Units 1 and 2 assessment task example: critique of an experimental design

**Information for teachers**

This assessment task involves students critiquing an experimental design provided by the teacher. The experiment relates to the use of primary cells in the production of electrical energy from chemical energy in Unit 2 Area of Study 1 but could be adapted as a task related to problem-solving for Units 3 and 4. The same approach can be used for other topics in the VCE Chemistry study design.

Students can work individually or in pairs to set up a poorly-functioning – or defective – primary cell and record observations. Subsequent analysis of the performance of the cell, and suggestions for improvement should be competed individually. The teacher can supply a list of suitable topics for exploration, including the topics listed below.

A number of assessment tools could be used for this task, including rubrics and marking schemes. In this example, a simple marking scheme has been used.

**Title:** Critique of a galvanic cell

**Background**

A galvanic cell is a device used to power an appliance. For a cell to be commercially useful, the manufacturer usually seeks to maximise the voltage and efficiency of the cell. As chemistry students, you should have an understanding of the redox principles that you can apply to ensure the cell performance is satisfactory. You should also have an awareness of how the differences in reactivity of metals is relevant to cell voltage.

**Task**

In this experiment you will set up a galvanic cell and record the voltage it produces. The teacher will deliberately provide you with materials that will lead to a cell that performs poorly and does not produce a useful voltage.

You are asked to

* set this cell up and to record its voltage
* critique the cell, making recommendations as to how to improve the performance of the cell
* justify the changes you are recommending
* set up a re-designed cell that incorporates some of your suggested changes.

**Materials**

* Voltmeter
* Electrical leads
* 0.5 M KNO3 for the salt bridge
* Zinc electrode
* Iron electrode
* 0.1 M Zn(NO3)2(aq)
* 0.1 M Fe(NO3)2(aq

**Procedure**

* Set up the cell as shown in Figure 1.
* Record the voltage produced by the cell in your logbook.

**Diagram

Description automatically generated**

Figure 1 Experimental set-up

**Design changes**

Consider each facet of this cell. Changes can be made to improve the voltage obtained.

* List four possible changes to the cell.
* For each suggested change, explain why you are anticipating a better performance from the cell.
* Set the cell up again, instituting some of your suggested changes.
* Record the voltage obtained.
* What conclusion can you draw on the changes you have made?

**Report**

You must submit a practical report on this task. Your report should include:

* the voltage you obtained from the initial cell
* analysis of this cell, the half-equations occurring, the direction of electron flow and the polarity of the electrodes
* each proposed change and the explanation as to why you have suggested that change
* the voltage you obtained from the second cell
* the conclusion you have made about the effectiveness of your changes.

**Assessment**

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| **Aspect of critique** | **Number of marks** |
| Voltage and polarity recorded from the initial cell | 2 |
| Analysis of the cell, half-equations, electron flow, polarity | 2 |
| First suggested changes and the justification | 4 |
| Second suggested changes and the justification | 4 |
| Third suggested changes and the justification | 4 |
| Fourth suggested changes and the justification | 4 |
| Voltage from redesigned cell | 4 |
| Conclusion | 6 |
| **Total marks** | **30 marks** |