Student Worksheet

Investigation 14.3 Testing Voltaic Cells

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| REPORT CHECKLIST |
| ○ Purpose | ● Design | ● Analysis |
| ○ Problem | ○ Materials | ● Evaluation (1, 2, 3) |
| ○ Hypothesis | ● Procedure |  |
| ● Prediction | ● Evidence |  |

Testing is a procedure that is common to both technology and science. In technology, testing is necessary to determine how a product or process works using criteria such as efficiency, reliability, and cost. In science, testing is a key part in the advancement of knowledge. Scientific concepts are developed and then tested to determine their validity and limitations. New ideas that fail the test then need to be restricted, revised, or replaced.

In your Evaluation, pay particular attention to sources of error or uncertainty, and to limitations of the evidence collected.

Purpose

The purpose of this investigation is to test the predictions of cell potentials and the identity of the electrodes of various cells.

Problem

In cells constructed from various combinations of copper, nickel, lead, and zinc half-cells, what are the standard cell potentials, and which is the anode and cathode in each case?

Prediction

According to the redox concepts and the table of redox half-reactions.

**Table 1** Predicted Cell Potentials

|  |  |
| --- | --- |
|  Cathode (+) Anode(–) | *E*ºcell (V) *(include calculations)* |
|  │ ││ │ |  |
|  │ ││ │ |  |
|  │ ││ │ |  |
|  │ ││ │ |  |
|  │ ││ │ |  |

Design (*Picture*)

 Materials

* lab apron
* eye protection
* voltmeter and connecting wires
* U-tube with cotton plugs or porous cups
* three 250 mL beakers
* distilled water
* CuSO4○5H2O(s)
* ZnSO4○H2O (s)
* Pb(NO3)2(s)
* Cu(s), Pb(s), and Zn(s) 🡪 strips



The materials used are toxic and irritants. Avoid skin and eye contact.

Procedure

Your procedure must be clear and unambiguous. All pieces of equipment must be used.

Observations (notes):

Evidence / Analysis

**Table 1** Cell Potentials

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cathode (+) | Anode (–) | Predicted potential (V) | Measured potential (V) | Percent difference (%)*(include calculations)* |
|  │ │ |  |  |  |
|  │ │ |  |  |  |
|  │ │ |  |  |  |
|  │ │ |  |  |  |
|  │ │ |  |  |  |
|  │ │ |  |  |  |

Evaluation/Conclusion:

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| --- | --- |
| **Lab Report Rubric**

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| Student Name:     \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| --- | --- | --- | --- | --- |
| CATEGORY | **5 Excellent** | **4 Good** | **3 Acceptable** | **2-0 Not Acceptable** |
| **Purpose** | The purpose of the lab or the question to be answered during the lab is clearly identified and stated. | The purpose of the lab or the question to be answered during the lab is identified, but is stated in a somewhat unclear manner. | The purpose of the lab or the question to be answered during the lab is partially identified, and is stated in a somewhat unclear manner. | The purpose of the lab or the question to be answered during the lab is erroneous or irrelevant. |
| **Components of the report** | All required elements are present. | One required element is missing. | Two required elements or one major element is missing. | Several required elements are missing. |
| **Materials/Procedure** | Materials and procedure are completely listed perfectly or are cited according to the set criteria. | Materials and procedure are listed but could be clearer or are cited but not according to the set criteria. | Materials and procedure are listed but are not clear enough or are cited not according to the set criteria and not easily understood. | Materials and procedure are listed in a way that is difficult to understand. |
| **Data** | Professional looking and accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in written form, but no graphs or tables are presented. | Data are not shown OR are inaccurate. |
| **Experimental Hypothesis** | Hypothesized relationship between the variables and the predicted results is clear and reasonable based on what has been studied. | Hypothesized relationship between the variables and the predicted results is reasonable based on general knowledge and observations. | Hypothesized relationship between the variables and the predicted results has been stated, but appears to be based on flawed logic. | No hypothesis has been stated. |
| **Calculations and Answers to Questions Posed** | All calculations are shown and the results are correct and labeled appropriately. If additional questions have been asked, they are all answered correctly. | Some calculations are shown and the results are correct and labeled appropriately. If additional questions have been asked, most are answered correctly and clearly. | Some calculations are shown and the results labeled appropriately. If additional questions have been asked, they are all answered correctly but some answers are unclear or incomplete. | No calculations are shown OR results are inaccurate or mislabeled. If additional questions have been asked, many are answered incorrectly or are very unclear. |
| **Error Analysis** | Experimental errors, their possible effects, and ways to reduce errors are discussed. | Experimental errors and their possible effects are discussed. | Experimental errors are mentioned. | There is no discussion of errors. |
| **Conclusion** | Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment. Purpose is fully addressed. | Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment. Purpose is addressed. | Conclusion includes what was learned from the experiment and the purpose is addressed. | No conclusion was included in the report OR shows little effort and reflection. |