B16 · Unit B review: choose the method

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

Sort a problem, choose between the table, Faraday and titration, and apply Unit B ideas to corrosion, plating, refining and batteries.

Name: _____ Date: _____

1. Choose the method

Sort the problem

Choose the method before you touch a calculator. Voltage, spontaneity or the anode: use the _____ table. Mass, current or time at an electrode: use _____'s law.

A concentration from a volume of a reactant: use a redox _____. It finds a concentration by reacting a sample with a solution of known concentration.

A positive E°cell means the reaction runs by itself, so it can be a _____ cell. A negative E°cell needs a power supply, so the cell is _____.

Either way, oxidation happens at the _____. The electrode names follow the reaction, not the cell type.

On the diploma: many wrong options use the right numbers in the wrong method, so name the method first.

Watch: Is this equation redox or not? (Alberta Chemistry Teacher, "Electrochemistry Diploma Prep - Chemistry 30 - Part 1 of 4", 18:39)

Watch: Spotting disproportionation (Alberta Chemistry Teacher, "Electrochemistry Diploma Prep - Chemistry 30 - Part 1 of 4", 20:04)

Methods in order

Table: the anode is the _____ value, E°cell = cathode − anode. Do not _____ E° values by coefficients, because voltage does not depend on the number of copies.

Faraday: q = _____ with the time in seconds, then $n(e^-) = q \div 9.65 \times 10^4$, then the mole _____ from the half-reaction, then the mass.

Titration: balance the _____, find the amount of the known reactant, use the ratio, then divide by the volume in _____. Divide millilitres by 1000.

The endpoint is the moment the reaction is just complete. With permanganate, it is the first lasting pale pink, so no indicator is needed.

On the diploma: a wrong mole ratio is a common wrong option, so read it from the half-reaction or the balanced equation.

Watch: Trends in the reduction table (Alberta Chemistry Teacher, "Electrochemistry Diploma Prep - Chemistry 30 - Part 1 of 4", 23:36)

Watch: Patterns: metals, halogens and multivalent ions (Alberta Chemistry Teacher, "Electrochemistry Diploma Prep - Chemistry 30 - Part 1 of 4", 24:21)

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

2. Apply the ideas

Corrosion and industry

Magnesium (−2.37 V) is below iron (−0.45 V), so it is a stronger reducing agent. It is the _____ anode that is oxidized, and the iron is protected as the cathode.

A power supply protects iron too, by making it the cathode. Both methods stop the iron from being oxidized.

In electroplating the object is the _____. In refining the impure metal is the _____. Oxidation is always at the anode, reduction at the cathode.

Judge a battery by voltage, mass, cost, lifetime and _____. On the diploma: a wrong electrode is a common wrong choice, so label the anode and cathode first.

B16 · Practice

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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.

B16-P01 · Easy · Which method do you use for a question that gives 2.00 A for 30.0 min and asks for a mass of copper? Explain.

B16-P02 · Easy · Given a calculated E°cell of −0.50 V. State the type of cell that can make the reaction happen and what it needs.

B16-P03 · Easy · Given Al^{3+}/Al −1.66 V and Ag^{+}/Ag +0.80 V. Write the cell reaction.

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B16-P04 · Easy · Find the voltage of the aluminium and silver cell, and explain why the silver value is not multiplied by three.

B16-P05 · Medium · A current of 3.00 A runs for 25.0 min with a silver cathode in Ag^+ solution. Find the charge and the amount of electrons.

B16-P06 · Medium · Continue the last question and find the mass of silver deposited. M(Ag) = 107.87 g/mol.

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B16-P07 · Medium · Given 4.00 A for 20.0 min through $Cu^{2+}(aq)$ with a copper cathode. Find the mass of copper deposited. M(Cu) = 63.55 g/mol.

B16-P08 · Medium · Given $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$. If 20.00 mL of 0.0150 mol/L MnO_4^- reacts with 25.00 mL of $Fe^{2+}(aq)$, find $[Fe^{2+}]$.

B16-P09 · Challenging · Describe the end point of the permanganate titration and say why no indicator is added.

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B16-P10 · Challenging · Explain how a magnesium block protects a steel pipe in soil. Name the role of the pipe.

B16-P11 · Challenging · A spoon is plated with silver using a silver nitrate solution. Name the electrode for the spoon, the half-reaction there and the power supply connection.

B16-P12 · Challenging · Choose the method and solve: 2.00 A runs for 30.0 min through molten NaCl. Find the mass of sodium at the cathode. M(Na) = 22.99 g/mol.