**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: Wired

Resource reference: Science VP-1.7 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-02-2015-90946-02-7294 |
| 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: 90946

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

Level: 1

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Resource title: Wired

Resource reference: Science VP-1.7 v2

Vocational pathway: Primary Industries

Learner instructions

# Introduction

This assessment activity requires you to investigate the implications of the properties of metals and how this affects choices of wires to use when making fences and for household wiring.

You are going to be assessed on how comprehensively you compare, explain and justify the implications of the properties of metals and how this affects the choice of wire to use when making fences or for household wiring.

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 company that you work for makes three different types of wire: galvanised steel wire, aluminium-coated wire and copper wire. The wires produced are used by local farmers for fencing and also by local electricians for household wiring. Fencing wire needs to be strong and resistant to corrosion while electrical wiring needs to be ductile and have good electrical conductivity. You, the engineer in the company, are tasked with the responsibility of creating a brochure to promote the different types of wire that your company produces.

This activity can be carried out individually or in groups.

## Investigate

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

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

## Research

Use library and internet sources to research the implications of the properties of steel, zinc, copper and aluminium for their use in different types of fencing wires.

## Design a brochure

Design a brochure to show the different types of wire made by your company, what metal they are made out of, and the implications of the properties of the metals for their use for fencing and in household wiring.

Use your brochure to:

* Compare and contrast the different metals used for wires and their different use in fencing or household wiring. You should comment on factors such as reactivity with water and oxygen, electrical conductivity, hardness, ductility and malleability.
* Explain in detail how the physical and chemical properties of the metals make them suitable for their use in fencing or household wiring.
* 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 wire and why.

In your brochure use chemistry vocabulary, symbols and conventions, for example names and formulae, including writing balanced symbol equations.

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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 wire metals (steel, zinc, copper and aluminium) for their specific use in fencing and household wiring.

# 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, Gallagher’s website (<http://www.gallagher.co.nz/>), 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 – Wired

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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 fencing and household wiring 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:* + gathers and records data regarding the physical and chemical properties of steel, aluminium, zinc and copper
	+ gives an account of the specific use of metals used in fencing or household wiring (e.g. aluminium coated wire is used when wiring the footing of the post)
	+ describes the physical and chemical properties of these metals (e.g. aluminium is covered with a thin layer of oxide that helps protect the metal from attack by air. So normally, aluminium wire does not react with oxygen)
	+ describes the specific use of metals used in fencing or household wiring linked to their properties (e.g. aluminium coated wire is used in the footing of the post because it does not corrode).

*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 fencing and household wiring 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:* + explains in-depth the specific use of metals used in fencing and household wiring, and the physical and chemical properties of these metals
	+ explains the specific use of the metals in fencing and household wiring, linked to their key usage properties (e.g. aluminium coated wire is used in the footing of the post by tying the foot to the post because it does not corrode and the steel is strong and flexible enough to be used for this purpose).

*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 fencing and household wiring 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 us
* explaining, elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing the links between the chemical and physical properties of metals and the implications of their use
* using chemistry vocabulary

For example, the learner:* + explains comprehensively the specific use of metals used in fencing and household wiring, and the physical and chemical properties of these metals
	+ makes significant key links between the properties of the metals and their specific use in fencing and household wiring (e.g. aluminium coated wire is used in the footing because it does not corrode and the steel underneath is strong and flexible. However if the oxide layer on the aluminium is damaged, the steel underneath will be exposed to attack from oxygen. It is also lightweight and has a low density, and it resists corrosion due to passivation of the metal on contact oxygen)
	+ justifies the links between the physical and chemical properties of metals and the implications of their use in fencing and household wiring (e.g. steel can also have zinc applied to it to prevent corrosion since the zinc will form a physical barrier and will preferentially react with any water and oxygen; copper does not react with water but will react slowly with oxygen – although it is more corrosion resistant it does not have the same strength as steel and so is not used for fence wiring. Its ability to corrode less means that aluminium must be used when corrosion is likely to occur. Wire above ground level is therefore steel coated with zinc, especially in coastal regions of New Zealand).

*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.