B15 · Investigation: analyze and explain

Student notes - complete the underlined spaces | Notes 1/2

Put together given evidence, compare predictions with observations, explain differences, identify products and judge a battery design.

Name: _____ Date: _____

1. Evidence and comparison

Put together the evidence

In B14 we predicted each voltage. Now we look at results. This lesson uses a _____ sample set that we did not measure.

Pairs are predicted/measured: Zn 1.10/1.07 V, Fe 0.79/0.76 V, Ni 0.60/0.57 V, Ag 0.46/0.43 V. Each row is one cell.

A good table has a title, _____ in the headings, the predicted column and the measured column. Note the controlled conditions too.

The measured column holds _____, because those numbers came from a voltmeter. The predicted column holds values from the reduction table.

On the diploma: a common wrong choice mixes up observation and prediction. Ask which column came from a measurement.

Compare

Difference = predicted − _____. Each cell here is _____ V lower than the prediction. That is a pattern with a direction and a size.

The order also matches, with zinc highest and silver lowest. So the data _____ the table. We say support, not prove.

A percent difference compares the gap with the prediction. For zinc, 0.03 ÷ 1.10 × 100 = _____ %. A small gap means close agreement.

On the diploma: describe a pattern with its direction and size, with the unit. Do not just say the numbers are close.

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2. Explain, identify and evaluate

Explain a difference

Three possible causes fit a constant gap: the salt bridge adds _____, the strips have _____ coatings, or the concentration is not exactly 1.0 mol/L.

Temperature is another, because the table assumes 25 °C. A good report records the room temperature and the concentration.

To test a cause, change _____ thing and measure again. For example, sand the strips and see if the voltage rises toward the prediction.

Until the test is done, the cause is _____, not proven. On the diploma: never claim a cause that was not tested.

Identify products

In the Zn/Cu cell, the zinc strip loses mass, so zinc is oxidized. The copper strip gains a _____ coating, so copper ions are reduced.

An observation is what we see or measure. An inference is a conclusion drawn from it. Zn^{2+} is colourless, so it is an _____.

In the Ag/Cu cell, copper is the anode. The copper strip loses mass, and the copper solution is already blue, so it gets _____ blue as Cu^{2+} forms.

A conclusion has a _____, the evidence and an explanation. Name a limitation and an _____, such as three trials averaged.

On the diploma: to identify a product, name the observation that supports it.

Battery design and disposal

Three cells of 1.07 V give 3 × 1.07 = _____. Judge voltage, mass, cost, lifetime and _____, because voltage is only one part of the evidence.

Used batteries contain metals that can harm soil and water, so they are collected for _____. Recycling has benefits and costs, like the energy it needs.

A hydrogen fuel cell gives about 1.23 V per cell. A fair presentation gives purpose, reactions, benefits and _____, and states the source of its evidence.

On the diploma: to evaluate a technology, name evidence that supports it and a limit that remains.

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State symbols: (s) solid, (aq) dissolved in water, (l) liquid, (g) gas. Use the supplied reaction and conditions. B4 values name the Alberta Chemistry 30 Data Booklet table where used.

B15-P01 · Easy · Name three things that a good data table includes.

B15-P02 · Easy · Which column of the table holds observations and which holds predictions? Explain.

B15-P03 · Easy · Given a given result for zinc and copper: predicted 1.10 V, measured 1.07 V. Find the difference.

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B15-P04 · Easy · All four given cells are 0.03 V below the prediction and the order matches. Does the data support the table? Give a reason.

B15-P05 · Medium · Give two possible explanations for a small constant gap and say how to test one of them.

B15-P06 · Medium · Explain why a possible cause should not be stated as proven before a test.

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B15-P07 · Medium · In a zinc and copper cell the zinc strip loses mass and the copper strip gains a reddish-brown coating. State two observations and the half-reactions they support.

B15-P08 · Medium · $Zn^{2+}(aq)$ is colourless. Is its formation an observation or an inference? Explain.

B15-P09 · Challenging · Given a given nickel and copper result: predicted 0.60 V, measured 0.57 V. Write a short conclusion with a claim, evidence and one possible explanation.

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B15-P10 · Challenging · A design uses one trial for each cell. Give one limitation and one improvement.

B15-P11 · Challenging · Four cells of 1.07 V are joined in a row. Find the battery voltage and name one disposal step for the used battery.

B15-P12 · Challenging · Name two parts that a short fuel cell presentation must include, and say why the source of evidence should be stated.