

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: Batteries |
| 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-02-2017-91393-02-6374 |
| 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 3.7B v2

Resource title: Batteries

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 comparing and contrasting the oxidation-reduction processes involved in a non-rechargeable and a rechargeable battery.

Conditions

You should determine the time taken for this assessment based on your students’ requirements.

Resource requirements

None.

Additional information

The choice of batteries could be altered with appropriate diagrams and reduction potential information.

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Achievement Standard Chemistry 91393: Demonstrate understanding of oxidation-reduction processes

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Resource title: Batteries

Credits: 3

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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 the oxidation-reduction processes involved in a non-rechargeable and a rechargeable battery.

You will be assessed on how comprehensively your report describes the oxidation-reduction processes occurring in the two types of batteries.

You have approximately two periods of in-class time to complete this task.

Task

Resources A and B provide diagrams of different batteries and a table of relevant reduction potentials. Choose one non-rechargeable battery and one rechargeable battery from the selection in Resource A.

Using Resources A and B and your knowledge of oxidation-reduction processes, write a report describing the oxidation processes in the discharge of both batteries and the recharge of the rechargeable battery.

In your report:

* identify the species oxidised and reduced
* identify oxidation numbers in relation to species
* write balanced half and full oxidation-reduction equations
* give conventional cell diagrams
* calculate cell potentials using data provided
* make and explain links between the oxidation-reduction processes, observations, equations, and calculations
* compare and contrast the discharge processes in both battery types
* justify why the recharge process is necessary in terms of amount of species
* elaborate on the recharge process of the rechargeable battery.

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

You will hand in the assessment materials to your teacher at the end of each period and you will be given them again at the start of the following period.

Resource A

**Non-rechargeable batteries**

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| Standard dry cell | Lithium iodine | Alkaline mercury zinc |
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**Rechargeable batteries**

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| Lead-acid | Nickel-cadmium |
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Resource B

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| Redox couple | Standard reduction potential (V) |
| *Li+/Li* | *-3.10* |
| Zn(OH)2/Zn | -1.25 |
| Cd/Cd(OH)2 | -0.82 |
| *Zn2+/Zn* | *-0.76* |
| Pb2+/Pb | -0.36 |
| *I2 /I–* | *0.054* |
| HgO/Hg | 0.098 |
| NiO(OH)/Ni(OH)2 | 0.48 |
| *MnO2/Mn3+* | *0.74* |
| PbO2/Pb2+ | 1.69 |

Assessment schedule: Chemistry 91393 Batteries

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student demonstrates an understanding of the oxidation-reduction processes involved in discharging both battery types and recharging of the rechargeable battery.  The student:   * identifies 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 loss/gain * makes reference to the requirement of energy for an electrolytic cell * links reduction potentials or cell potential to the electrochemical cell. | The student demonstrates an in-depth understanding of the reduction-oxidations processes involved in discharging both battery types and recharging of the rechargeable battery.  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 oxidation-reduction processes occurring supported by reduction potentials or cell potential calculations. | The student demonstrates a comprehensive understanding of the oxidation-reduction processes involved in discharging of a battery and the electrolytic process involved in recharging the rechargeable battery.  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.