**Design Task: Electrochemistry**

**Introduction and Purpose of Task:**

Galvanic cells are electrochemical cells that produce energy. Two half cells are connected by an external circuit to enable a redox reaction to occur. Galvanic cells are used as portable sources of energy in the form of batteries.

In order to construct a galvanic cell a selection from various types of electrodes, solutions and other materials must be made. Different materials may affect the production of electricity by the cell. The aim of this task is to design and carry out an investigation to test the effect of one factor on the production of electricity by a galvanic cell.

**Part A: Design your own experiment**

You will initially work individually to deconstruct the problem ‘what factors might affect the production of electricity by a galvanic cell?’

Make a list of possible factors. Consider which factor would be best to investigate and design an experimental procedure to investigate the effect of this factor on the production of electricity. You will have time to try out a rough procedure and record some data, from which you can make adjustments to your design. You will need to:

* pose a hypothesis
* identify dependent and independent variables, and explain your choice of independent variable
* consider factors that should be held constant and explain why and how you will attempt to control these factors
* identify factors that may not be able to be controlled that could affect the results
* list materials required
* devise a method to be followed
* consider how the data will be displayed and analysed
* identify safety considerations

Submit your deconstruction evidence and design to your teacher for assessment. Evidence of deconstruction should outline the deconstruction process, the method designed as most appropriate, and a justification of the plan of action, to a maximum of 4 sides of an A4 page.

**Part B: Perform the experiment in groups**

In consultation with the teacher, one method will be selected from the students working together. The group may make modifications to the procedure if appropriate and then submit a materials and equipment request form.

The investigation will be conducted in a double lesson.

Each student should collect their own data.

**Part C: Write an individual investigation report**

Use the data you have collected to write your own report.

The practical report must include:

• introduction with a brief description of the galvanic cell used and the relevant electrochemistry concepts and chemical equations. Also state the purpose of the investigation and the hypothesis to be tested.

• materials/apparatus

• the method that was implemented

• identification and management of safety and/or ethical risks

• results, including table(s) and/or graph(s)

• analysis of results, including identifying trends and linking results to concepts

• evaluation of procedures and their effect on data, and identifying sources of uncertainty

• conclusion, with justification.

Attach your deconstruction evidence to your report.

Word Count: maximum of 1000 words or 6 minutes for an oral presentation.

Only the following sections of the report are included in the word count:

* introduction
* analysis of results
* evaluation of procedures
* conclusion and justification.

**Assessment Conditions for this task:**

Class time will be given for students to individually design the investigation question/hypothesis.

A double lesson will be used to undertake the practical in group/pairs. One draft will be permitted.

Each student submits an individual practical report.

The report is due 2 weeks after the experiment is completed.

**Guidelines for addressing the Performance Standards in the report:**

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| **Section of the Report** | **Requirements/Indicators** | **Performance Standards** |
| Introduction | Relevant chemistry Information presented that relates specifically to the investigation. The information relates to the aim of the experiment. | KA4 |
| Aim | Indicates the purpose of the investigation | IAE1 |
| Hypothesis | Links the independent and dependent variable and is a prediction. | IAE1 |
| Method | Describes how the independent variable is changed, is detailed and describes how the dependent variable is measured.  All variables should be identified.  A clear and logical procedure is outlined with enough detail for someone else to repeat. | IAE1 |
| Safety Audit | Detailed analysis of the potential risks, hazards and how they are managed and the precautions taken in the classroom. | IAE1  IAE2 |
| Results | Data is represented in an appropriate manner  Table has the correct format  Significant figures are correct  Graphs are drawn appropriately- axis are labelled, appropriate scale used, title, size, correct format | IAE2 |
| Discussion | Explains all the data obtained and any overall trend in the results  Provides reasoning based on the data for supporting or rejecting the hypothesis  Evaluates the experimental method and identifies potential sources of uncertainty, including random and systematic error, and the effect on the results.  Could include a discussion of the data’s reliability, precision, accuracy and validity. | IAE3  IAE4 |
| Conclusion | A justified statement based on the hypothesis that acknowledges the limitations of the conclusion. | IAE3 |
| Communication | Use of appropriate language and chemical terms, equations, representations and conventions | KA4 |

Performance Standards for Stage 1 Chemistry

| - | Investigation, Analysis, and Evaluation | Knowledge and Application |
| --- | --- | --- |
| A | Critically deconstructs a problem and designs a logical and coherent chemistry investigation with detailed justification.  Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.  Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.  Critically and logically evaluates procedures and discusses their effect on data. | Demonstrates deep and broad knowledge and understanding of a range of chemical concepts.  Applies chemical concepts highly effectively in new and familiar contexts.  Critically explores and understands in depth the interaction between science and society.  Communicates knowledge and understanding of chemistry coherently, with highly effective use of appropriate terms, conventions, and representations. |
| B | Logically deconstructs a problem and designs a well-considered and clear chemistry investigation with reasonable justification.  Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.  Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.  Logically evaluates procedures and their effect on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of chemical concepts.  Applies chemical concepts mostly effectively in new and familiar contexts.  Logically explores and understands in some depth the interaction between science and society.  Communicates knowledge and understanding of chemistry mostly coherently, with effective use of appropriate terms, conventions, and representations. |
| C | Deconstructs a problem and designs a considered and generally clear chemistry investigation with some justification.  Obtains, records, and represents data, using generally appropriate conventions and formats, with some errors but generally accurately and effectively.  Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.  Evaluates procedures and some of their effect on data. | Demonstrates knowledge and understanding of a general range of chemical concepts.  Applies chemical concepts generally effectively in new or familiar contexts.  Explores and understands aspects of the interaction between science and society.  Communicates knowledge and understanding of chemistry generally effectively, using some appropriate terms, conventions, and representations. |
| D | Prepares a basic deconstruction of a problem and an outline of a chemistry investigation.  Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.  Describes data and undertakes some basic interpretation to formulate a basic conclusion.  Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of chemical concepts.  Applies some chemical concepts in familiar contexts.  Partially explores and recognises aspects of the interaction between science and society.  Communicates basic chemical information, using some appropriate terms, conventions, and/or representations. |
| E | Attempts a simple deconstruction of a problem and a procedure for a chemistry investigation.  Attempts to record and represent some data, with limited accuracy or effectiveness.  Attempts to describe results and/or interpret data to formulate a basic conclusion.  Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of chemical concepts.  Attempts to apply chemical concepts in familiar contexts.  Attempts to explore and identify an aspect of the interaction between science and society.  Attempts to communicate information about chemistry. |