:

<http://www.mii.com/artefact/download.asp?aid=65747>

<http://www.masons.org.nz/products/brick-ties.php>

<http://www.eaglewire.co.nz/brickties>

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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 investigate comprehensively the different chemical and physical properties of metals (zinc, copper, aluminium and iron) for their specific use in wall ties for brick and block work.

# Conditions

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

# Resource requirements

For their investigation and processing of data, learners will need:

* samples of the selected metals
* appropriate laboratory equipment
* secondary information sources which may include chemistry magazines, internet sites, Alpha series or other Royal Society resources, or access to libraries.

# Additional information

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

# Assessment schedule: Science 90946 – Tie it

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner investigates the implications of the properties of four metals for their use in brick and block work in the construction industry by:* gathering primary data
* making and recording experimental observations of the physical and chemical properties of metals
* giving an account of the properties of metals and the implications for their use
* using chemistry vocabulary.

For example, the learner:* + gives an account of the specific use of metals used in brick and block work (e.g. iron as steel is used in the wall ties which help hold the external and internal block together. It is placed in the cavity wall during construction and spans the cavity. The ends of the ties are designed to lock into the mortar)
	+ describes the physical and chemical properties of iron as steel (e.g. iron is relatively soft and so is alloyed with carbon to make steel which is harder and stronger; the iron in steel reacts easily with water and oxygen so it is coated with zinc (galvanised) to prevent rusting)
	+ describes the specific use of metals used in brick and block work linked to their properties (e.g. ties are made out of galvanised steel so that they don’t rust and have greater strength).

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner investigates, in depth, the implications of the properties of four metals for their use in brick and block work in the construction industry by:* gathering primary data
* making and recording experimental observations of the physical and chemical properties of metals
* giving an account of the properties of metals and the implications for their use
* making links between the physical and chemical properties of metals and the implications for their use
* using chemistry vocabulary.

For example, the learner:* + gives an account of the specific uses of metals in brick and block work
	+ explains in depth the physical and chemical properties of these metals (e.g. iron is both malleable and ductile; however it is relatively soft, so when combined with carbon it forms steel and becomes much stronger. Iron/steel will corrode in water and when exposed to air. Galvanising involves dipping iron/steel into zinc, which is more reactive than iron/steel thus water and oxygen will react with the zinc rather than the iron. This means that the galvanised iron/steel is less likely to rust)
	+ explains the specific use of the metals in brick and block work linked to their key usage properties (e.g. galvanised steel is used when making wall ties because it does not rust in the presence of water and air. It is strong and flexible enough to make into ties that will not break).

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner investigates, comprehensively, the implications of the properties of four metals for their use in brick and block work in the construction industry by:* gathering primary data
* making and recording experimental observations of the physical and chemical properties of metals
* giving an account of the properties of metals and the implications for their use
* making links between the physical and chemical properties of metals and the implications for their use
* explaining, elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing the links between the chemical and physical properties of metals and the implications for their use
* using chemistry vocabulary.

For example, the learner:* + makes significant key links between the properties of metals and their specific use in brick and block work (e.g. zinc is used in the galvanising process with iron/steel. This prevents rusting because water and oxygen will react with the zinc rather than the iron. The zinc also forms a physical barrier preventing water and air from coming into contact with the iron/steel. However, if the zinc layer is damaged the iron/steel will be exposed to the water and oxygen)
	+ justifies the links between the physical and chemical properties of metals and the implications of their use in brick and block work (e.g. adding chromium to iron produces stainless steel. Stainless steel has greater corrosion resistance than galvanised steel but galvanised steel is more malleable and ductile and therefore easier to work with. Stainless steel ties would be used in coastal regions where there is a greater chance of corrosion from salt air while galvanised steel would be used inland where there is less chance of salt corrosion).

*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.