

NZQA Approved

Internal Assessment Resource

Chemistry Level 3

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| This resource supports assessment against:  Achievement Standard 91393  Demonstrate understanding of oxidation-reduction processes |
| Resource title: Making copper |
| 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 2017 Version 2  To support internal assessment from 2017 |
| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number: A-A-02-2017-91393-02-6373 |
| 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 91393: Demonstrate understanding of oxidation-reduction processes

Resource reference: Chemistry 3.7A v2

Resource title: Making copper

Credits: 3

Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Chemistry 91393. 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 activity requires students to write a report describing the non-spontaneous production of copper using an electrolytic cell and the spontaneous production of copper using an electrochemical cell.

Conditions

Students using a fume hood could carry out the production of copper by electrolysis of copper chloride if safety can be ensured. Alternatively, you could demonstrate this. The report will be completed as an individual activity. The students must be given sufficient time to show their understanding.

Resource requirements

Electrolysis of copper chloride:

* 1 mol L-1 copper chloride solution
* 250 mL beaker
* carbon electrode
* copper electrode
* connecting wires
* power source.

Test tube reaction:

* test tube
* zinc foil
* 2 mol L-1 copper sulphate solution.

Additional information

None.

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Demonstrate understanding of oxidation-reduction processes. | Demonstrate in-depth understanding of oxidation-reduction processes. | Demonstrate comprehensive understanding of oxidation-reduction processes |

Student instructions

Introduction

This activity requires you to write a report demonstrating your understanding of oxidation-reduction processes in the context of. the non-spontaneous production of copper using an electrolytic cell and the spontaneous production of copper using an electrochemical cell.

Teacher Note: You could substitute the electrolytic and electrochemical processes given in this activity with other appropriate reactions.

You will be assessed on the comprehensiveness of oxidation-reduction processes in your report.

You have approximately two periods to individually complete this task.

Preparatory activity

This preparatory activity will provide you with necessary observations for completing your report. You will not be assessed on this activity.

Your teacher will ensure that you follow normal laboratory safety procedures.

*Observation*

Watch your teacher demonstrate the production of copper by electrolysis of copper chloride. Record your observations.

*Practical*

Place a piece of zinc foil into a test tube half filled with copper sulphate solution to create an electrochemical reaction. Record your observations.

Teacher note: Depending on the resources available, the students may be able to conduct the electrolysis of copper cholride themselves. This should only be done if safety can be ensured.

Task

Write a report describing why the production of copper using an electrolytic cell is non-spontaneous and requires energy to be supplied, whereas the production of copper using an electrochemical cell is spontaneous.

In your report:

* describe observations of the reactions
* identify oxidation numbers in relation to species
* identify the species oxidised and reduced by name or formula
* identify the oxidation and reduction reactions
* write balanced half and full oxidation-reduction equations
* give conventional cell diagrams to demonstrate understanding of the reactions involved in the cells
* make and explain links between the oxidation-reduction processes, observations, equations, and calculations
* compare and contrast and justify links between oxidation-reduction processes, observations, equations, and calculations
* calculate cell potentials using data provided to predict spontaneity of reaction.

Throughout your report use chemistry vocabulary, symbols, and conventions.

Resource A

Teacher note: Insert resources required for electrolysis of copper chloride if to be carried out by students.

Test tube reaction:

* test tube
* zinc foil
* 2 mol L-1 copper sulphate solution.

Standard electrode potentials:

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| Redox couple | Standard electrode potential (V) |
| Cl2/Cl- | 1.36 |
| Cu2+/Cu | 0.34 |
| Zn2+/Zn | -0.76 |

Assessment schedule: Chemistry 91393 Making copper

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| This student demonstrates understanding of the oxidation-reduction processes involved in the electrolytic and electrochemical cell.  The student:   * names reactants and products * identifies what has been oxidised and reduced in each couple * explains what has been oxidised and reduced in terms of oxidation number change or electron gain/loss * makes reference to the requirement of energy for an electrolytic cell * links reduction potentials or cell potential to the electrochemical cell. | This student demonstrates in-depth understanding of the reduction-oxidations processes involved in the electrolytic and electrochemical cells by making and explaining links.  The student:   * explains what has been oxidised and reduced in terms of oxidation number change or electron gain/loss * gives balanced oxidation-reduction half equations for the reactions occurring * explains the spontaneity of the oxidation-reduction processes supported by reduction potentials or cell potential calculations. | This student demonstrates a comprehensive understanding of oxidation-reduction processes by comparing and contrasting the use of electrolytic and electrochemical cells to produce copper metal.  They justify why the production of copper metal using the electrochemical cell is spontaneous, whereas the production of copper metal using the electrolytic cell is not spontaneous and requires a power source.  The student:   * elaborates on and analyses the links between the spontaneity of the reactions using reduction potentials and any relevant observations * shows consistent use of chemistry vocabulary, symbols, and conventions such as: * oxidation numbers * balanced half and full equations * cell potential calculations. |

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