

Internal Assessment Resource

Chemistry Level 2

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| This resource supports assessment against:  Achievement Standard 91163 version 2  Demonstrate understanding of the chemistry used in the development of a current technology |
| Resource title: Discovering Chemistry |
| 3 credits |
| This resource:   * Clarifies the requirements of the standard * Supports good assessment practice * Should be subjected to the school’s usual assessment quality assurance process * Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic |

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| Date version published by Ministry of Education | February 2015 Version 2  To support internal assessment from 2015 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number: A-A-02-2015-91163-02-5421 |
| Authenticity of evidence | Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.  Using this assessment resource without modification may mean that students’ work is not authentic. The teacher 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. |

**Internal Assessment Resource**

Achievement Standard Chemistry 91163: Demonstrate understanding of the chemistry used in the development of a current technology

Resource reference: Chemistry 2.3B v2

Resource title: Discovering Chemistry

Credits: 3

Teacher guidelines

The following guidelines are designed to ensure that teachers can carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by the Achievement Standard Chemistry 91163. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

This task requires students to demonstrate their understanding of the chemistry involved in a recent (within the last twenty years) development of a material, including the history of its development. Students will research secondary information on a solid, record notes, process these notes, and prepare a report in a designated format.

A recent discovery in chemistry could include but is not limited to: nanotechnology, cosmetics, pharmaceuticals, paints, catalytic converters, fabric and fibre technology, or alloys.

Conditions

This assessment will require multiple sessions, over an extended period (approximately four weeks). Students should work individually on this assessment, in and out-of-class. Provide 2 to 3 hours of class time for research, plus some extra class time to assist students who encounter concepts beyond the normal scope of a Level 2 Chemistry programme during their research. Additional research, processing of the research data, and preparation of the report should occur independently outside of class.

Offer students an appropriate range of examples of developments or discoveries to research. Student choice is an important aspect of this task.

Students should maintain a record of their research process. The format could be, but is not limited to, a student workbook, a logbook, or a computer spreadsheet. Confirm an appropriate notes format with your students.

Confirm the format of the report with your students. The format could be, but is not limited to, a poster, a computer presentation, or a wiki.

Additional information

This task requires students to have an understanding of the properties of different types of solids; this is described in Achievement Standard Chemistry 91164. Ensure that teaching and learning about the properties of solids has occurred within the school programme before beginning this assessment.

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Demonstrate understanding of chemistry used in the development of a current technology. | Demonstrate in-depth understanding of the chemistry used in the development of a current technology. | Demonstrate comprehensive understanding of the chemistry used in the development of a current technology. |

Student instructions

Introduction

In this assessment, you will research a material developed in the last twenty years and prepare a report demonstrating understanding of the chemistry of the material, including the historical development of that chemistry. You will choose a discovery, independently perform secondary research, record notes, process your data, and prepare and present a report in an agreed format, for example, an oral presentation with a poster or computer presentation.

You will have [insert time] to complete this assessment; your teacher will provide you with a limited amount of time to perform research in class, however, you are expected to work on your own, outside of class time, to prepare your report.

Task

Discoveries in chemistry often occur as a result of a mistake, hunch, or intuition. The materials we use today are the result of historical developments, planned research, accident, and economic demand. The chemistry of new materials gives them certain properties; the properties of these materials make them useful to society.

Select a material, discovered in the last twenty years, to research from any one of the following domains:

* nanotechnology
* cosmetics
* pharmaceuticals
* paints
* catalytic converters
* fabric and fibre technology
* alloys.

Working independently, research the chemistry involved in the development of your selected material – find out what experimentation, events and/or discoveries led to the development of this material. You will be assessed on both your report and the notes you used to produce your report. Before you begin, confirm the format for your report and how you should record your notes with your teacher. For example, your report may be an A3 poster based on notes recorded in a logbook.

Your recorded notes should include enough information to allow you to comprehensively describe:

* the historical developments in chemistry that led to the discovery of the chosen material (while historical aspects may encompass the whole of human history, focus on those aspects which directly relate to the development of your selected material)
* the discovery itself
* the chemistry of the material
* the chemistry of the process by which the material was developed
* the usefulness of the chosen material to society
* the research references you consulted, including web sites.

Ask your teacher for clarification if you encounter difficult or unfamiliar concepts in the course of your research.

Using only your own notes, prepare and present your report. Your report should clearly show your understanding of the chemistry in the development of the chosen material. Use appropriate chemistry vocabulary, symbols and conventions. Include in your report how the development of the material relates to chemistry ideas, and how it is useful to society. Provide evidence for your conclusions, for example, quotes from your research. Hand in your notes with your report.

Assessment schedule: Chemistry 91163 Discovering Chemistry

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student:   * gathers, processes and interprets teacher provided and/or other secondary source information about a recent material and records notes appropriately * describes the development of the material * gives an overview of the history of the material's development * uses chemistry vocabulary to describe the development and composition of the material, for example, the chemical equation that describes a reaction used to make the material * provides some related chemistry information about the material.   For example:  *Nanotechnology relates to very small particles, measured in nanometers (1 nm = 1 x 10–9 metre). The idea of building objects with atomic precision was suggested in the 1950s, however, the term nanotechnology was not used until the 1970s. Nanotechnology particles are less than 100 nm. Nanotechnology has been used for hundreds of years. For example nano–sized particles of gold and silver have been used as coloured pigments since the tenth century. Nanoparticles can be both natural and synthetic. Plants, algae and volcanic activity all create nanoparticles. Nanoparticles are also formed as products of cooking, burning and vehicle exhausts. In 1985 the soot produced in an experiment with graphite was dissolved in benzene and formed a red solution. This substance was called buckyball and consisted of carbon atoms joined together in carbon rings with both five atoms and six atoms. Similar hollow structures called fullerenes were discovered in the 1900s. Nanotubes are forms of fullerenes. The small size of these particles changes their properties. The surface area increases (per unit mass). A nanoparticle of 30 nm has 5% of its atoms on the surface, but a particle of 3 nm has 50% of its atom on the surface. This increases their reactivity; consequently they can be used as surface catalysts. Quantum effects change the optical and conductive properties. A metal surface covered in nanoparticles is a much lighter and stronger material than the equivalent made without nanoparticles.* | The student:   * gathers, processes and interprets teacher provided and/or other secondary source information about a material in depth and records notes appropriately * describes the development of the material in depth * gives a detailed description of the history of the material's development * links the development of the material to related current or historical chemistry knowledge * uses and explains in detail the chemistry vocabulary necessary to describe the development, composition, and properties of the material.   For example:  *Nanotechnology relates to very small particles…* *In 1985 the soot produced in an experiment with graphite was dissolved in benzene and formed a red solution. Metals do not dissolve in any solvents. However, if the particles are sufficiently small (nanoparticles) they no longer behave as metallic structures, instead they are able to dissolve. The colour of the resulting solution depended on the size of the particle. The type of solid was determined to be molecular rather than a covalent network as covalent networks are insoluble but molecular substances can be soluble. This substance was called buckyball and consisted of carbon atoms joined together in carbon rings with both five atoms and six atoms. Carbon is able to form giant lattices of carbon atoms as they form strong covalent bonds between atoms. These atoms can be arranged in rings with delocalized electrons in the structure. Similar hollow structures called fullerenes were discovered in the 1900s. Nanotubes are forms of fullerenes.*  *The small size of these particles changes their properties. The surface area increases (per unit mass). A nanoparticle of 30 nm has 5% of its atoms on the surface, but a particle of 3 nm has 50% of its atom on the surface. This increases their reactivity; consequently they can be used as surface catalysts. A catalyst changes the rate of reaction by providing a surface on which the reaction can occur. It remains unchanged at the end. Quantum effects change the optical and conductive properties. Nanoparticles allow materials to be unusually light and strong. In a metal the particles are in close contact, however, as the particle size decreases and nanoparticles are used, the interface between particles increases. This means the material is very strong, and because the particles are so small it is also lightweight.* | The student:   * gathers, processes and interprets teacher provided and/or other secondary source information about a material and records notes appropriately * describes the development of the material in depth * gives a comprehensive description of the history of the material's development, including reasons why a particular development path was pursued * links the development of the material to related current or historical chemistry knowledge * uses chemistry symbols and vocabulary extensively to describe the development and composition of the material, for example, diagrams the structure of the material * evaluates the discovery or development with respect to its use by society, for example, the needs met by the material and the new challenges it presents.   For example:  *Nanotechnology relates to very small particles…* *This substance was called buckyball and consisted of carbon atoms joined together in carbon rings with both five atoms and six atoms. Carbon is able to form giant lattices of carbon atoms as they form strong covalent bonds between atoms. These atoms can be arranged in rings with delocalized electrons in the structure. Similar hollow structures called fullerenes were discovered in the 1900s. Nanotubes are forms of fullerenes. These diagrams illustrate typical carbon chains, buckyballs, and fullerenes…*  *The small size of these particles changes their properties…*  *There are a vast number of applications of nanotechnology to society, for example, in lightweight and strong building materials, or as components of fabric surfaces. Fabrics that are coated in nanoparticles resist water or dirt. However the effect of nanoparticles on our body is still not understood and there is evidence to suggest that nanoparticles are dangerous when taken into the body as their small size means that they interact with living cells. Because of the high reactivity caused by having high numbers of atoms on the surface, nanoparticles react in unexpected ways, including reacting with substances that don't react with larger size particles. For example, plating a metal with a thick coating of gold normally reduces its reactivity, but coating the same metal with gold nanoparticles may increase it.* |

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.