

Internal Assessment Resource

Chemistry Level 2

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| This resource supports assessment against:  Achievement Standard 91167 version 2  Demonstrate understanding of oxidation-reduction |
| Resource title: Redox rules |
| 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 3  To support internal assessment from 2017 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number: A-A-02-2017-91167-03-5801 |
| 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 91167: Demonstrate understanding of oxidation-reduction

Resource reference: Chemistry 2.7A v3

Resource title: Redox rules

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 91167. 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 carry out oxidation-reduction reactions and demonstrate understanding of the reactions.

Oxidants and reductants are used in a variety of ways in modern society.

* Hydrogen peroxide is used as a bleach, in glow sticks, hydroponics, disinfectants, and laundry detergents.
* Potassium permanganate is used as a disinfectant for hands and feet, to kill fungal infections, to treat water, and to make props used in film and television look old.
* Potassium dichromate is used as an ingredient in cement, for cleaning glassware, tanning leather, wood treatment, and analysing alcohol in the “breathalyser test”.

Conditions

In part 1, students will gather information by carrying out each test tube reaction, recording their observations and then interpreting their results. In part 2, students interpret the observations provided.

You will provide three oxidants and three reductants.

You may choose to change the task by using other oxidants or reductants selected from explanatory note 4 of the standard.

Prior learning required includes an understanding of oxidation numbers, electron transfer in reactions, oxidants and reductants, balancing oxidation-reduction equations, and the ability to relate these to experimental observations.

Resource requirements

* Magnesium ribbon
* acidified potassium permanganate solution
* acidified potassium dichromate solution
* dilute hydrochloric acid solution
* dilute sodium hydrogen sulfite solution
* dilute iron(II) sulfate solution.

It is recommended that you trial the practical experiments before the students to check all solutions and reactions.

Additional information

None.

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

Student instructions

Introduction

In this assessment activity, you are required to explore the reactions of common oxidants and reductants, interpret experimental results or observations, write equations to show your understanding of the reactions involved and compare reactions. In Part 1, you are to carry out test tube reactions and record suitable observations, in Part 2 the observations are provided.

You will produce a written report showing your understanding of the reactions involved.

This individual assessment activity that will take place over three to four lessons.

You will be assessed on your understanding of oxidation numbers, electron transfer in reactions, oxidants and reductants, and balancing oxidation-reduction equations. You will also be assessed on your ability to relate this understanding to experimental observations.

Task

Oxidants and reductants are used in a variety of ways in modern society.

* Hydrogen peroxide is used as bleach, in glow sticks, hydroponics, disinfectants and laundry detergents.
* Potassium permanganate is used as a disinfectant for hands and feet, to kill fungal infections, in water treatment and to make props in film and television look old.
* Potassium dichromate is used as an ingredient in cement, for cleaning glassware, tanning leather, wood treatment and analysing alcohol in the “breathalyser test”.

Part 1 – Redox reactions

Carry out the following three experiments:

1. Place 3mL of hydrochloric acid in a test tube. Add a small piece of magnesium metal.
2. Place 2 mL of acidified potassium dichromate solution to a test tube. Add 2 mL of sodium hydrogen sulphite solution.
3. Place 2 mL of acidified potassium permanganate solution to a test tube. Add 2 mL of iron (II) sulphate solution.

For each experiment:

* Record your observations.
* Explain how the observation for each reaction relates to the species involved.
* Write balanced half and overall equations.

Part 2 – Hydrogen peroxide reactions

Hydrogen peroxide can undergo two different reactions.

Observations:

Reaction 1: Acidified hydrogen peroxide will react with potassium iodide solution to produce a brown solution.

Reaction 2: When non-acidified hydrogen peroxide solution reacts with iodine solution the brown solution turns colourless and bubbles of a colourless gas appear.

For each reaction above:

* Relate the observations to the species involved.
* Write balanced half and overall equations.
* Compare and contrast these two reactions by identifying the oxidant and reductant in terms of changes in oxidation number or electron transfer.

Assessment schedule: Chemistry 91167 Redox rules

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student shows understanding for two reactions:   * oxidation and reduction species are correctly identified * oxidation and reduction are identified with reasons in terms of loss/gain of electrons or oxidation number change.   *For example:*  *In the first reaction H2O2 is*  *reduction because it gained*  *electrons .* | The student shows in-depth understanding for two reactions:   * balanced half equations are written   *For example:*  *Mg + H+  → Mg2+ + H2 Cr2O72- + HSO3- → Cr3+ + SO42- MnO4- + Fe2+ → Mn2+ + Fe3+*  *H2O2 + I- → I2 + H2O*   * observations are linked to species   *For example:*  *Metal dissolves because Mg turns to Mg2+. Bubbles occur because H+ turns to H2. The solution turns from orange to green because Cr2O72- is orange and Cr3+ is blue/green. HSO3- and SO42- are* colourless. *MnO4- is purple, Fe2+ is pale green. The resulting solution is pale yellow-brown due to the formation ofFe3+. Mn2+ is colourless.*  *Brown colour forms due to the formation of I2. All other species are colourless.*   * oxidation and reduction are explained in terms of oxidation number change or loss/gain of electrons. *For example:*   *H2O2 is the oxidant because each oxygen gains one electron or oxidation number goes from -1 to -2 in H2O.  I- is the reductant because it loses one electron or oxidation number goes from -1 to 0.* | The student shows comprehensive understanding for two reactions:   * balanced overall equations are written with no errors   *For example:*  *Mg + 2H+ → Mg2+ + H2 Cr2O72- +3HSO3- +5H+ → 2Cr3+ +3SO42-+4H2O MnO4- + 8H+ + 5Fe2+ → Mn2+ + 5Fe3+ + 4H2O*  *H2O2 + 2H+ + 2I- → I2 + 2H2O*   * observations are linked to species * oxidation and reduction are explained in terms of oxidation number change or electron transfer. *For example:*   *When acidified H2O2 reacts, it is the oxidant because each oxygen gains one electron or oxidation number goes from -1 to -2 in H2O.  I- is the reductant because it loses one electron or oxidation number goes from -1 to 0. When non-acidified H2O2 reacts it is the reductant because each oxygen loses one electron or oxidation number goes from -1 to 0 in O2. I2 is the oxidant because it gains one electron or oxidation number goes from 0 to -1.* |
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Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.