**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: The big catch

Resource reference: Science VP-1.7 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-02-2015-90946-02-7292 |
| 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

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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 manufactured items used in the fishing industry.

You are going to be assessed on how comprehensively you investigate the implications of the properties of metals for their use for fish storage containers in the fishing 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 engineering company that you work for has been approached by a fisherman who needs a container to store fish. The container needs to be made of metal and has to hold at least 200 kg of fish. The fisherman has heard that iron, aluminium, zinc, copper and chromium are possible metals that could be used. Fish containers are subjected to sea water and rough handling and therefore must be resistant to corrosion and need to be durable. They also need to be as lightweight as possible for easy handling. You, an engineer in the company, are tasked with the responsibility of identifying the best metal that could be used to make fishing containers.

This activity can be carried out individually or in groups.

## Investigate

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

* reaction with oxygen
* reaction with water
* hardness
* malleability
* ductility
* density.

## Research

Use library and internet sources to research the implications of the properties of iron, aluminium, zinc, copper and chromium for their use in the fishing industry for fish storage containers.

## Produce a report

Produce a report which identifies the benefits and drawbacks of using the different metals you have investigated and the implications of the properties of the metals in their use for fish storage containers.

Report in detail on:

* the benefits of the different types of metals in the containers
* the drawbacks of the different types of metals in the containers
* the physical and chemical properties of the metals which would make them suitable for their use in the container
* links between the chemical and physical properties of the metals and their different use
* circumstances in which you would use these different types of metals for the containers.

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

# Resource

## The following website may be useful:

[www.stainlessrestorations.co.nz/what-is-stainless-steel.html](http://www.stainlessrestorations.co.nz/what-is-stainless-steel.html)

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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 (iron, aluminium, zinc, copper and chromium) for their specific use in fish storage containers.

# 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 – The big catch

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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 five metals for their use in fish storage containers in the fishing 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:* + gathers and records data regarding the physical and chemical properties of iron, aluminium, zinc, copper and chromium
	+ describes the physical and chemical properties of these metals (e.g. chromium is a hard metal which does not tarnish in air)
	+ describes the specific use of metals used in making the container, linked to their properties (e.g. chromium alloy such as stainless steel is used because its resistance to corrosion makes it ideal to use for the fishing container. Its strength is also useful as it can take a lot of weight without losing its shape).

*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 five metals for their use in fish storage containers in the fishing 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:* + explains the physical and chemical properties of these metals (e.g. chromium is a hard metal which when combined with steel creates stainless steel. Its tensile strength depends on the class of stainless steel, with classes such as 300 and 400. The 300 class stainless steel uses nickel and chromium to increase resistance properties while the 400 class stainless steel uses carbon to increase tensile strength)
	+ explains the specific uses of the metals in containers linked to their physical and chemical properties (e.g. the container made of stainless steel class 300 would be good to use as it contains a higher percentage of nickel and is therefore more corrosive resistant because of the added nickel. This makes it better to use in salt conditions than stainless steel class 400 which does not contain nickel).

*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 five metals for their use in fish storage containers in the fishing 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 containers (e.g. chromium is a hard metal which when combined with steel creates stainless steel. Its tensile strength depends on the class of stainless steel, with classes such as300 and 400. The 300 class stainless steel uses nickel and chromium to increase resistance properties while the 400 class stainless steel uses carbon to increase tensile strength. Chromium is unstable in oxygen and it immediately produces a thin layer of oxide which prevents corrosion by water and oxygen and protects the steel below)
	+ justifies the links between the physical and chemical properties (e.g. when comparing galvanised steel to stainless steel, stainless steel is less corrosive in salt water than galvanised steel. Stainless steel will outlast galvanised steel by more than five times in a variety of corrosive environments. However, galvanised steel is a lot cheaper than stainless steel and its strength is comparable to 300 class stainless steel. If friction on tops or lids of stainless steel containers is noticed, then this should be considered as the friction can weld the steel together. It is also important not to clean stainless steel with bleach as chlorine can eat through the oxide barrier. Galvanised steel is more resistant to chlorine than stainless steel).

*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.